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A STUDY OF THE UNDERGROUND ECONOMY IN TANZANIA: AN EMPIRICAL ESTIMATION

by

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A Study of the Underground Economy in Tanzania: An Empirical Estimation

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ABSTRACT

The purpose of this thesis is to estimate the underground economy in Tanzania by applying macroeconomic and microeconomic methods. The macroeconomic method used is the currency-deposit ratio due to Gutmann while the microeconomic method uses the randomized response technique. This appears to be its first application to estimation of an underground economy . The estimates using this microeconomic method (in two versions) are qualitatively comparable to those obtained by the more traditional macroeconomic method. The estimates resulting from these estimation techniques of the micro method are merged to produce an estimate of the underground economy for 1991 of about 30 percent of the measured economy. As well, the macroeconomic methods produce estimates for the years 1978-1991

DEDICATION

TO THE MEMORY OF MY GRANDMOTHER, NDILI LIGULANO TUTSIVENE SANGA, WHO ''SLAVED'' SO THAT I COULD GO TO SCHOOL

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION.

The objective of this study is to estimate the underground economy in Tanzania for the period 1978-1991 and to introduce to the literature on estimation of the underground economy a new estimation technique. Several estimation methods common in the literature are used, including the new method of estimation. Some of the traditional methods do not yield good results.

For Tanzania such a study is important for two main reasons. First, information on the underground economy can help the government better monitor economic trends and formulate appropriate policies. Second, no existing study provides an adequate measure of the size of the underground economy. The only existing study, Maliyamkono and Bagachwa (1990), here after referred to as M-B, analyses the underground economy from an institutional perspective and devotes relatively little attention to estimating the size of the underground economy. Thus, the present work expands the M-B study particularly with respect to estimating the underground economy in Tanzania.

In this study, we use two main approaches to estimate the underground economy in Tanzania: (1) the monetary (macro) approach, and (2) the micro, randomised response approach of Warner (1965) based on survey data. Within the macro approach four different techniques are employed.

1.2 An Overview

In recent years there has been a growing interest among economists, institutions and governments in the study of underground economies. Many terms, such as black, cash, fiddling, hidden, illegal, irregular, parallel, second, shadow, subterranean, twilight, unobserved, unofficial, unrecorded and unreported have been used synonymously or quasi-synonymously for 'underground', introducing considerable confusion in the literature. A few writers, Dallago (1990), Feige (1990), Jones and Roemer (1989), Chugh and Uppal (1986), Carter (1984) have attempted to define and clarify the various terms and concepts used to explain this phenomenon in an attempt to establish some basic understanding and principles so that a credible theoretical analysis can be developed.

Theoretical and empirical research requires a finer set of conceptual distinctions to clarify both the differences and the interconnections among the variety of descriptive terms presently used by the so called 'underground economy economists' Such variety has lead researchers such as Feige (1982) to adopt the term 'irregular economy' which he considers to be a neutral term. He defines the underground economy in a way to avoid the evocative connotations of terms like 'subterranean' or 'black', which he asserts lend themselves all too readily to journalistic sensationalism.

Feige's (1982, 1989) definition appears to be one of the more generally accepted ones. He defines the term ''irregular economy'' as referring to those economic activities which go unreported or are unmeasured by society's current techniques for monitoring economic activity. In the present study, we use the term 'underground economy' to

reflect the same meaning as Feige's (1982) definition.

In addition to following Feige's meaning in a general sense, in the present study the term 'underground economy' is used in two particular senses. First, as a portion of the GDP which is not captured by the national income accounting procedures The empirical estimation of this portion is carried out in chapter four. Second, in the sense of unreported income by tax payers to the tax authorities. The estimation of this unreported income is done in in chapter five.

Activities associated with the underground economy can be grouped into four categories: (1) traditional criminal activities such as loan - sharking, prostitution, narcotics and the like, (2) legally earned income which is not reported to the tax authorities (3) organised non cash transactions such as exchange of goods and services, through bartering; for example, when a dentist treats a painter without charge in exchange for the latter's promise to paint the dentist's house and (4) a non monetary sector in which real goods and services are produced but are directly consumed by the producing unit (for example the household). Current methods of estimating the underground economy are based on the use of cash balances and so capture only the first two categories. The micro approach discussed later in chapter five may capture the third and fourth categories.

It is therefore clear that to estimate the size of the underground economy directly is a difficult task since some of the participants in this economy are actively attempting to avoid detection of their activities. Thus, to a certain extent there is no simple direct source of information about activities in the underground economy.

These economic activities, for example, prostitution, smuggling, tax evasion, drug trafficking, are unmeasured for different reasons, one of which is the illegal nature of the activities. Participants in these illegal activities actively and knowingly violate society's laws and regulations governing the regular economy.

We note here that activities in the informal economy are also not included in national income measurement since current methods for national income accounting are not capable of capturing such activities. These informal activities are not necessarily illegal in nature.

To the extent that informal activities are not captured in national income accounting in the same way illegal activities are not captured, though for different reasons, our definition of the term 'underground economy' and the estimation of it include both illegal and informal activities.

One of the major areas of concern shown by researchers has been the relationship between the reported and the underground economies. Explanation of this relationship requires analysis of the effect on supply and demand pressures in the underground economy resulting from changes in the performance of the official economy with respect to its growth, unemployment, and inflation.

The analysis may begin by considering the factors which support Cassel's (1983) assumption that the health of the formal and the underground economies are inversely related, that is when the formal economy's performance is weak the underground economy performs well and vice versa.

Slow or even negative growth in the formal economy may, by restraining real earnings increases, increase the pressures on individuals to seek additional or supplemental sources of income in order to maintain current or expected living standards. Such pressures in turn create the pressure to supply labour in the underground economy, and if, for example, unemployment rises, these pressures can be accompanied by an increase in the supply of labour potentially free to engage in occasional, part time or even full time underground economy employments such as smuggling and other illegal activities. These competitive pressures on individuals might be expected to intensify not only the search for new sources of income but also the search for new underground economy markets, thus increasing the range of goods and services available or easily accessible in the underground economy and therefore enlarging its magnitude.

Whilst higher unemployment and slower growth may tend to increase the size of the underground economy through supply effects, higher inflation may increase its size by increasing consumers demand for underground goods and services, although inflation is also likely to have a negative effect on the underground economy. Smith's (1983) empirical study of US consumers' purchases in the underground sector supports the view that rising prices in the formal economy were among the reasons given for increasing underground economy purchases.

Each of the negative features of the official economy performance: declining growth rate, rising unemployment and higher inflation may therefore lead to a larger underground economy, though it could be offset or even outweighed by demand side factors. So, in fact it is possible to

conceive of a situation where a growth slowdown in the formal economy can cause less rather than more underground activities once both supply and demand effects are considered.

The demand side of the underground economy, like that of any other market, is affected by the purchasing power of the would-be consumers. The effect of a recession on incomes is, ceteris paribus, likely to reduce consumers' demand both in the formal and underground economies. Further if the underground economy's goods and services have a higher income elasticity of demand, the growth path of the underground economy will be an accentuated version of the official economy.

Feige (1989), however, notes the problem that causation can go the other way, that is exogenous growth in the underground economy makes the official economy appear to have the symptoms outlined above. Thus the problem is that growth in the underground economy may make official statistics appear as if output is declining and unemployment increasing even when this is in fact not the case.

1.3 Outline of the Study

Government controls on the economy and heavy tax rate margins are generally considered to be the two main causes of the underground economy in many countries. In Tanzania, controls such as those of prices of consumer goods and other basic goods and high tax rates have been important features of the economy particularly since the mid 1960s.

Tax evasion theory, Sandmo (1981), Cowell (1990) would predict that a rational tax evader would choose that magnitude of understatement

of income which would maximise his net expected gain. The individual who engages in such illegal activity compares the net gains expected from it with what he could get by pursuing a legal activity. He would choose the former only if he perceives that the net expected gain from it is greater than the gain he would receive from a legal activity.

The problem of tax evasion can be analysed under the assumption that participants in the underground economy act rationally and are interested in maximising their expected benefits from these activities, in the same way firms or other types of investors hope to maximise their profits. This crucially depends on the extent of the risk they undertake in their investment activities. An individual would engage in tax evasion only if the expected utility (through non payment of taxes) exceeds the expected disutility. Expected utility from tax evasion equals the amount of taxes evaded multiplied by the probability of not being caught. The expected cost of evasion equals the penalty for evasion times the joint probability of getting caught, convicted and punished, and thus being made to pay the penalty. Thus an individual's estimates of expected costs and gains would differ for differeng magnitudes of income understated or not declared and also their attitudes towards risk taking, Sandmo (1981), Cowell (1985a, 1985b).

The expected cost here must be interpreted more broadly as there are costs associated with being suspected or investigated for tax evasion even if not convicted. Also there are psychic costs, for example social slur, associated with loss of self esteem or respect.

As we have commented above that in estimating the underground economy by the macro approach, we employ four different techniques.

The first technique is the cash-deposit ratio first used by Cagan (1958) and later developed and refined by Gutmann (1977) under specific assumptions (to be outlined later in the study).

To estimate the size of the underground economy of a country under this technique, one first selects a base period during which no underground economy is assumed to have been present, then the researcher calculates the cash-deposit ratio for that period. Then the ratio of the base period is compared with the cash-deposit ratio of the period (or periods) under study. If the latter ratio is higher, then that reflects the existence of excess currency over and above what is required to carry out the monetary transactions in the official economy.

This technique assumes that transactions in the underground economy are conducted in cash, and the excess currency is needed to finance such transactions. It also assumes no financial innovations which would decrease the demand for cash.

The second technique is the 'transactions' method developed by Feige (1979). It is based on Fisher's identity of exchange which specifies that:

MV = PT

where:

M is the quantity of money (currency plus demand deposits)

V is the transactions demand

P is the price level, and

T is the volume of transactions.

The method depends critically on (1) the selection of the base year during which all the income generated is assumed to have been

reported, (2) knowing the life time transactions of the various bills of currency (or at least those of large bills), that is knowing the number of turnovers (the number of times a bill changes hands) before it is retired and (3) the average length of time (in years or months) each type of bill lasts before it is retired. The last two pieces of information allow for the calculation of the velocity (turn over rate) of each type of bill.

Applying this information, one then calculates the total volume of monetised transactions conducted during the base period and divides this by that period's national income to obtain the base period ratio which is then used as the "benchmark" for estimating the size of the underground economy for the later years.

To estimate the underground economy for a particular year, the total volume of transactions conducted by that year's stock of money is calculated and divided by the base period ratio to obtain the total level of income generated (both official and underground). From this total income, one subtracts the officially reported GNP to obtain the size of the underground economy.

The third technique of the macro approach is the currency-money ratio method developed by Tanzi (1982,1983). This technique is also a modified version of Cagan (1958). It involves regressing the currency-money (M_1 or M_2) ratio on effective average tax rates, the share of wages and salaries in national income, interest rates on deposits, and real per capita income. According to this technique, the expected sign for both taxes and the ratio of wages to national income is positive, while the expected sign for both per capita income and the rate of

interest is negative. First, as the level of taxation rises, individuals are encouraged to engage in tax evading activities which are facilitated by the use of cash since this practice leaves no traces, thus the use of currency rises. Second, because wages are often paid in currency, especially for daily workers, and other types of incomes (interests, dividends etc)are almost always paid by cheques, an increase in the ratio of wages in total income paid will require more currency. Third, on the other hand, economic development proxied by per capita real income is assumed to lead to replacement of currency by cheques thus leading to a fall in the currency-money ratio. Lastly, as an increase in the rate of interest increases the opportunity cost of holding currency, the currency-money ratio and the rate of interest can be expected to be negatively correlated because broad money (M_2) includes time deposits which are interest earning assets.

The magnitude of the underground economy in this technique is estimated by first running a time series regression of the currency-money ratio, C, on taxes, share of wages and salaries in GNP, real per capita GNP and the rate of interest. Second, another currency-money ratio C' is calculated using the same explanatory variables outline above with the value of the tax variable being the base year ratio of tax revenue to GNP. The excess increase in currency not statistically accounted for by the explanatory variables which now exclude the tax variable is attributed to the underground economy. Thus the magnitude of the underground economy is indicated by the difference between the two regressed currency-money ratios that is C-C'.

The fourth technique is the error component method of Bhattacharyya (1990) which is a modification of the technique of Tanzi. The technique involves estimating the currency demand equation incorporating an assumption that the underground economy can be approximated by a linear combination of the squares, cubes and fourth powers of the regular economy (the only justification offered for this strong assumption is an appeal to the logic of the RESET test). The underground economy is then estimated by employing the coefficient estimates for the currency demand equation (specifically, the coefficients of the linear combination referred to above) to estimate this linear combination.

A new major method of estimation of the underground economy is the micro, randomised response approach based on survey data. The data used to estimate the level of tax evasion are obtained by using a randomized response technique developed by Warner (1965) and a more efficient version of it ,the vector response due to Bourke and Dalenius (1976). One of the reasons for the use of this method is to overcome the incentive on the part of the interviewee to deny working in the underground economy. This is the first study which uses this method comprehensively to estimate the underground economy (in the form of unreported income) of a country. The Internal Revenue Service (IRS) contracted a private firm, CSR, Incorporated, in 1979 to employ this method to estimate unreported income in the US. However, the way the method was used was too restrictive and so it did not in fact estimate the amount of income tax unreported. This is one reason why the study is not accessible and not available in the literature.

In chapter two, we review the literature on the estimation of the underground economy to date with particular emphasis on its estimation in developing countries. Many of the methods are simply modified versions of the monetary approach versions of Gutmann (1977), Feige (1980, 1989) and Tanzi (1982, 1983).

In chapter three, we provide an economic profile of the economy of Tanzania since the country became independent in 1961. We also briefly outline how GDP data is compiled in Appendix 3.1 to chapter three. In chapter four, we estimate the underground economy in Tanzania using the macro approach. In chapter five, we provide a brief theoretical analysis of tax evasion with the help of theoretical work on tax evasion due to Allingham and Sandmo (1972), Sandmo (1981) and Cowell (1985b, 1990). The analysis is based on the Income Tax Act (1973) and the amendment (1990) to the act.

In chapter six we carry out an empirical estimation of unreported income by applying the micro, randomised response method. We also compare the results obtained in this chapter with the estimates obtained by using the macro methods in chapter four.

In chapter seven, we examine the implications for government policy of the underground economy in Tanzania. A brief summary of the study, some conclusions and recommendations are also included in this last chapter.

CHAPTER TWO

(A REVIEW OF THE LITERATURE OF THE UNDERGROUND ECONOMY)

2.1 MAJOR ESTIMATION APPROACHES USED IN THE LITERATURE

The objective of this chapter is to review the existing literature on the subject of estimating underground economies with particular emphasis on developing countries. Although the literature is extensive, relatively little has been written on the subject in the case of developing countries. Most of the work done on developing countries has been devoted to estimating the underground economy in India and to a much lesser extent in China, Columbia, Ghana, Algeria, Egypt, Morocco, Senegal and Tunisia, plus a few other developing countries.

The literature starts with a theoretical analysis of the underground economy precipitated by price controls; the original research in this area was pioneered by Boulding (1947), Plumptre (1947), Bronfenbrenner (1947) and Michaely (1954).

Cagan's (1958) classical work in which he estimated the demand for currency relative to total money supply in the US was the basis for the empirical work on the underground economy that was to follow.Following Cagan's (1958) approach Gutmann (1977) estimated the underground economy in the US by using the currency-deposit ratio method of the monetary approach. Feige (1979, 1980) has estimated the underground economy in the US by employing the so called transactions method which is based on the quantity equation $MV = PT$. Tanzi (1980, 1982, 1983) estimated the

underground economy in the US using the currency - money ratio method.

These three methods are the most widely used in estimating underground economies in many countries. The three methods are collectively known as the Monetary (or Macro) Approach. Most of the work done by researchers to estimate underground economies has used one or another of these three methods.

A few researchers have used slightly different methods. For example, in the case of the US de Leeuw (1985, 1986) used an indirect aggregate method to estimate the underground economy. He classifiedclassifying fifty six representative industries in the country into three classes (1) the well measured (2) the intermediate and (3) the suspect, in which he assumed that their operations include a high proportion of underground economic activities. Then he notes that there are certain indicators, (three to be specific), of the understatement of econonomic growth due to the underground economy. These indicators are (1) the ratio of full-time equivalent employment to toatal employment, an indicator of understatement of hours worked, (2) the ratio of employee compensation to full-time equivalent employment, an indicator of understatement of employee compensation, and (3) the ratio of national income to employee comppensation, an indicator of understatement of proprietors' income and ptofits. He then suggested that the indicators should behave differently for these three classes of industries. The extent to which this behaviour differs among the three classes is estimated through a regression analysis, and activity in the underground economy is measured by assuming that this difference is entirely due to

the underground economy. Thus under this assumption, indicators for the ''suspect'' class of industries ought to be declining relative to the same indicators for the ''well measured'' and the ''intermediate'' classes. finally, he reported regression results for all the 56 industries for a period of thirty three years (1949-1982) and concluded that the underground economy caused the growth of national income in the domestic industrial sector to be understated by an average of 0.25 percent per year for the period of his study. In the case of the UK, Dilnot and Morris (1981) estimated the underground economy by applying a micro method in which they compared household income and expenditure. They assumed that the discrepancy between the two was due to the underground economy. Wealth or borrowing were not considered in their estimation. This technique is known as the income - expenditure discrepancy method. O'Higgins (1980, 1981, 1982, and 1986) Macafee (1980) have used an aggregative version of the income - expenditure method.

The labor market employment participation rate is another method which has been used in the literature. This method has mainly been applied in the case of Italy (see, for example) Contini (1981a, 1981b),. The method involves observing the officially measured labour participation rate over time. If the rate falls continually over time, the decline may be interpreted as a shift of labor from the official to the underground economy. However, the results of the method only make sense if the decline in the official participation rate is due to factors related to the underground economy. For this reason, it has been argued

that one should only look at the participation rate of males, since over the recent past the share of women taking up official (legal) work has been influenced by a variety of factors such as the general emancipation of women. The OECD labor force statistics report that the participation rate of male adults (ages between 15 - 64 years) in Italy has been declining steadily from 93.3 , 86.0, 83.5, 82.2 percentage points for 1960, 1970, 1975 and 1980 respectively. A decline from the ''normal''rate of participation is interpreted as a rise in the underground economy. This ''normal'' rate is taken from some previous base year period. In this case the rate of 86.0 percent (for 1970) was taken to be the ''normal'' rate of participation.

In the case of the (former) USSR, O'hearn (1980) estimated the share of the underground economy relative to that of the official economy by comparing the official prices and the underground prices of selected basic goods and services. He obtained information on the prices of goods and services in the underground economy from various sources including the press.

Work on estimating the underground economy in developing countries has mainly been done for India, and to a lesser extent on China and a few Latin American and African countries. Notable among researchers in the case of India are: Chugh and Uppal (1986), Kabra (1986), the National Institute of Public Finance and Policy (NIPFP) Report (1986), Pandit and Sundaran (1985), Sandesara (1982a, 1982b, 1983, 1985), Prasad (1984), Chopra (1982), Gupta and Gupta (1982), the Wanchoo Committee Report (1971), Kaldor (1956).

Chugh and Uppal (1986), Datt (1983) and Gupta and Mehta (1981) review the entire range of approaches which have been used to estimate the underground economy in India. They classify these approaches into three broad categories: first, the fiscal approach category which was used in the National Institute of Public Finance and Policy, (NIPFP) Report (1986), Chopra (1982), in the Wanchoo Committee Report (1971) and Kaldor (1956). The approach is used to calculate the discrepancy between estimated taxes and the actual tax revenue realised. Second, the monetary approach of Gutman' (1977) has been used by Sandesara (1982a, 1982b, 1983, 1985). Third, the transactions approach of Feige (1979) has been used by Prasad (1984), and Gupta and Gupta (1982) ,Rangnekar (1984) and Gosh et al (1981). The second and third methods are used in this study while the first is not due to the difficulty of obtaining data required for estimation by this method.

Table 2.1 below illustrates a few selected methods which have been used to estimate the underground economy in India together with the respective sizes of that economy as obtained by each method.

Table 2.1

Estimates of the Size of the Underground Economy for India by Selected Methods

Year	Wanchoo	Gupta & Gupta	Gupta & Mehta	Gosh et al	Rangnekar	NIPFP
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1960-61	5.0	-	-	-	-	6.1
1961-62	5.0	-	-	-	-	4.5
1962-63	5.3	-	-	-	-	4.9
1963-64	5.2	-	-	-	-	7.4
1964-65	4.9	-	2.8	-	-	6.8
1965-66	5.1	-	-	-	9.8	6.4
1966-67	3.5	-	-	-	-	6.1
1967-68	4.9	9.5	-	-	-	5.7
1968-69	5.0	13.6	-	-	8.6	4.0
1969-70	5.8	14.9	-	-	8.4	7.4
1970-71	4.8	22.3	-	7.6	-	5.2
1971-72	5.1	28.7	-	7.8	-	3.2
1972-73	4.0	31.9	-	7.8	-	3.8
1973-74	4.9	27.1	-	7.4	9.9	8.1
1974-75	5.9	20.9	13.8	8.1	9.3	12.4
1975-76	5.6	25.0	-	8.4	10.0	9.9
1976-77	5.7	37.6	-	8.7	11.3	10.2
1977-78	-	38.4	-	8.7	12.1	-
1978-79	-	48.1	19.8	-	13.5	-
1979-80	-	-	-	-	14.4	-

Note: [(1)] Columns (2), (3), (5), (6), and (7) are computed as percentage of GNP at current market prices. Column (4) is computed as a percentage of GDP at factor cost and 1970-71 prices.

[(2)] Estimates by Gupta and Gupta are higher than those by other researchers. No explanation is provided in the source for this difference

Source: Report of the National Institute of Public Finance and Policy, submitted to the Ministry of Finance, Government of India, September 1986, pp.45 - 6

In the case of China, Zafanolli (1985) and Chan (1982) did not estimate the underground economy in China per se, rather they outlined the major sectors in which underground economic activities have been observed to be taking place most. Such sectors are: real estate, finance, consumer goods and services, producing, labor market and local government.

With regard to African countries, very little has been done in the way of estimating their underground economies. As noted earlier M - B (1990) have done some work on Tanzania. Azam and Besley (1989) on Ghana (though they have not specifically estimated the size of the underground economy in Ghana, Morris and Newman (1989) on Senegal and Dobosiewcz (1987) on Algeria, Egypt, Morocco and Tunisia. To be precise Dobosiewcz's work is an outline, (rather than an estimation), of the role of underground economies in the four Northern African countries.

We make a detailed comment on M - B (1990) study later on in this chapter. Azam and Besley (1989) use a general equilibrium model to analyse the simultaneous determination of the underground economy in both the exchange rate and the goods markets in Ghana as they respond to controls on the foreign exchange rate and the prices of selected consumer goods. They assert that their model demonstrates that market controls create two kinds of wealth effects (1) through smuggling profits and (2) through the provision of consumption goods at below the equilibrium prices. Further, they assert that there are costs in real resources which depend on the nature of the smuggling technology.

Morris and Newman (1989) establish the presence of an underground

economy for cereals (rice, millets, coarse grains, and ground nuts) in Senegal by the use of survey data from northern and central Senegal which is generalised to the whole country. Using the data, they estimate the costs and returns to labor and management in the cereals market, and on the basis of these estimates (which they make by interviewing participants in this market) they then estimate the average gross margins and compare them with the officially prescribed marketing margins for the cereals.

Morris and Newman (1989) assert that their study confirms the existence of an active underground economy for cereals in Senegal. Further, they conclude from their study that underground trading activities perform many market functions more efficiently than the inefficient official marketing organisations. The reason for inefficiency in the official organisations is that they are overburdened by government regulations.

2.2 A TAXONOMIC OUTLINE OF METHODOLOGY USED IN THE LITERATURE

A taxonomy is necessary given the proliferation of methods and estimates of underground economies which have been developed in the literature in recent years. Two major classifications of the methods used to estimate the sizes of the underground economy in various countries can be identified. The classifications overlap to some extent due to (1) the heterogeneous nature of the underground economy (2) the absence of a clearly defined theoretical paradigm to explain underground

economic activities. The two classifications are (1)) that of the Indian National Institute of Public Finance and Policy (INIPFP) and (2) the Dallago classification.

2.2.1 Classification of the Indian National Institute of Public Finance and Policy (INIPFP)NIPFP)

According to the Institute (INIPFP), five different approaches of estimating the underground economy may be distinguished. Two more from a related study of Monga and Sanctis (1984) are included in this classification in the interest of comprehensive analysis. Thus the seven methods are: (1) the fiscal approach (2) the monetary approach (3) the physical input approach (4) the labor market approach (5) the national accounts approach (6) the tax evasion approach and (7) the 'naive' approach.

First, most variants of the fiscal approach make independent estimates of income tax revenues, next they compare these with the revenues actually collected from taxation (which are typically much less), then they attribute the discrepancy between the two to the underground economy. Park (1979), Kenadian (1982) have used this approach to estimate the underground economy for the US. Others who have used this method are Dilnot and Morris (1981), O'Higgins (1982) for the UK, and Chopra (1983), Kaldor (1956) for India.

In the case of Tanzania revenues actually collected yearly are not necessarily less than the estimated ones; in fact, in some years they are

higher. This information is contained in an undated, untitled unofficial mimeographed document, obtained by the author from the Ministry of Finance (available from the author on request). This situation makes it difficult to apply this method for the case of Tanzania.

Second, the monetary approach rests on the assumption that there is a stable relationship of various money stock aggregates to each other and to the total of income (or transactions) in the economy, and it attributes departures from the "norm" values to the existence and growth of the underground economy. The three well-known variants of this approach are: (1) the currency - deposit ratio method developed by Cagan (1958) and refined by Gutmann (1977), (2) the currency - money ratio developed by Tanzi (1980, 1982, 1983) and (3) the transactions method of Feige (1979, 1990). As we have noted earlier these three methods have been employed quite extensively to estimate the underground economies of many countries, particularly the western developed countries.

Third, the physical input approach in which one starts with an intermediate input, such as electric power, which is widely used in almost the entire economy, and for which the aggregate output and consumption data are deemed reliable. Next, one estimates a relationship between national (or sectoral) output and input use. To the extent that the consumption of the input (for example, electric power) cannot be explained in terms of growth in officially measured GNP and other relevant variables, such as changes in technology and output mix, the 'residual' consumption is attributed to the underground economy and serves as a measure of its size. Gupta and Mehta (1981) have attempted

to apply this approach to estimate the underground economy in India.

Fourth, the labor market approach in which the labor participation rate is observed over time assuming a certain base year during which the rate is assumed to have been 'normal'. If the rate declines continually relative to the base year 'participation' rate; the decline is interpreted as a shift of labor from the official to the underground sector. Contini (1981a, 1981b) has applied this approach to measure the underground economy in Italy.

Fifth, the national account approach within which two versions may be identified: (1) the micro variant in which household incomes and household expenditures are compared. Any discrepancy between the two is attributed to the underground economy. This income-expenditure discrepancy approach has been used by Dilnot and Morris (1981) to estimate the underground economy in the UK. (2) the macro version of the income-expenditure approach, which uses aggregate data rather than household data, has been used by Macafee (1980) and O'Higgins (1989) to estimate the underground economy for the UK. Both versions of the income-expenditure discrepancy approach depend on a clear distinction between household or national income estimates on the one hand and household or aggregate expenditures on the other. Where such a distinction is not clear, as in Tanzania, because of the absence of a reliable and fine distinction of data between the two, the approach cannot be effectively applied.

Sixth, the tax evasion approach employs tax data published by income tax authorities; the data is then used to estimate the underground

economy in the context of the NI. In this method, the estimates basically reflect the judgments made by the tax authorities about the level and frequency of misreporting or non reporting mainly by the self employed sector in the economy. The judgments are presumably based on the tax authorities' experience in the administration and enforcement of the income tax system. To date, estimates by this method are available only for the US by the Internal Revenue Services [(IRS) (1979)] and the UK by the Board of Inland Revenue (1980).

Finally, the 'naive' approach devised by Frey and Weck (1981), Frey and Pommerehne (1982), Frey and Weck-Hanneman (1984 p.35) involves estimating the relative magnitude of important determinants of the size of the underground economy across several countries (through surveys, for example). These determinants are burden of taxation, tax morality, the perception of tax burden, the burden of regulations and the labour market conditions, namely the level and extent of unemployment. Using these relative magnitudes, an estimate of the overall size of a country's underground economy relative to other countries' underground economy is made. This means that this method does not produce an estimate of the size of the underground economy, but rather only a listing of relative sizes. Nevertheless, the method does provide useful information to those estimating the size of a country's underground economy.

Table 2.2 below summarises the magnitude of the underground economy as a proportion of GNP for selected countries for the period 1970-1982 as estimated by the use of various approaches outlined above. The only method whose estimates are not represented in the table is the

physical input approach of Gupta and Mehta (1981). The source does not indicate the reason for excluding this method.

Table 2.2

Estimates of Underground Economy of Selected Developed Countries by Different Methods

Country	Magnitude of underground economy
Australia	11%
Austria	8%
Belgium	10-14%
Denmark	5-8%
Finland	7%
France	8%
Germany	5-7%
India	9-49%
Ireland	6%
Japan	3%
Norway	2-5%
Spain	5%
Sweden	3-12%
Switzerland	4%
United Kingdom	2-6%
United States	5-21%
USSR	10%

Note: The estimates show different magnitudes of the underground economy estimated for different countries at different periods. They are suggestive rather than precise.

Source: Adopted from Tanzi, " The Underground Economy", Finance and Development, Vol, 20 No. 4, Dec, 1983, p. 13.

2.2.2 The Dallago Classification

Dallago (1990) has come up yet with another classification of methods of estimating the size of the underground economy. He classifies the approaches of estimation into four main categories: (1) the direct methods (2) the indirect methods (3) methods based on determinants which influence the underground economy and (4) methods used to estimate the underground economy in East European countries.

Dallago's classification consists mainly of the same methods as those of the INIPFP classification outlined in section 2.2.1. The main addition he makes is the class of methods (class 4 above) which he says have been used to estimate the underground economy in East European countries. A detailed comment on these methods is made below.

2.2.3 Methods and Estimates for East European Countries

Dallago (1990) analyses five major methods of estimation which have been employed to date to estimate the underground economy in East European countries. Besides these five methods, there exist a number of analyses based on the experience of actually living in at least one of these countries, on contact with its inhabitants and from readings from the local press, Binyon (1983), Smith (1976). On the basis of this experience, several researchers have attempted to provide aggregate estimates. For example, Katz (1973) found that the underground economy in the former Soviet Union in 1970 accounted for between 10 and 50 percent of the official NI, while Kaiser (1976) estimated this percentage at around 20 percent during the 1970s.

The shortcomings of this method of physical contact which depends heavily on ad hoc sources of information are obvious and the estimates from such a method can at best be an approximation of the underground economy.

Of the five East European methods classified by Dallago (1990), the first consists of a careful and frequent examination of these countries with respect to various sources of information. Newspaper print stories and letters concerning scandals, trials, protest and denunciations of certain situations of unbecoming nature, as well as crime statistics and report of trials for economic crimes, resolutions by the parties in power, government measures and other sources of information material, are the major sources of information from which estimates of the underground economy in these countries are made. Notable in this respect are studies which have been conducted by by criminologists, Chalidze (1977), Feldbrugge (1989), Los (1980), Pomorski (1977, 1978, 1981 and 1986), Pormoski and Ginsburgs (1980). Other researchers have drawn on these studies and combined them with official statistics in order to analyse the features and the role of the underground economy, see, for example, Grosfeld and Smolar (1984), Grossman (1977, 1979 and 1982), Shroeder and Greenslade (1979) and Treml (1982)

These surveys suffer from the obvious limitation that they have to use second hand data, already censored by the official sources of the countries under study. Thus, such studies cannot provide reliable aggregate analysis of the entire economy and are less capable of yielding

reliable estimates of the underground economy.

The second method of Dallago's classification is one in which there exists a relatively large number of sample surveys based on interviews combined with available official statistics , Bicanic (1987), Gabor and Galasi (1981), Kertesi and Sziracki (1984) and Sowa (1982). The problem with this method is that the reliability of information extracted from the interviewees may be questionable and even outright biased in view of the possibility that some or even the majority of the respondents may have responded in such a way as to avoid possible official persecution in the event they released information which might displease the authorities.

Thirdly, an attempt has recently been made to devise aggregate methods which take into account the specific features of the economies of East European countries. For example, the method developed by Wisniewski (1986a, 1986b) and also used by Colijn (1987) is based on Brus and Laski's (1985) concept of price multiplier. The underlying hypothesis of the method of price multiplier is that if an exogenous shock such as the one of 1974 is introduced in the economy, there develops an excess demand in the official economy which gives rise to an inflationary gap. Part of this excess demand overflows into the underground economy.

This latter attempt is a good example of the more general approach also used by other researchers, see for example, Treml (1985). It consists basically of (1) working out a set of equations regarding the underground economy (based on some of the more general assumptions governing the conduct of the underground economy, for example, that only

cash is used in this economy), (2) specifying micro and macro conditions under which underground economic activities are assumed to take place, (3) setting the supposed relationship between the relevant variables in the official and underground economies and (4) estimating the necessary parameters. In this way an overall estimate of the underground economy can be made. This method can also be used to estimate the underground economy in the Western countries though we are not aware of any work done in that regard.

Fourthly, besides the aggregate approach, there is the so called 'building block approach', Treml (1987). Under this method, the main variables of separate components of the underground economy are estimated, Alexeev (1981, 1987), Alexeev and Sayer (1987), Dallagc (1989), Revesz (1986) and Treml (1982, 1985). They are then summed up to arrive at an overall estimate of the underground economy. This approach has been facilitated by recent progress made in the publication of official statistics released by the government. This is particularly so in the case of Hungry, Poland and to a lesser extent the former Soviet Union, Treml (1987).

Dallago's fifth and last method consists basically of a combination of the four types of methods discussed above. Leading in the application of this method is the official research undertaken, among other institutions, by the USSR Gosplan Economic Scientific Research Institute on the underground economy, Korjagina (1988).

Table 2.3 below shows some estimates of the underground economy for a selected few East European countries .

Table 2.3

Estimates of the Underground Economy of Selected East European countries

Country	Method	Year	% of NI	Source
Hungary	1	1986	14.8 (a) (b)	Dallago, 1989b
Poland	2 (c) (d)	1970	3.8	Wisnewski, 1986a
	2 (c) (d)	1980	7.1	Wisnewski, 1986a
	2 (c) (d)	1981	10.9	Wisnewski, 1986a
	2 (c) (d)	1983	9.6	Wisnewski, 1986a
	2 (c) (d)	1978	10.5	Colijn, 1987
	2 (c) (d)	1980	10.5	Colijn, 1987
	2 (c) (d)	1981	18.0	Colijn, 1987
	2 (c) (d)	1982	15.0	Colijn, 1987
	2 (c) (d)	1983	12.5	Colijn, 1987
USSR	3	1986	20-26 (f)	Korjagina, 1988

Methods: 1 = 'building block approach'
2 = aggregate method based on price multplier
3 = combination of various approaches

Notes:
(a) regular plus underground non-socialised activities
(b) in percent of gross output
(c) only underground economy caused by macroeconomic disequilibrium in the official economy
(d) in percent of personal incomes paid in the official economy
(e) at fixed 1983 prices
(f) 'shady commodity circulation' over total turnover of socialised retail trade.

Source: Dallago, B. The Irregular Economy, pp. 30

2.2.4 Estimates of the Underground Economy for Less Developed Countries

A summary of the studies and methods which have been used to date to establish the existence of the underground economy for developing countries is made in table 2.4 below. Most of the studies do not provide percentage estimates; nonetheless, they are important for they consist of useful information which can be applied if and when attempts to make quantitative estimates of the underground economy in these countries and others are made in the future.

It is important to underscore the point that most of the methods, as will be seen in table 2.4 below, do not provide actual estimates as a percentage of the official economy. Many of them confirm the presence of the underground economy in the countries of study without providing actual estimatesof its size. There are three main reasons for this. First, the heterogeneous nature of the phenomenon of underground economy itself, coupled with the difficulty of defining it and the lack of a clear theoretical foundation makes it extremely difficult for researchers to conceptualise the determinants of the underground economy, despite a general understanding of its causes. Second, the underground economy is a relatively new research area in the developed countries; it is even newer in the case of the less developed countries and thus most of the studies on the phenomenon in these countries lack even what one would consider an educated guess of its size. Third, the nature of the phenomenon of underground economy makes it difficult for researchers to acquire the required data for its estimation in the case of developed

countries; it is even more difficult in the case of less developed countries, where available data is often distorted and unreliable, due to the low level of technical ability to collect and process such data efficiently.

Table 2.4 below shows some estimates of the underground economy in selected less developing countries as commented above.

Table 2.4

Estimates of the Underground Economy of Selected Developing Countries

Country	Year	% of GNP	Source
Algeria	1987	+	Dobosiewicz
Argentina	1988		Bridges
Bangladesh	1989		Reza
Columbia	1982	*	Junguito & Cabllero
Egypt	1987	^*	Dobosiewicz
Ghana	1985 & 1989	7-32%	May
Guyana	1989	*	Thomas
Israel	1982	5-8%	Report on the Commission on Tax Reform
Kenya	1989		Lawrence
Liberia	1988		Willmott
Morocco	1987	*	Dobosiewicz
Nigeria	1989		Ode
Pakistan	1990		Jafarey
Senegal	1989	^	Morris & Newman
Sierra Leone	1989		Pinto
Sudan	1989		Elbadawi
Syria	1990		Butter
Tunisia	1987	*	Dobosiewicz
Uganda	1981	67.0%	Green
Zambia	1988		Southern African Economist

Note: (1) work on Algeria, Egypt, Morocco and Tunuisia is from the same study
(2) unmarked works are from the same principal source noted below as (1)

Sources: (1) Joint Bank-Fund Library (the World Bank-IMF) Annoted Bibliography print-out, Sept. 1990.
(2) ^ = World Development Vol. 17. No 12, Dec. 1989
(3) * = Tanzi, 'The underground Economy in the US and Abroad', Lexington Books, 1982
+ = Alessandrini and Dallago, 'The Unofficial economy', Gower Publishing Company, Vermont, 1987.

As can be seen in table 2.4 above, estimates on the magnitude of the underground economy are only available in the cases of Ghana, Israel and Uganda. In the case of Israel (some researchers do not consider Israel a developing country) the estimates reflect the gap between the assessed tax revenue due to the government and the revenue actually collected by the tax authorities.

The estimates for Ghana and Uganda are mainly a result of information obtained by the researchers from various sources including the press, casual interviews, questionnaire responses designed by researchers to achieve defined objectives such as information extraction and the like.

2.2.5 The M-B Estimates of the Underground Economy in Tanzania

The M-B study is the only major work on the underground economy in Tanzania. The study estimates the size of the underground economy by employing two variants of the monetary approach - those of Gutmann and Tanzi though the latter fails to yield good results. The study also employs the household survey (micro-version) method in which they trace the discrepancy between the household incomes and expenditure and attribute the discrepancy to the presence of the underground economy. The micro-version of the income-expenditure method was first used by Dilnot and Morris (1981) in estimating the underground economy for the United Kingdom.

M-B employ the method of Gutmann to obtain the estimates of the size of the underground economy for the period 1975-1986. We make a detailed comment on the M-B estimates in Appendix 4.1.

The motivation for M-B in estimating the underground economy is to support the contention that among others, nationalisation and introduction of controls and regulations by the government, discussed in chapters two and three of their book; were the main causes in distressing the economy whose ailing nature manifested itself in the form of corruption, a rising government deficit, balance of payments problems, declining output, a rising national debt, an acute shortage of foreign exchange, declining welfare and social infrastructure, particularly medical and education as well as a rapid deteoreration in the physical infrastructure particularly roads railways, bridges as well as communication infrastructure, particularly telephone and postal services. These malaises led many people to take the risk of participating in illegal activities which generated the underground economy, which in turn persisted as long as the regulations remained in place.

From the administrative and historical view point, M-B identify and classify four causes of the underground economy in Tanzania. First, the economic crisis in the mid 1970s and early 1980s which was made worse by a span of drought periods, the world oil price increases in 1974 and 1979, and the worsening of the terms of trade due to the deteriorating commodity (coffee, tea, sisal, tobacco, cotton, cashewnut) prices for most of the period put adverse pressure on the balance of payments.

These factors were exasbated by the costly war with Uganda in 1979

and the break of the East African Community in 1977 which forced the government to start a costly program to provide services such as railways and road transport, telephone and postal services, various research programs, income and excise tax services, shipping and harbours services, custom and cargo handling services, airline services and many more; all of which had been managed, provided and paid for jointly by the three member states of the community, Kenya Uganda and Tanzania.

Second, there was a failure by the government to institute an effective legal and control mechanism which would ensure successful implementation of its interventionist policy in the economy. Third, inefficient government administration and regulations have generated costly bureaucratic barriers which have stifled private sector and ironically public sector economic activity and fourthly, the failure of the agricultural (particularly the foodcrops) sector to adequately support the fast growing population. This failure was partly caused by the lack of incentive among the peasant farmers who would not increase food production because of regulations and the low prices given to them for their produce.

The causes of the underground economy outlined above lead M-B to support the government's initial steps towards the introduction of policy and institutional reforms, in its effort to improve the performance of the economy. These efforts began in 1987 with the introduction of the Economic Recovery Program (1987-9) which was intended to help restore macro-economic balance and stability.

M-B argue that policy and institutional reforms must be encouraged

and supported particularly those which deal with the gradual relaxing and reduction of controls on the economy. As for institutional reforms, M-B argue that the government should do away with controls and regulations in the various sectors of the economy in particular the agriculture and industrial sectors. They argue that in both of these sectors, the government should create and encourage incentives to private producers, such incentives may include provision of attractive prices for the products they produce, particularly peasant producers who constitute the majority of agricultural producers in the country.

We commented in the introductory section of chapter one of the present study that the M-B is the only serious work which has attempted to estimate the underground economy in Tanzania. In this respect, they have made an important contribution to the study of the underground economy in Tanzania. We view the present work as an improvement on the M-B study.

2.2.6 Estimation of the underground economy in the present study

We stated earlier in chapter one that in this study we estimate the underground economy in Tanzania by using (1) the monetary (macro) approach in which four versions are employed, those of Gutmann (1977), Feige (1990, 1989, and 1979), Tanzi (1982 and 1980) and Bhattacharyya (1990 and 1989), reported in chapter four; and (2) the sample survey randomised response method, reported in chapter six. This is a micro approach in two versions, the version of Warner (1965) and a modified

version, the vector response method of Bourke and Dalenius (1976). In both of these versions, we estimate the proportion of the population not reporting parts of their income to the tax authorities; we then estimate the underground economy as this unreported income expressed as a percentage of the total income for 1991. This estimate is compared with the estimates of the size of the underground economy obtained by the methods of the monetary approach of chapter four.

Thus, as we have commented elsewhere that in some sense the present study takes and expands on the M-B study. It is hoped that the study makes a contribution towards a better understanding of the phenomenon of the underground economy in Tanzania.

CHAPTER THREE

A PROFILE OF THE TANZANIA ECONOMY 1961-1991

3.1 INTRODUCTION

The objective of this chapter is to provide an economic profile of the Tanzania economy since independence in 1961 to 1991. Section one is an introduction. Section two is a brief description of how the national income data are compiled. Section two analyses the performance of the economy on a sector by sector basis for the period 1961-1980. Section three provides a brief description of the performance of the economy in the 1980s. A sub-section on changes in monetary policy during the period 1966-1991 is also included in this section. Section four discusses the economy on a broad sectoral basis.

Five major phases of economic policy and its impact on the economy can be identified. The first phase was in the early period of reconstruction, starting in the year of independence in 1961 and continuing up to the Arusha Declaration (AD) in 1967. This period was characterized by dependency on private capital, tolerance of foreign investment and emphasis on the objectives of growth in per capita income and national self-sufficiency on human capital.

In the second phase, during the period 1967-1975, emphasis shifted to policies arising from the AD, stressing socialism and self-reliance with rural and agricultural development as the important areas of policy action. During this period, the government also undertook an ambitious

program to provide free social services for all Tanzanians as well as allocated resources to build the basic social and economic infrastructure.

The third phase, during 1976-1984, was marked by an economic crisis manifested in a general decline in agricultural production and underutilisation of industrial capacity. This period was also characterized by the government's resistance to the International Monetary Fund (IMF) policy prescriptions. During this period, a number of events occurred, some resulting from government action while others were beyond government control. These events were:

(i) a large increase in the world prices of oil in the spring of 1974 had a catastrophic impact on world economies, particularly on those like Tanzania which depended entirely on imported oil;

(ii) the government closed the cooperative movement which was started by the colonial government before independence. The movement - the Cooperative Union of Tanganyika - had been formed to ensure attractive producer prices of agricultural goods produced by farmers, including the peasants. The closing down of the cooperative union system dealt an instant blow to the peasant producers and from that time agricultural productivity declined continuously, (M-B, 1990 p.68-75);

(iii) the introduction of 'ujamaa vijijini' (villagisation program) by which the government moved the rural population from their traditional homes into designated areas where the new villages were started. The intention of the government was to provide the rural population with (a) basic social services, particularly clean water, medical and para-medical

services, schools, rural electrification, (b) agricultural inputs and (c) inputs like building materials to meet the basic needs for shelter. The implementation of the villagisation program was badly managed with the result that the government had to abandon the program in 1982 with huge human, social and psychological suffering (M-B 1990 p.6).

(iv) the break up in 1977 of the East African Community (EAC), an economic community started in 1963 by Kenya, Uganda and Tanzania. The dissolution of the community had serious adverse budget implications for the economy. For one thing, the government was forced to finance all of the services which had previously been financed under the EAC arrangements. Among others, these services were the railways, roads, customs and harbors, taxation, and research services. As commented in chapter two, the government could only finance these services by increasing its budget deficit.

(v) the war between Tanzania and Uganda in 1979-80 cost the government about $500 million.

In addition to the events outlined above, there were severe droughts in the periods 1971-1974, 1981-1982, and 1983-1984.

As a result of these events and problems, the economic crisis was clearly reflected in the severe shortages of most goods and services. This situation forced some people to transact the scarce goods and services illegally.

In response to the crisis-particularly the serious shortages of consumer goods, corruption in the business and public sectors - the government launched in the early 1980s a nationwide anti-hoarding and

anti-racketeering crackdown. In the process, goods worth hundreds and thousands of shillings as well as thousands of shillings in cash were thrown away in the forests, rivers, lakes and even in the Indian Ocean by people, particularly in private business who had hoarded these goods and money in residences or warehouses. Some of the goods and money were recovered and confiscated by the government agencies.

Because of the dire state of the economy during this period, the government introduced an economic and social adjustment program, the Structural Adjustment Program (SAP), to alleviate some of the problems the economy was going through. The program was to cover the period 1983-1985 with the following objectives: (1) improve the performance of the public sector, (2) improve the balance of payments; (3) restructure the economy, partly through incentives to agricultural producers; (4) improve labour productivity and industrial capacity utilisation; (5) rationalize government spending through more effective budgeting, monitoring and enforcement of priorities; and (6) reduce inflation.

The SAP was introduced in part as government's reaction to improve the state of the economy resulting from the failure of a hastily prepared National Economic Survival Program (NESP) in 1981, whose main objectives were to ease the foreign exchange constraint and improve the utilization of available industrial capacity. NESP did not achieve any of its objectives and was abandoned in 1982.

The fourth phase (1985-1989) of economic policy in Tanzania was characterized by the introduction of the Economic Recovery Program (ERP) in 1986. The program stressed improvement in direct productive sectors

with the expectation that the program would subsequently generate enough resources to revive the social service sector.

The fifth and last phase (1990-1995) was meant to gradually attain sustained growth in real incomes and output through (i) higher productivity, (ii) improved marketing, (iii) appropriate incentive structure (4) improvement of physical infrastructure, and (v) improvement of capacity utilisation in industry. In addition, the ERP was expected to correct external imbalance, reduce inflation and the government budget deficit, and help provide incentives to producers mainly through the price system. These measures were subsequently incorporated in the agreement which the government had signed with the IMF in 1986. Further, the measures included regular monthly exchange rate adjustment, improvement of agricultural marketing structures, consolidation of partial import liberalization, relaxation of price controls, and introduction of partial/full privatisation of several public sector activities.

3.2 ECONOMIC PERFORMANCE: 1961-1980

3.2.1 Growth of Gross Domestic Product (GDP)

In this section, we analyze the performance of the economy during the first two decades from 1961 to 1980. The macroeconomic data are shown in Tables 3.1 and 3.2. The economy had performed relatively well up to the mid-1970s with an annual growth rate of the GDP well above five percent. The growth rate dropped slightly to an average of 4.9

percent during the period 1975-80. With the population growth rate averaging three percent per year, this implied a modest growth in income per capita. Thus, economic performance after the mid 1970s was characterized by low growth rates in real income per capita.

The low economic performance was marked with declining structural imbalances. Agriculture was the dominant sector employing more than 85 percent of the labour force and contributing nearly 40 percent of the GDP in 1980. Its average share in the GDP was 54 percent during the period 1961-65. There was a rapid growth of the tertiary and service sectors with their contribution to the GDP increasing from an annual average of nearly 35 percent in the period 1961-65 to 46 percent during 1965-80. The contribution of the secondary sector to GDP increased only modestly from an average of 12 percent to 14 percent respectively, during these two periods.

Agricultural export earnings were declining during this period (1965-1980) mainly due to factors such as (1) bad weather conditions, (2) unfavorable terms of trade and (3) the oil price increases in the mid-1970s. The government's pricing policies for agricultural producers during this period and controls on selling and purchasing of agricultural produce through parastatals lead to the stagnation and even decline in export volumes, particularly during the late 1970s. A lack of systematic export promotion and inadequate marketing facilities also contributed to the poor export performance.

A PROFILE OF SELECTED MACROECONOMIC VARIABLES IN TANZANIA 1961-1990

TABLE 3.1

RATES OF GROWTH OF SELECTED VARIABLES

	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90
Rate of Growth of GDP	5.7	5.3	4.2	4.9	3.9	4.6
Rate of Growth of GNP/person	2.6	2.7	0.9	-0.2	-0.5	-0.2
Rate of Growth of Exports	6.5	4.5	21.1	12.6	-5.2	-3.5
Rate of Growth of Imports	6.5	6.9	18.5	13.6	1.0	0.3
Rate of Inflation	-	9.5	12.0	16.7	30.2	26.8
Rate of Growth of Money Supply	9.1	33.2	19.8	26.0	21.2	32.6

Note: the negative growth rate of per capita GNP (1975-1990) implies that the population growth rate was growing faster (2.8%) than income and thus real income was declining

TABLE 3.2

TRENDS IN SELECTED VARIABLES AS PERCENTAGES OF GNP

	1965	1970	1975	1980	1985	1990
Budget Deficit as % of GNP	3.0	4.0	10.8	9.2	7.6	5.0
Balance of Payments as % of GNP (Deficit)	20.5	18.1	24.4	26.9	29.2	26.1
Savings as % of GNP	-	20.5	8.5	13.3	7.2	-5.9
Investment as % of GNP	12.9	22.5	21.1	23.0	15.7	3.1

Sources:
(1) Balance of Payment Yearbook IST Statistics Department Washington D.C. various years
(2) Government Finance Statistics Yearbooks, Government Finance Division of the Bureau of Statistics, the IMF, Washington D.C. various years
(3) International Finance Statistics, the IMF, Washington D.C various years
(4) World Development Reports, the World Bank, Oxford University Press, Washington D.C. various years
(5) World Tables, the World Bank, Washington D.C. various years
(6) Bank of Tanzania: Economic and Operations Reports, various years - 1967 - 1992
(7) Economic Surveys, various years
(8) National Accounts of Tanzania, (1976-1991) and (1976-1984)

3.2.2 Investment and Savings

Gross domestic investment as a proportion of nominal GDP increased from 15 percent in 1965 to more than 20 percent in early 1970s. The increase in constant 1966 prices was from 13 percent to 21 percent over the same period. The ratio of nominal fixed capital formation to nominal GDP increased from 15 percent in 1965 to 25 percent in early 1970s; whereas the private sector investment, which accounted for 60 percent of the gross nominal capital formation, fell to less than 30 percent in the 1970s compared to mid 196s. Public sector capital formation contributed more than 75 percent of the aggregate monetized fixed capital formation. This shift in the contributions to capital formation clearly reflected the extensive nature of the parastatal sector.

The rate of savings first increased from 16 to 18 percent of GDP in the late 1960s and then fell to 9 percent in the mid 1970s. This explains the increasing recourse to foreign sources in the post-1976 period. The share of foreign savings in capital formation increased from three percent in the period 1967-69 to nearly 33 percent in 1971, reaching a high of 50 percent in 1974/75. Hence the dependence on external sources was rapidly accentuated when domestic savings efforts were decelerating.

Changes in the ratio of private sector savings to monetary GDP were more or less offset by counter movements in the ratio of public sector savings for the major part of the 1970s. The result was that the ratio of national savings to GDP stayed at just under 10 percent. Some of the changes in the national investment and savings are shown in Table

3.2.3 Inflation and Unemployment

Inflation increased considerably, starting with a moderate rate of three percent per year during the period 1965-69 to an average of 20 percent per year between 1978 and 1980. The intermediate period 1970-77 experienced an average annual rate of 11.3 percent.

As for employment, public sector employment was dominant for most of the period from the late 1960s. For example, government employment (excluding parastatals) was 36 percent of the total employment and by 1984 it had increased to 42 percent while the private sector employment accounted for only 24 percent of the total employment.

The data for unemployment are not good because (1) the nature of the unemployed labour is such that it is difficult to disaggregate it into measurable components, and (2) the government's inability to measure unemployment due to lack of resources. On average the rate of unemployment was not less than 10 percent of the total labour force for most of the period since 1961.

3.2.4 Policy Response to Economic Decline

As stated earlier, the economy performed reasonably well up to the mid 1970s. The economic crisis started in the late 1970s with the decline in agricultural and industrial productivity causing the overall productivity to fall by 1.7 percent in 1981 and 3.2 percent in 1982. While the real GDP had registered an average rate of 5.4 percent yearly for the period 1964-83, the per capita income declined by 8.3 percent

over the same period (the International Financial Statistics, 1965, 1970, 1975, 1980, and 1985).

The economic decline in the 1970s led the country into a crisis in the 1980s when economic performance was characterized by a further decline in the real GDP, high rates of inflation and unemployment, and the balance of payments problems. For example, the value of export crops - sisal, cotton, tea, coffee, and cashew nuts - accounting for more than 70 percent of total exports earnings dropped nearly 40 percent from US $576 million in 1980 to US $348 million in 1985. The total external debt was 93 percent of the GDP in 1986 or about double the total value of export earnings for that year [World Tables (1990)]. The real income (in 1969 prices) fell to 68 percent for the rural households and to 39 percent for urban households by 1983. By the early 1980s shortages of consumer goods and other basic needs such as fuel, building materials etc, were widespread.

Instead of relaxing its controls, the government intensified them, with essential goods either being rationed or obtainable through official permits. These controls led to increased smuggling, widespread racketeering and corruption, (M-B 1990, p.92).

In response to this crisis, the government introduced a series of policies to restore the economy from the brink of collapse. These policy actions were: (i) introduction of the National Economic Survival Program (NESP) in 1981, (ii) the Structural Adjustment Program (SAP) in 1982/83-1985/86, (iii) the Economic Recovery Program (ERP) in 1986/87-1988/89, and (iv) the Economic and Social Adjustment Program in

1989/90-1991/92. We have commented on all of these policy initiatives earlier.

3.3 ECONOMIC PERFORMANCE: THE POST-1980 PERIOD

After resisting the pressures to negotiate with foreign parties in the 1980s, the government reached an agreement with the IMF in 1986 in which an 18-month standby arrangement of Special Drawing Rights (SDR)64.2 million was approved by the Fund with a parallel endorsement for a multi-sectoral credit of US $150 million by the World Bank. This accord with the IMF allowed Tanzania to get access to other external sources. It is claimed that the ERP reforms are exhibiting positive results (Wagao, 1993). For example, the real GDP rose by 3.9 percent in 1986, the highest since 1980, followed by a growth rate of 3.9 percent in 1987 relative to the population growth rate of 2.8 percent. This upturn in aggregate output was largely a result of the recovery in the agriculture sector, which grew in real terms at 3.3 percent and 4.4 percent in 1986 and 1987 and at annual average rate of 14.4 percent between 1988-90. The recovery was the result of (i) favorable weather conditions, (ii) improved availability of farm inputs and (iii) increased incentives for rural producers mainly in the form of increased prices of agricultural products.

Whereas the industrial sector failed to recover after the ERP, other sectors performed relatively well. For example, water and energy increased by an average of 13.4 percent in 1986 and by 7.5 percent in

1987. Finance, insurance, and real estate recorded an average real growth rate of 2.7 percent in 1987 and transport and communications grew by 2.1 percent and 4.5 percent in 1986 and 1987, respectively. In the case of investment, the increased support for private sector investment since 1987, through a number of liberal economic policies, has had a modest effect on national investment. For example, while the share of fixed capital formation was 12.4 percent in 1983, it increased to 24 percent in the post-ERP period.

Other gains have been recorded as well: (i) reduced bank borrowing by the government; (ii) the inflation rate of under 19 percent is somewhat manageable, and efforts are underway through tight monetary policy to reduce it even further; (iii) liberalization of the policy on exchange rate ; and (iv) positive policy initiatives towards export promotion. It is important that these positive indicators represent sustainable economic performance and not merely show the immediate and short-term consequences of factors such as favorable weather conditions during 1987-90 and the availability of foreign exchange following the agreement with the IMF.

The indicators will continue to represent sustainable economic performance only if the government takes deliberate efforts to help improve productivity both in the agriculture and industrial sectors, primarily by creating price incentives and increased availability of agricultural inputs to producers, and taking steps to improve the utilization of industrial capacity.

3.3.1 Monetary Policy: 1966-1991

Before 1966, monetary policy was exercised by the East African Currency Board, a joint monetary institution which had been introduced by the colonial government to conduct and manage the monetary policy for Kenya, Uganda and Tanzania. In 1966 the three independent countries agreed to establish their own central banks. The Bank of Tanzania started functioning in the same year.

After 1966, the broad money supply increased at high rates. For example, the average annual growth rates of broad money for the periods 1960-65, 1965-1970, 1970-1975, 1975-1980, 1980-1985, and 1985-1990 were 9.1 percent, 33.2 percent, 19.8 percent, 26.0 percent, and 32.6 percent respectively.

The increase in the growth of money supply as indicated by these data, together with the general shortage of basic goods resulting from government controls and increases in government deficit financing, contributed to high inflationary pressures, particularly from the late 1970s reaching the 30 percent range in the mid 1980s. Inflation has been falling since 1990, though not markedly: it was 31.19, 25.80, 19.70 and 22.30 percent, respectively in 1988, 1989, 1990, and 1991 compared to an average of above 30 percent in the mid 1980s (35.3 percent and 33.3 percent for 1984 and 1986). The fall in inflation is probably due to the liberalization policy adopted by the government since 1986 after the agreement with the IMF.

The overall picture since the inception of the Bank of Tanzania in 1966 is that the growth of money supply (Table 3.1) was increasing at

high rates when the corresponding rates of real variables such as real GDP, per capita GDP, household incomes, and employment were increasing at much lower rates, particularly since the late 1970s.

3.4 GOVERNMENT CONTROLS ON THE ECONOMY

The extensive government controls in Tanzania have taken two forms: (1) price controls of goods and services and (2) controls of economic activities through parastatal organizations which are categorized on the basis of economic sectors, like: agriculture, industry, trade, transport and communications, mining and natural resources, finance, and social services.

3.4.1 Price Controls

Price controls are exercised through the Price Control Commission under the Ministry of Industry and Trade. From time to time, maximum prices are announced mainly for the following goods:

(i) rent for public housing which is managed by a parastatal, the National Housing Corporation;

(ii) specific consumer goods and beverages, particularly, bread, rice, flour, cooking oil, soft drinks, beer and cigarettes;

(iii) building materials, particularly, cement, corrugated iron sheets,and glass;

(iv) agricultural inputs,in particular, seeds, pesticides, fertilizers,

tractors and tractor parts and other farm equipment; and

(v) petroleum products, such as petrol, diesel and engine oils as well as cooking gas, and paraffins.

The government also imposes minimum prices on the following items, (i) unprocessed coffee, tea, cashewnuts, cardamon, and tobacco; and (ii) wages under the minimum wage legislation of 1964.

3.4.2 Sectoral Controls Through Parastatal Organizations

The government exercises controls on economic activities by using parastatal organizations which are categorized by the economic sectors in which they operate. Below we will describe the activities of selected parastatals under the major sectors of the economy.

3.4.3 Agriculture Sector

Most of the agricultural products, particularly cereal staples such as maize, rice, beans, and raw fruit produces, are purchased from producers by the National Milling Corporation (NMC). The NMC processes the produce and distributes them by using another parastatal, the National Distributing Company Ltd (NDL). Both the NMC and the NDL have branch offices through out the country. The major functions of these branch offices are to purchase the produce, process it and sell the processed products to the public.

The National Agricultural and Food Corporation (NAFCO), is charged

with the responsibility of producing food crops such as maize, rice, beans, etc. Since NAFCO cannot produce enough to meet the country's demand for food, private producers are allowed to produce to supplement the production by NAFCO.

Also there are parastatals established to distribute and market specified food crops and cash crops. For example, Sugar Development Corporation (SUDECO) controls the entire operation of production, marketing and distribution of sugar for domestic and foreign markets. Each of the six main exports (cash crops), coffee, tea, cotton, cashewnuts, sisal and tobacco, has a separate parastatal organization.

3.4.4 Industrial Sector

The industrial sector is operated under the supervision of the National Development Corporation (NDC), the largest public holding company in the country. The NDC is the parent organization of about twenty smaller organizations,each has a responsibility for producing, distributing and marketing a specific industrial good. For example, the production, distribution and marketing functions of industrial goods such as steel products, tanneries, animal skin products, shoes, etc are done by parastatal organizations each specifically established for dealing in one of these industrial goods.

Consumer products, such as cigarettes, beer, hard drinks, etc have a separate parastatal organization for each charged with the responsibility of producing, marketing and distribution of the good.

3.4.5 Trade Sector

Domestic trade is conducted under the control of the Board of Internal Trade (BIT), supplemented by six National Trading Companies (NTCs), each deals with the trading of a specific category of goods. For example, Household Supply Company (HOSCO), deals with the trading of household goods, Agricultural and Industrial Supply company (AISCO), agriculture and industrial goods, Building, Hardware and Electrical Supply Company (BHESCO), building and electric goods and domestic appliances.

The national trading companies are supplemented by twenty Regional Trading Companies (RTCs), each with the responsibility of conducting trading activities in the administrative region in which it is situated.

External trade is operated under the control of the Board of External Trade (BET). Its responsibility includes managing the foreign trade particularly the marketing and trading of the main exports - cotton, coffee, tea, tobacco, sisal, and cashewnuts.

There is a strong possibility that some of the functions of both BIT and BET overlap with those of the crop specific parastatals established to manage the distribution and marketing of specific crops. This would be particularly true with respect to marketing activities.

3.4.6 Transport and Communications Sector

The transport and communications sector is also controlled by the parastatal organizations. The transport sub-sector is managed by the

parent parastatal, the National Transport Corporation (NTC) and twenty Regional Transport Companies (RTCs), one for each of the twenty administrative regions of the country.

The communications sub-sector is operated under the Tanzania Post and Telecommunications Corporation (TPTC). This parastatal organization is one of the largest in the country. Its responsibility is to provide postal and telecommunications services, including external telecommunications.

3.4.7 Mining, Energy and Natural Resources Sector

The mining sub-sector is operated by the State Mining Corporation (SMC), with several smaller organizations, each is responsible for the management (mining, marketing and distribution) of a single or group of minerals.

The energy sub-sector is under the supervision of (1) the Tanzania Petroleum Development Corporation (TPDC), which is responsible for the exploration and development of oil and natural gas; and (2) the Tanzania Electric Supply Company (TANESCO), whose responsibility is to supply electricity for the whole country.

The natural resource sub-sector is managed and controlled by several organizations, for example, the Tanzania Tourist Corporation (TTC), which is responsible for the management of tourism and provision of tourist services. The Tanzania Wildlife Corporation (TWC) is responsible for the management of the wildlife; whereas the Tanzania

National Parks Corporation ((TNPC) is charged with the responsibility of managing the national parks and game reserves. The Tanzania Wood Industry (TWICO) is responsible for managing lumber and other wood related products.

Other organizations in the natural resources sub-sector are the Tanzania Forest Research Institute (TFRI), for forestry research, the Tanzania Fisheries Research Centre (TFRC), for fisheries research and management.

3.4.8 Financial Service Sector

The financial sector is managed and controlled by several banking institutions under the leadership of the Bank of Tanzania. There is only one commercial bank, the National Bank of Commerce (NBC), its responsibility is to provide commercial banking services in the country. Then there are several other banks with specific roles.These banks include (1) the Tanzania Investment Bank (TIB), whose role is to finance and oversee investment activities; (2) the Tanzania Housing Bank (THB), which provides financing to clients who want to build or want to invest in real estate development; (3) the Co-operative and Rural Development Bank (CRDB), which provides funding to co-operative societies, rural development societies and individuals who can conceive development projects in the rural areas; and (4) the Tanzania Postal and Savings Bank (TP&SB), whose function is to provide postal saving facilities.

Other financial institutions are (1) the National Insurance

Corporation (NIC), which is the only organization in the country mandated to provide insurance services; (2) the Institute of Financial Management (IFM), which conducts courses on financial management mainly for personnel working in the public sector; (3) the College of Business Education (CBE), which conducts courses in business studies for middle cadre personnel working in the public sector; and (4) the Dar-es-Salaam School of Accountancy and three of its subsidiaries in the regions; their role is train accountants most of whom are employed in various government ministries and other public institutions, particularly the parastatal organizations.

3.4.9 The Services Sector

There are two main sub-sectors in the services sector: (1) education and (2) health. The education sub-sector involves the management of education at the elementary, secondary and post-secondary levels. Education is mostly in the public sector with a few private secondary schools. The three universities are all public.

Other post-secondary institutions - all managed by one or the other government ministries - include three technical colleges, the Institute of Development Management (IDM), the two Civil Service Training Centres, Agriculture Training Institutes, Veterinary Training Institutes, the Social Welfare Training Institute, the Postal Training Institute, the National Institute of Transport,and the National Institute of Productivity.

The Ministry of Education is responsible for education policy initiatives, the implementation of these initiatives, the management and administration of the formal education. The specialized training conducted by various institutions outlined above is managed by the relevant parent government ministries.

The health sub-sector is managed by the Ministry of Health. Most of the hospitals, medical and para-medical training institutes are publicly owned. There are only a few privately owned hospitals, most of them belong to non-governmental organizations (NGOs), which are mostly religious organizations.

The 1986 government agreement with the IMF initiated the gradual process by which the government intends to privatise most of the parastatal organizations. This will be achieved through the Parastatal Organizations Privatisation Commission established in 1991.objective.

Table 3.3 shows the shares of the public sector enterprises (parastatal organizations) in the Tanzania economy.

Table 3.3

SHARE OF PUBLIC ENTERPRISES IN THE TANZANIA ECONOMY

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
No. of Public Enterprises	-	398	433	448	460	420	166	188	197	197	197[a]
Contribution to GDP (%)	12	12	12.6	11.7	11.4	13[b]	-	-	-	-	-
Share of Domestic Investment (%)	22.4	31.7	16.5	30.9	26.20[c]	-	-	-	-	-	-
Net Financial Flows between Government and Public Enterprise (Mlns)	447.0	654	635	465	677	793.0[d]	-	-	-	-	-

Notes: (1) [a] the average for Tanzania is 189 enterprises which is only second to that of Egypt,
(2) [b] third after Zambia, Egypt and Morocco respectively,
(3) [c] comparable with other African countries,
(4) [d] highest in Africa followed by Mauritius,
(5) data for 1986-1990 is not available for b, c and d
(6) * in TShs.millions

Source: African Development Indicators, 1992, UNDP,
New York, N.Y.
The world Bank, Washington, D.C.

APPENDIX 3.1

HOW THE NATIONAL INCOME DATA ARE CONSTRUCTED

The national income data - the Gross Domestic Product (GDP) and associated concepts - are compiled on the basis of the System of National Accounts (SNA) of the United Nations. The actual construction is the responsibility of the Bureau of Statistics, a division of the Planning Commission in the Office of the President.

The concept of GDP described here and for national accounting purposes is GDP at current market prices which comprises gross output less intermediate consumption: the value-added of all final goods and services. It is the market value of all goods and services by the resident producers of Tanzania in a particular year.

Three approaches are used in constructing the GDP at factor cost: (1) by industrial sector origin; (2) by capital formation based on the type of assets; and (3) by capital formation of public and private sectors. Construction by industrial origin is the most commonly used approach.

The industries (sectors) for the purpose of estimating the GDP are grouped into nine main categories: (1) agriculture, hunting, forestry and fishing; (2) mining and quarrying; (3) manufacturing; (4) electricity and water supply; (5) construction; (6) wholesale and retail trade, restaurants and hotels; (7) transport, storage and communication; (8) finance, insurance, real estate and business services; and (9) public administration and other services.

Within the agriculture sector, estimates of output in the subsistence sector, mainly produced by peasant producers, are based on an annual growth rate of the rural population estimated to be an average of 2.8 percent yearly for the period 1961-1991. The private household consumption is assumed to be at producer prices which are estimated from the retail prices of goods and services used by the urban population.

The objective of this approach is to bring the consumption by the rural population in line with that of the urban population for purposes of national income accounting.

Peasant production of goods and services is imputed in national income accounts under the category of industrial origin by evaluating rural production and consumption based on consumption of the urban population.

While the peasant production is included in the estimation of GDP, peasant income is not subject to taxation according to the Income Tax Act (1973) and its subsequent amendments. We provide a detailed description of the Income Tax Act in chapter five.

A final comment on the subsistence sector is in order. The output estimates for the subsistence sector are imputed in the over all aggregates The National Accounts sources do not indicate explicitly the magnitude and changes in the subsistence sector over time. This may affect the reliability of our estimates of the underground economy. However, it is claimed that for some developing countries, for example, Pakistan and India, the size of the subsistence sector has become increasingly less important with time. It may also be the case for

Tanzania, (there is no evidence to support this view) in which case the effect of the subsistence sector on the estimates of the underground economy may be minimal. We are also aware of the fact that the use of currency relative to GDP differs quite substantially among different sectors of the GDP. For example, it is likely that more currency is used in the finance, insurance, real estate, and the business sector than it is used in the mining and quarrying sector.

The use of currency also depends on the relative size and importance of a particular sector in the composition of the GDP, thus more currency is used in the agriculture sector than in construction because agriculture has a larger share in the GDP than construction. Ideally, the estimates of the underground economy (obtained by any method using currency as one of the major variables) should reflect these differences in the use of currency among the different sectors and the relative changes in these sectors of the economy over time. However, the estimates of the underground economy are derived for the economy in general and not on a sectoral basis.

CHAPTER FOUR

ESTIMATION BY THE MACRO (MONETARY) APPROACH

4.1 INTRODUCTION

The objective of this chapter is to estimate empirically the underground economy in Tanzania by using several of the macro versions of estimation. The choice of the these methods has been determined on the basis of availability and reliability of data for Tanzania.

4.2 The Macro (Monetary) Approach

Under this approach, we use four methods to estimate the underground economy in Tanzania. They are (1) the currency-demand deposits ratio of Gutmann (1977, 1979)), (2) the 'transactions' method of Feige (1982 1989, 1990), (3) the currency - money ratio of Tanzi (1979, 1980, 1982 and 1983), and (4) the 'error component' method of Bhattacharyya (1989, 1990).

In this study the fiscal year is from the beginning of July of each year to the end of June of the following year. Money supply data is measured at the beginning of every calendar year.

4.2.1 The Gutmann Method.

This method involves the calculation of a currency-demand deposits ratio, C/D, which is assumed to have been relatively stable since an initial normal period. Gutmann assumes this period for the US to have been 1937-1941. Four assumptions are key to Gutmann's analysis: (1) there is a benchmark (initial) period (1937-1941) during which the underground economy is assumed to have been non existent (or at least negligible), (2) the underground economy uses currency as the exclusive medium of exchange, (3) the velocity of money in the underground economy is the same as that in the official economy and (4) 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 underground economy.

The basic data required for estimation are the components of money supply for the benchmark period and for each of the years of the study and the GDP for every year of the period of study. In this study the monetary data has been averaged by taking the sum of the end of the year data for every two subsequent years and dividing it by two. This averaging is done to obtain data which reflects more accurately currency and demand deposits actually used during the period.

4.2.2 Methodology

First, work out the currency-demand deposits ratio for the benchmark period. In this study this ratio is 0.595 for 1977, the reasons for this choice are given below. Second, work out the currency

to demand deposits ratios for each of the years following the benchmark year, that is for the period 1978-1991. These ratios are shown in column (3) of table 4.1 below.

Third, deduct the currency demand deposits ratio of the benchmark period from each of the annual ratios of the period of study. The resulting values for each year are shown in column (4).

Fourth, multiply each of these resulting values of column (4) by the values of the demand deposits for each year, column (2), to obtain the annual values of ''illegal'' currency used to undertake transactions in the underground economy in each year. These yield ''illegal'' currency, IC, in column (5).

Next, in column (6) is calculated ''legal'' money, LM by subtracting column (5) from the sum of columns (1) and (2). In column (8) the velocity of ''legal'' money is calculated by taking the ratio of GDP to LM. The size of the underground economy is then calculated by multiplying this velocity by illegal currency, IC, namely columns (5)X(8) to produce column (9), the absolute annual values of the underground economy. In other words, the underground economy is expressed in column (9) in its absolute size as a product of column (5) and the velocity of money, V, [column (8)]. Finally, the underground economy in column (9) is expressed as a percentage of GDP,column (8). This is shown in column (10).

The year 1977 is chosen to be the benchmark period of the study for the following reasons (1) it was the year when the C/D ratio was smallest, compared to the years before and after 1977, (2) it was the

year during which the EAC broke up and the Tanzania economy had to be restructured from 1978 by incorporating all the services (outlined elsewhere in this thesis) which had hitherto been managed under the EAC arrangements and (3) to be consistent with M-B who make the same assumption of non existence of the underground economy in 1977 although they do not spell out the reasons for making such an assumption. The third reason above should make it is easy (Table A4.3) to compare the estimates of the size of the underground economy by M-B with those of this study.

The computed currency-demand deposit ratio of 0.595 is the average of the annual currency-demand deposit ratios for the years 1975-1977. This low ratio reflects the lowest demand for currency compared to three years before and three years after1977. This would imply an absence or a negligible level of the underground economy in 1977.

Table 4.1 below illustrates the explanation given above.

Table 4.1

Estimation of the Underground Economy by the Currency-Demand Deposit Ratio Method

Year

1977: C/D = 0.595

	C	D	(C/D)	K	IC	LM	GDP	V	N	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1978	2648	3958	0.669	0.074	293	6313	28582	4.53	1327	4.64
1979	3485	5146	0.677	0.082	422	8209	32117	3.94	1650	5.15
1980	4650	7241	0.642	0.047	340	11551	37454	3.24	1193	2.96
1981	5931	8443	0.703	0.108	912	13462	43906	3.26	2975	6.74
1982	7303	9560	0.764	0.169	1616	15247	52546	3.45	5569	10.59
1983	8092	11353	0.713	0.118	1340	18105	62608	3.46	4636	7.40
1984	9333	11218	0.832	0.237	2659	17892	78143	4.37	11615	14.86
1985	11596	11308	1.026	0.431	4874	18030	108083	6.00	29220	26.99
1986	15515	15026	1.033	0.438	6581	23960	140866	5.88	38690	27.43
1987	21431	20040	1.069	0.474	9499	31972	200377	6.27	59530	29.74
1988	28127	28140	1.000	0.405	11397	44870	285152	6.36	72428	25.36
1989	36399	37512	0.970	0.375	14067	59844	335505	5.61	78860	23.53
1990	49507	47245	1.048	0.453	21402	75350	400719	5.32	113816	28.39
1991	55715	54997	1.013	0.418	22989	87723	573536	6.54	150348	26.21

Notes
(1) K is the annual C/D ratio less the base year C/D ratio
(2) IC is the illegal money i.e. column (2)X(4)
(3) LM is the legal money i.e. M_1 (C+D) less column (5)
(4) V is the GDP/legal money ratio i.e. columns (7)/(6)
(5) N, column (9) is the absolute annual values of the UE
(6) P, column (10) is the size of UE as a % of GDP
(7) GDP is reporddtd at current prices
(8) Monetary data is the average of end of every two consecutive consecutive years
(9) Monetary components in TShs.million
(10) Estimates in column (10) under P can also be obtained by the simple ratio of IC/LM expressed in percentage form. Thus the detailed table is meant to enable the reader folllow every step of calculation.

Sources
(1) Bank of Tanzania Operations Reports, various years
(2) Bank of Tanzania Economic Bulletins, various issues
(3) International Financial Statistics, the IMF, various years
(4) Economic Surveys, 1991, 1987
(5) National Accounts of Tanzania, 1976-1991
(6) National Accounts of Tanzania 1976-1984 (Sources and Methods)

4.2.3 Interpretation of Results of Gutmann's Method.

The size of the underground economy has been increasing somewhat steadily from 1978 to 1991 with the lowest size of 2.96 percent in 1980 and the highest of 29.74 and 28.39 percent in 1987 and 1990 respectively. Various reasons can be attributed to the different estimated sizes of the underground economy.

For example, the fall of the size of the underground economy from 5.15 percent of the GDP in 1979 to 2.96 percent in the following year, 1980, is a probable indication that the war against Uganda may have had a discouraging effect on some participants in underground econonomic activities.

It seems the nationwide crackdown against hoarders and other economic saboteures carried out by the government in 1983 achieved the desired effect of reducing the size of the underground economy. This is supported by the observation that the size of the underground economy dropped from 10.59 percent in 1982 to 7.40 percent in 1983, the smallest size for the entire period of study. It rose again to 14.86 percent in 1984 when the pressure of the crackdown was being eased by the government.

From 1985 the size of the underground economy was in the high twenty percent range except for 1989 when its size was in the low twenty percent range, that is 23.53 percent. It rose to the second highest size for the period of study , that is to 28.39 percent in 1990 and dropped slightly to 26.21 in 1991. The probable explanation for the relative increase in the size of the undergound economy in 1990 is the nationwide

debate on political reforms which started late in 1988 and the introduction of a multi-party political system introduced in 1991.

It is feasible to speculate that once it was becoming obvious that the political system was going to change and that the country would now be a multi-party state after thirty years (since independence in 1961) of a one party political system, some people being uncertain about the political future of the country, increased their involvement in underground economic activities hoping that they would leave the country if the political changes turn out to be violent.

This situation would be particularly true about the Asian community who dominate most of the private and business sector of the economy and most of whom are either non Tanzanians or secretly possess dual citizenship of Tanzania and some other countries, particularly United Kingdom, Canada, India, Pakistan, United States or other European and Arian countries.

Typically, people involved in such underground activities would conduct their business activities (legal or illegal) and illegally ship the money realised from their business activities out of the country. Since money realised from such activities can be substantial, it is not surprising that this portion of income and income not accounted for in the national income statistics from other underground activities, could increase the size of the underground economy to the level of the estimates for 1988.

This observation is supported by the results of the estimates which show a significant fall in the size of the underground economy from

33.66 percent in 1988 to 26.21 percent in 1991 with the exception of 1990 when it was highest of all time. The explanation for this drop in the size of the underground economy is that by the end of 1991 it was clear that the adoption of a multi-party system was going to take place peacefully.

This did assure those who might have engaged themselves in unusually high degree of underground activities from 1987 that political change was going to take place peacefully after all, and there was therefore no need to engage in huge underground activities and ship the profits illegally out of the country. Political parties were allowed to register themselves and start political activities in 1992 and as of now (1993) there are at least ten different political parties functioning in Tanzania.

4.2.4 Limitations of the Gutmann Method

Several criticisms can be made of the currency-demand deposits method of Gutmann. First, in general the ratio of currency with the public to demand deposits in the case of the US, for example, has been increasing over time, Molefsky (1982), implying that cash has been growing rapidly presumably because part of it is spent in the underground economy in line with the second of Gutmann's assumptions, described above.

However, Gutmann's critics suggest that the increase in the ratio of currency to demand deposits can also be due to checking accounts

(which include demand deposits) having been growing too slowly, (due to financial innovations increasing the velocity of the demand deposits) rather than cash growing too rapidly, Garcia (1978).

Secondly, the rise in currency use relative to demand deposits can be explained by changes in income, consumption and interest rates, implying that even if there were no underground economy, the rise in currency would still take place, see, for example, Garcia (1978 p.64 - 66), Porter and Thurman (1979).

I speculate, however, that because demand deposits play a much smaller role in effecting transactions, than currency financial innovations have had only a modest impact in affecting the currency/demand deposit ratio and so this criticism carries less weight. In addition, financial innovations in Tanzania have not proceeded as fast nor have they been accepted as fast as in Western developed countries. This criticism is valid though in practice its empirical magnitude is small.

Third, it is difficult to account for howall the currency is used in an economy. This is particularly true in the case of the US currency with an unknown quantity of it in the hands of foreigners and not readily available for domestic use. For example, Tanzi argues that the ratio of currency to demand deposits may actually be lower than indicated by published data because some of the currency is used outside the US and consequently the estimated size of the underground economy may in fact be higher than its real size, Tanzi (1982 p.103). This observation is also relevant (though to a much less scale) in the case of Tanzania whose

smuggled currency is readily available in some of her neighbouring countries particularly Rwanda, Burundi, Zaire, Uganda and to a lesser extent Mozambique, Kenya, and Malawi.

In sum, the limitations outlined above should serve as a caution when one interprets the estimates of the size of the underground economy obtained by Gutmann's method.

4.3 The 'Transactions' Method of Feige

Feige (1979, 1980 1990) has developed a method which is based on the ratio of total monetary transactions to GNP. His procedure begins with Fisher's (1911) equation of exchange which specifies the identity MV = PT where M is the stock of money, V is the velocity and PT is the total value of monetized transactions in the economy.

The key assumption in this method is that total transactions are proportional to total economic activity and the term "total" here means the sum of official (above ground) and underground economic activity. In this framework, total transactions can be broken into three main components: (1) those involving the production of final output (2) transactions involving the exchange of real or financial assets and (3) transactions involving direct transfer payments, see Feige (1989 p. 49).

Feige realised that transfer payments continually change over time and that purely financial transactions associated with asset exchanges have probably increased tremendously in the US in response to various financial innovations. Hence, to device a measure of net total

transactions appropriate for estimating the underground economy, he deducted three major categories of financial transactions and direct transfer payments from gross transactions to reduce the effect of the increase in transactions resulting from financial innovations. The three categories were: (1) estimated debits to demand deposits for cash withdrawals and withdrawals to other checkable deposits, (2) debits to demand deposits for the purchase of various money market instruments such as repurchase agreements, time and savings deposits and the like and (3) estimated transactions in the stock and bond market, Feige (1989 p.134).

4.3.1 Methodology

The application of the method involves the following four steps. First, a benchmark period is chosen during which it is assumed that there was no underground economy. Feige selects the year 1939 to be such a period in the U.S. For Tanzania, the base year is 1977 as explained above. Second, the ratio of total transactions to measured GDP is calculated for the benchmark period. Total annual transactions are obtained by summing up transactions supported by currency (cash) and those supported by demand deposits. Annual transactions supported by currency are estimated by calculating the turnover rate of a bill (the average number of times a bill changes hands during its lifetime) and then multiplying it by the total stock of currency due to supported by the particular bill). Transactions supported by demand deposits are estimated by taking the average annual stock of demand deposits

multiplied by their turnover rate (the average number of times a demand deposit changes hands). Third, divide the total transactions in each succeeding year by the ratio of the benchmark period derived in step two to obtain annual estimates which are a sum of both the measured GDP and the estimated underground economy for the succeeding years.

Fourth, subtracting the annual size of the measured GDP from the sum of both obtained in the third step above yields the annual estimates of the underground economy for the period of study.

Finally, as indicated above, the necessary adjustments must be made wherever possible to make the total net transactions and income series appropriately comparable for estimation of the underground economy.

4.3.2 Applying the Transactions Method to Tanzania Data

We could not apply the transactions method to estimate the underground economy in Tanzania for the folllowing reasons:

First, we could not decompose the transactions into the three major components done by Feige in tha case of the US, that is (1) transactions involving production of final goods, (2) the exchange of existing real or financial assets and (3) direct transfer payments. The reason for the failure is that such monetary data are simply not available.

Second, we could not deduct the three major categories of financial transactions and direct transfer payments from gross

transactions to reduce the effect of the increase in transactions resulting from innovations in the financial market, as suggested by Feige, because as we have commented above that such decomposed monetary data is not available.

Third, any adjustment along the lines of Feige would require the decomposed monetary data mentioned above and such data, as we have noted above is not available.

Fourth, as commented earlier, the financial market in Tanzania is not as well integrated and developed as those in developed economies, for example, there is no stock market in Tanzania to date.

Fifth, we could not have access to data on actual annual debits, savings and current accounts recorded by commercial banks. Apparently this data is not submitted to the Bank of Tanzania by the commercial banks at least for for a good number of years.

Therefore, for the reasons given above, we were unable to employ the method to estimate the underground economy in Tanzania.

4.4 The Currency - Money Ratio Method

Tanzi (1979, 1980,1982 and 1983) developed a demand for currency equation to estimate the underground economy in the US for the period 1930-1980. The method consists of specifying a demand for currency equation (expressed as a ratio of currency to broad money) or even a currency to demand deposits ratio, Tanzi (1980 p.434) to be used to infer the effect of a change in the level of tax on that demand.

The key assumptions made are (1) the underground economy is a direct result of high taxes and (2) cash/currency is used mainly to carry out transactions in the underground economy.

Thus the size and growth of the underground economy directly influences the demand for cash by the public, whereas the size and growth of the underground economy is directly influenced by high taxes.

Tanzi fitted equations of the following form to US data:

$$\ln(C/M_2) = b_0 + b_1 \ln T + b_2 \ln(Ws/NI) + b_3 \ln Y + b_4 \ln R \qquad (4.3.1)$$

where (C/M_2) is the ratio of currency to broad money (including time deposits), T is the income tax variable, Ws/NI is the share of wages and salaries in national income NI, Y, is real per capita GNP and R is the rate of interest on time deposits.

Tanzi used the variable, Y, (real per capita income) as a proxy for trends which accompany economic development and which also influence public demand for cash holdings. These trends include growing travel per capita, increases in urbanisation, spread of commercial branch banking and other financial innovations as well as other indicators of economic development.

The variable, Ws/NI, represents the portion of income which is wages typically received in cash and hence the ratio, Ws/NI, could be expected to influence the demand for currency. The variable, R, affects C/M_2 ratio negatively through both the fall in currency and the increase in broad money as the the rate of interest increases and vice versa.

As noted above, Tanzi then fits the above equation to annual time series data for the US for the period 1930 - 1980. After obtaining what he regards as statistically significant estimates for the equation, he proceeds to estimate the underground economy for a given year, t, as follows:

By taking his 'best' equation, he obtains the predicted value for currency demand, C_t'', given the observed value for all the other variables in year, t. Then he obtains another prediction of currency demand, C_t', by setting the value of the tax variable at zero (or alternatively, to the lowest observed value of the tax variable in the sample period) while keeping the observed values for all the other variables. The difference $C_t''-C_t'$ gives an estimate of 'illegal currency', namely the holding of currency which can be attributed to the increase in taxation.

Tanzi then subtracts the estimated value of 'illegal' currency from the value of narrow money, M_1, in year, t.

Dividing nominal GNP in year, t, by the estimate of 'legal' money yields an income velocity for legal money. By assuming that the income velocity of 'illegal' currency is the same as that of legal currency, he generates an estimate of unaccounted income, namely the underground economy, for year, t, and for each of the remaining years of his study.

4.4.1 Adopting the Currency-Money Ratio Method to Tanzania.

Following the example of the National Institute of Public Finance and Policy, [(NIPFP)] (1986 p.56) study on the underground economy in India; we use the method of Tanzi with some modifications (to be described below) to estimate the underground economy in Tanzania for the period 1978-1991.

We modify the C/M_1 equation by using the rate of inflation for the rate of interest as one of the regressors. McKinnon (1973) has argued that estimation of money demand and money currency ratios (functions) in developing countries should be conducted by using the rate of inflation as a proxy for the rate of interest because the latter is a less reliable guide to financial market behavior than the rate of inflation. The reason for this is that in the case of developing countries, the rate of interest has less impact on the financial markets behavior because of the way it is set, McKinnon (1973 p.57-65), which is a result of the disorganised nature of the financial markets in developing countries. In these markets, interest rates are institutionally and artificially fixed by monetary authorities. These interest rates do not therefore reflect financial market behavior which is assumed to be determined by the supply and demand forces on the financial assets. Needless to note that Tanzania is no exception to this observation.

Therefore, following McKinnon's proposition, we specify Tanzi's currency-money ratio in the following modified form:

$$\ln C/M_1 = a_0 + a_1 \ln TTR/GDP + a_2 \ln W/GDP + a_3 \ln P^* + a_4 \ln PCGDP$$

$$+ \qquad - \qquad - \qquad -$$

(4.3.2)

where, C/M_1 is the ratio between the average annual currency holdings with the public and narrow money, M_1. TTR/GDP is the ratio of total tax revenue to GDP, P^* is the rate of inflation, PCGDP is real GDP per capita

The relevant expected signs are shown under each coefficient letter of the regressors. The coefficient, a_1, for the ratio of taxes to GDP is hypothesised to be negative because as the burden of taxation in the economy increases, participants in tax evasion are tempted to evade even more of it, an activity which is facilitated by conducting transactions in cash wherever possible. Hence, ceteris paribus, the public will want to hold more cash, the greater the burden of taxation, (the coefficient should be negative because the log of the ratio of taxes to GDP is negative).

The coefficient, a_2, for the ratio of wages and salaries in GDP is expected to be positive because wages are paid mainly in cash whereas other types of income (interest, dividends, etc) are almost always paid by cheque. An increase in the ratio of total income paid will require more currency.

The coefficient, a_3, for the rate of inflation is expected to be negative because as the rate of inflation increases, the demand for cash should decrease. The reason for this is that the rate of inflation plays the same role as that of the rate of interest.

The coefficient, a_4, for real income per capita is hypothesised to

be negative because economic development (and presumably the resulting innovations in the financial market) as proxied by per capita real income, is assumed to lead to replacement of currency by cheques, thus leading to a fall in the currency-money ratio.

Once equation (4.3.2) has been estimated for the period of the study, it will then be 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 in turn will be used to determine the extent of the underground economy by multiplying excessive currency (namely the difference in currency between the estimate which include taxes and the one in which taxes take the value of zero) by the income velocity of money.

4.4.2 Results and Interpretation

The currency-money ratio regressed in log form on the explanatory variables described above yielded results with the correct coefficient signs for all the variables except real per capita income, and the crucial tax variable. The positive sign for the coefficient of the tax variable yields negative estimates for the size of the underground economy. It shold also be noted that the tax variable is statistically insignificant.

The negative results for the size of the underground economy can also be explained in terms of the tax-GDP ratio which was declining for some years as the dependent variable (the currency-money ratio) was

increasing over time. This is shown in Table A4.3.

A description of the way we used the method and the results we obtained is shown in Appendix 4.2 to this chapter.

4.5 Bhattacharyya's Error Component Method

The method of Bhattacharyya involves estimating an omitted part of the GNP which is reflected by the currency in circulation to the public. Bhattacharyya calls these estimates of the GNP error component the 'hidden economy' a term which in this study is used interchangeably with the term 'underground economy'.

To use Bhattacharyya's method, it is necessary to note the conventional wisdom that published GNP data are subject to measurement errors. These errors are usually due to: first, GNP measurements ignore output generated in the informal sector. Secondly, recorded GNP data suffer from errors due to exclusion of income generated from illegal activities such as tax evasion, smuggling, transactions involving illicit goods such as drugs, poaching of wildlife products etc. This is an additional problem in measuring GDP or GNP in developing countries. The second category of measurement errors may also contain statistical discrepancies, omission of income from activities in the informal economy, calculations and other observational errors.

In sub-section 4.5.1, we estimate the underground economy in Tanzania using a modified form of Bhattacharyya's method. We report the results in Appendix 4.3.

4.5.1 Estimation Procedure

Following Bhattacharyya (1989, 1990), we estimate the underground economy in Tanzania under a maintained hypothesis consisting of the following components: First, the underground economy exists in Tanzania and it is related to the demand for currency in circulation with the public in the same way the official economy is related to this demand for currency. Secondly, the underground economy uses currency for transactions. Third, the variables which explain the variations in the currency demand of the official economy are completely known. Fourth, there is no functional mis-specification in the official economy's demand for currency.

We use the GDP measure in the estimation as we have done in the previous cases.

Following the maintained hypothesis, we can write:

$$M_t = M_{ot} + M_{ut} \qquad (4.4.1)$$

where, M_t is the total demand for currency in circulation with the public at time, 't', and M_{ot} and M_{ut} are respectively the demand for the official and the underground economy.

The currency demand equation for the official economy can be specified as follows:

$$M_{ot} = \alpha_1 Y_{ot}^{\beta_1} P^{*\beta_2} \qquad (4.4.2)$$

where M_{ot} is as defined before, Y_{ot} is the official national income (GNP)

variable, and P_t^* is the rate of inflation proxing for the rate of interest used by Bhattacharyya. The justification for using the rate of inflation rather than the rate of interest is the same as given earlier in the method of Tanzi, McKinnon (1973)

The demand for currency equation for the underground economy is specified as follows:

$$M_{ut} = Y_{ut}^{\beta_3} \qquad (4.4.3)$$

where M_{ut} is as defined before and, Y_{ut}, is a measure of the underground economy as the third explanatory variable (see equation 4.4.4) below.

Equation 4.4.1 can be expressed by combining equations (4.4.2) and (4.4.3) to obtain the following equation:

$$M_t = \alpha_1 Y_{ot}^{\beta_1} P_t^{*\beta_2} + Y_{ut}^{\beta_3}/H \qquad (4.4.4)$$

where $H = \alpha_1 Y_{ot}^{\beta_1} P_t^{*\beta_2}$

According to the maintained hypothesis, the only unknown variable in equation (4.4.4) is the size of the underground economy, Y_{ut}. Thus, within the maintained hypothesis, the implication is that among all proxies for Y_{ut}, the one which gives the best fit for the equation will yield the "best" obtainable estimate of the underground economy. If the model is estimated without the inclusion of the underground economy variable, Y_{ut}, which is a relevant variable, then the estimates will be

unbiased and inconsistent.

One of the established tests in the literature for this type of mispecification is the RESET procedure suggested by Ramsey (1969). According to this procedure, there exists a number of variables, say a_i,s, a linear sum of which will proxy a non zero mean in a regression equation which is generated by omitted variables. When the proxy variables correctly identify the existence of the non zero mean, it implies that the proxy variables accurately mimic the effects of the omitted variables.

The particular approach taken in this study from the extensive literature on the RESET procedure is an extension of Thursby and Schmidt (1977) who observed from a Monte Carlo study that a fourth degree polynomial in terms of included explanatory variables is powerful in detecting different types of mispecification including misspecification due to omitted variables. Pagan (1984) has also noted the importance of this result.

Within the maintained hypothesis, the only mispecification which can exist in our model is through the non observability of Y_{ut}.

Utilising Thursby and Schmidt's results, we consider that Y_{ut} can be proxied by third degree polynomial in Y_{ot}, and P_t^* where the intercept term and the first degree terms are set to zero.

The modified RESET proxy for Y_{ut} can therefore be expressed as follows:

$$Y_{ut} = \sum_{i=2}^{4} \alpha_i Y_{ot}^i \qquad (4.4.5)$$

Combining equations (4.4.4) and (4.4.5) and expressing them in logs gives us the following equation

$$\ln M_t = \ln\alpha_1 + \beta_1 Y_{ot} + \beta_2 P_t^{*} + \beta_3 \left(\sum_{i=2}^{4} Y_{ot}^{i}\right)^{\beta_4} \qquad (4.4.6)$$

The estimates for α_i (i = 2, 3 and 4) are obtained by fitting the model to the observed data by using a routine non linear least squares procedure. The estimate of the underground economy, Y_{ut}, is then obtained from equation (4.4.5) as follows:

$$\hat{Y}_{ut} = \Sigma\hat{\alpha}_i Y_{ot}^{i} \qquad (4.4.7)$$

Following Bhattacharyya (1989 p.16) the actual estimation procedure can be summarised as (1) set the value of β_4 within the range of 0 to unity, (2) estimate all the parameters of equation (4.4.6) using the routine non linear least squares on the assumption of no auto correlation for the error terms. Note that the parameters associated with the underground economy are α_2, α_3, and α_4.

4.5.2 Interpretation of Empirical Results

After running of non linear regression for the period 1978-1991 the demand for currency on GDP and inflation, the results obtained were uninformative, the 't' statistics for the GDP and the rate of inflation are insignificant. In addition the standard errors are too large to draw any meaningful conclusion from such results.

Consequently, we could not proceed any further with such results. The results are described in Appendix A4.3.

APPENDIX A4.1

REPLICATION OF THE M-B ESTIMATES

In this appendix, we replicate the estimates by MB (1990), and show that their estimates are based on flawed data on currency and demand deposits for part of the peiod of their study. We then re-estimate using correct data and compare the results with the flawed estimates of M-B.

M-B do not show precisely how they obtain their estimates of the underground economy for the period of their study (1975-1986) using the currency-deposit method of Gutmann (1977). The calculation of their estimates of the underground economy is based on table 2.3 (p.144) and Appendix II, table B1 (p.177) of the M-B text.

In the following sections of this appendix, first, we replicate in Table A4.1 the pricise data used by M-B and produce the estimates which are close to those of M-B except for random variations. Second, we replicate the M-B estimates with the correct data in Table A4.2 and compare the results with M-B estimates.

Third, we believe that the data used by M-B for currency for the period 1981-1986 and that of demand deposits for the period 1979-1986 as shown in table 2.3 (p.143-144) of the M-B text is flawed because it differs from the data provided by the Bank of Tanzania and the International Financial Statistics of the International Monetary Fund. (Both these sources have the same data for currency and demand deposits).

Accordingly, as we have noted above, we re-estimate the underground economy with the correct data for the same period (1975-1986) covered by the study of M-B. The results are shown in table A4.2. Then

we average the correct data for every two consecutive years to be consistent with the estimation in Table 4.1. These results are consistent with the estimates of the present study shown in table 4.1.

Finally, we report (1) the M-B estimates, (2) the replicated estimates with the M-B data, (3) the estimates of the replicated and corrected data for currency and demand deposits, (4) the estimates of the replicated, corrected and averaged data and (5) the estimates of the current study for the same period (1975-1986) covered by M-B.

Table A4.1

REPLICATION OF THE ESTIMATES BY M-B (1990)

Year 1977: C/D = 0.59

	C	D	M_1	C/D	K	IC	LM	GDP	V	N	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1975	1756	2528	4284	0.70	0.11	278	4006	16988	4.2	1179	6.6
1976	2071	3261	5332	0.64	0.05	163	5169	22620	4.4	717	2.8
1977	2380	4003	6383	0.59	-	-	-	26105	-	-	-
1978	2915	3911	6827	0.75	0.16	626	6201	28430	4.6	2879	9.8
1979	4055	4380	8435	0.92	0.34	1489	6946	32452	4.7	6957	21.1
1980	5246	5380	10626	0.98	0.39	2098	8527	38667	4.5	9442	24.2
1981	5992	5855	11847	1.02	0.43	2538	9309	45193	4.9	12435	27.3
1982	7178	6908	14086	1.04	0.45	3108	10977	54845	5.0	15542	28.4
1983	7794	7734	15528	1.01	0.42	3231	12297	60702	4.9	15950	26.3
1984	9389	9439	18829	0.99	0.40	3776	15053	74608	5.0	18879	25.5
1985	10680	10186	20866	1.05	0.46	4685	16180	97767	6.0	28112	28.8
1986	13679	12566	26245	1.09	0.50	6283	19962	131346	6.6	41468	31.4

Note: the captions at the top of the columns are explained in Table 4.1

Source: Calculated by author of this study using data by M-B (1990) p.144.

We have commented above that if M-B (1990) had used the correct data for the currency and demand deposits for the periods 1981-86 and 1979-86 respectively, they should have obtained the estimates of the underground economy shown in column (11) Table A4.2 below.

Table A4.2

REPLICATION OF THE ESTIMATES BY M-B WITH CORRECT DATA

Year 1977: C/D = 0.59

	C	D	M_1	C/D	K	IC	LM	GDP	V	N	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1975	1756	2528	4284	0.70	0.11	278	4006	16988	4.2	1168	6.6
1976	2071	3261	5332	0.64	0.05	163	5169	22620	4.4	717	2.8
1977	2380	4003	6383	0.59	-	-	-	26105	-	-	-
1978	2915	3911	6827	0.75	0.16	626	6201	28430	4.6	2879	9.8
1979	4055	6380	10435	0.64	0.05	319	10116	32452	3.2	1021	2.9
1980	5245	8101	13346	0.65	0.06	486	12860	38667	3.0	1458	3.6
1981	6616	8785	15401	0.75	0.16	1406	13996	45193	3.2	4498	10.3
1982	7989	10335	18323	0.77	0.18	1860	16463	54845	3.3	6139	11.5
1983	8194	12370	20564	0.66	0.07	866	19698	60702	3.1	2684	4.6
1984	10472	10065	20537	1.04	0.45	4529	16008	74608	4.7	21285	28.3
1985	12919	12551	25270	1.01	0.42	5272	19999	97767	4.9	25830	27.9
1986	18309	17500	35810	1.05	0.46	8050	27760	131346	4.7	37835	28.7

Note: (1) calculated by the author of the present study using correct data for currency (1981-1986) and for demand deposits (1979-1986).

Sources (1) Bank of Tanzania Operations Report, various years,

(2) Bank of Tanzania Economic Bulletins, various issues,

(3) International Financial Statistics, the International Monetary Fund, various years

The difference in the estimates of the underground economy between those derived in this study and those produced by M-B (1990) for the period covered by both studies (1978-1986) is primarily due to the incorrect data for the currency and demand deposits, for the period specified earlier, as employed by M-B, otherwise they should have been very close to each other.

Further, M-B used the end of year monetary data, whereas we employ an average of end-of-year of every two consecutive years. The latter is preferable since it reflects more accurately the money actually available for use all the year round.

Table A4.3 shows in column (1) the estimates of M-B (1990). Column (2) shows our estimates replicating the data of M-B. Column (3) shows our estimates using the corrected data for the currency and demand deposits covering the same period (1975-1986) covered by the M-B (1990) study. Column (4) shows our estimates corrected and averaged for every two consecutive years consistent with the estimates in in this study shown in Table 4.1. For ease of comparison, we report the estimates in column (10) of table 4.1 as column (5) of table A4.3 of Appendix 4.2.

Table A4.3

Replication and Comparison of Estimates of the Underground Economy as % of Measured GDP Using M-B and Corrected Data

Year	A	B	C	D	E
	(1)	(2)	(3)	(4)	(5)
1975	6.6	6.6	6.6	6.9	-
1976	2.8	2.8	2.8	3.1	-
1977	-	-	-	-	-
1978	9.8	9.8	9.8	4.6	4.64
1979	21.1	21.1	2.9	5.2	5.15
1980	24.2	24.2	3.6	3.0	2.96
1981	27.2	27.3	10.3	6.7	6.74
1982	28.2	28.2	11.5	10.6	10.59
1983	22.0	26.4	4.6	7.4	7.39
1984	25.4	25.4	28.3	14.9	14.86
1985	28.8	28.8	27.9	27.0	26.99
1986	31.4	31.4	28.7	27.4	27.43

Note (1) column (A) represents the original M-B estimates
(2) column (B) represents the replication of M-B estimates using their original data
(3) column (C) represents the replication of the M-B estimates with corrected data drawn from Table A4.2
(4) column (D) represents the replication of the M-B estimates with corrected and averaged data
(5) column (E) represents the estimates from our study for the period covered by the M-B (1990) study.
(6) the estimates in columns (D) and (E) are almost identical except that they are reported in one and two decimal places respectively
(7) notice that the estimates of M-B, in column (A) for 1983 are different from the replicated estimates, in column (B). We believe there is an error in the M-B estimates

Sources: (1) M-B (1990) and estimates done by author of this study
Bank of Tanzania Operations Reports, various years
(2) Bank of Tanzania Economic Bulletins, various years
(3) International Financial Statistics, the International Monetary Fund

APPENDIX A4.2

ESTIMATION BY THE CURRENCY-MONEY RATIO METHOD OF TANZI

In this appendix, we report the annual estimates of the underground economy using the currency-money ratio method. Following Tanzi, the estimates are derived as follows: (1) regress currency-money ratio on tax rate, TR/GDP, the ratio of wages to GDP, W/GDP, the rate of inflation, P^*, and per capita GDP, PCGDP in log-linear form (2) use the estimates obtained to forecast the value of the currency-money ratio (3) use the estimates to forecast the currency-money ratio using the tax rate variable taken on its base year value (1977) (4) use the calculations in (2) and (3) to estimate the amount of underground money-currency used for underground purposes (5) calculate the velocity of 'legal' money as the ratio of GDP to total money (M_1) less underground money (6) estimate the size of the underground economy as a product of the velocity of money and the underground money and (7) express this size of the underground economy as a percent of the GDP.

The results of the regression is as follows:

$$\ln (\hat{C}/M_1)_0 = -1.959 + .031TR/GDP + .372W/GDP + -.053P^* + .434PCGDP$$

	(.751)	(.502)	(.328)	(.170)	(.216)
t-ratio	-2.609	0.608	1.135	-0.308	2.001

(A4.2.1)

Note that the figures in brackets are the standard errors.

On the assumption that all underground activity arises from avoiding taxes beyond those of the base year,, then estimating C/M by

setting taxes equal to the base year rate produces an estimate of currency-money ratio, $(C/M_1)_1$, which includes only cash holdings for regular (legal) economic activity.

Consequently total cash used for both regular and underground activities can be estimated as the product of M_1 and the currency-money ratio $(C/M_1)_0$, and cash used for regular economic activities can be estimated as the product of M_1 and the currency-money ratio $(C/M_1)_1$.

The difference between these two gives the amount of cash used in underground activities 'illegal' money which can be expressed as a percentage of the 'legal' money to obtain the size of the underground economy for every year.

Estimation Results

Unfortunately the positive sign on the tax variable implies a negative estimated underground economy (because the log of the tax variable is negative).

One reason for this result is the fact that the increase in the ratio of total tax to GDP was in some periods declining rather than increasing, for example, between 1980 and 1981, 1984 and 1985 and 1990 and 1991.

This means that the application of the method of Tanzi which assumes that the underground economy is caused by the increase in taxes may not be applicable to Tanzania.

For ease of reference we report in Table A4.3, total taxes, GDP and the ratio of taxes to GDP to confirm the comment we have made above.

Table A4.4

Magnitude of Tax Revenue, GDP and Tax Revenue-GDP Ratio

Year	TR	GDP	TR-GDP Ratio
1978	5992	28582	0.2096424
1979	6817	32117	0.2122552
1980	8147	37454	0.2175202
1981	9079	43906	0.2067827
1982	11252	52542	0.2141525
1983	13368	62608	0.2135190
1984	17252	78143	0.2207747
1985	19662	108083	0.1819157
1986	29527	140866	0.2096106
1987	42557	200377	0.2123847
1988	58235	285152	0.2042244
1989	67568	335505	0.2013919
1990	78253	400719	0.1952815
1991	89181	573536	0.1554933

Note (1) TR is tax revenue and GDP is gross domedtic product

Source: (1) Economic Survey 1991
(2) Undated, untitled document, Ministry of Finance

APPENDIX A4.3

BHATTACHARYYA (1990) ERROR COMPONENT METHOD OF ESTIMATION

Following Bhattacharyya (1990) method of estimation of the underground economy by non linear least squares, we proceeded with the estimation by specifying the model as follows,

$$\ln M_t = \ln \alpha_1 + \beta_1 \ln Y_{ot} + \beta_2 \ln P^* + \left(\sum_{i=2}^{4} \alpha_i Y_{ot}^i\right)^{\beta_4} / H \qquad \text{(A4.3.1)}$$

where M_t is the total demand for currency

Y_{ot} is the measured (GDP) income

P^* is the rate of inflation

and

$$H = \alpha_1 Y_{ot}^{\beta_1} P_t^{*\beta_2}$$

Note that the expression in the bracket is the underground economy component of the total economy.

We obtained the following results:

$$\hat{M}_t = 1.134 + 0.529Y_{ot} - 0.587P^* + (0.053Y_{ot}^2 + 0.055_{ot}^3 - 0.001Y_{ot}^4)^{0.9} / H$$

$$\begin{array}{lccccccc} & (.997) & (.999) & (.956) & (.617) & (.133) & (.003) & (.848) \\ \text{t-ratio:} & 1.139 & 0.530 & 0.614 & 0.086 & 0.413 & -0.409 & 1.420 \end{array}$$

(A4.3.2)

Note that the figures shown in brackets are the standard errors

These results yield the estimates for the size of the underground economy for the period of study as follows:

Table A4.5.

Estimated Size of the Underground Economy as Perccentage of GDP

Year	Size of the underground economy as % of GDP
1978	0.58
1979	0.70
1980	0.92
1981	1.20
1982	1.65
1983	2.23
1984	3.27
1985	5.68
1986	8.74
1987	14.75
1988	22.06
1989	24.32
1990	23.38
1991	-12.59

Source: estimates from the regressions adopted from Bhattacharyya (1990) model.

These estimates have the following shortcoming: they are much too small compared to the estimates obtained by the methods of Gutmann and the RR method for 1991. Infact the estimate for 1991 is negative (-12.59%) which does not make sense.

Since the results are not realistic, we refrained from using the method to estimate the underground economy for Tanzania.

CHAPTER FIVE

A THEORETICAL ANALYSIS OF TAX EVASION

5.1 INTRODUCTION

The following analysis is concerned with the relationship between income tax evasion and risk-taking and is based on Cowell (1990). An individual taxpayer who wants to evade paying taxes on his income must make a decision on the extent to which he wants to evade by deliberate under reporting. Thus, the basic problem is that the taxpayer is faced with the problem of choice under uncertainty and risk.

5.2 The Nature of Optimization

The individual taxpayer must decide on his choice of whether or not to pay taxes on his income in such a way that the decision maximizes his utility from the income he obtains as a result of his decision. The analysis on how this can be achieved is done with the help of a simple model below:

5.2.1 The Basic Model

The decision to declare full income for taxation purpose is one made under uncertainty because failure to declare one's income to the tax authorities does not automatically constitute a provocation which would trigger an official reaction in the form of a penalty. The taxpayer has

a choice between two main strategies, (1) to declare his actual income and (2) to declare less than his actual income.

If he chooses the second strategy, his pay off will depend on whether or not he is detected by the tax authorities or other law enforcement agencies. If he is not detected, then he is better off than strategy (1), but if he is detected, he is worse off because then he has to pay his income taxes as well as the prescribed penalty. Therefore, the choice of which strategy to take is crucial.

5.2.2 The Basic Assumptions

For the analysis to be valid, the following basic assumptions must hold,

1) The taxpayer is a rational individual

2) The tax is specifically based on income

3) A single time period, for example, one year, (in this study, the application of the analysis is done by estimating under reporting of income, in chapter six, for the year 1991) within which the taxpayer must decide whether or not to avoid paying income tax. If he decides to evade, then he must also decide by how much.

4) Once he decides to evade, then one of the two possible states of the world must obtain, (a) either the taxpayer escapes detection and enjoys a consumption level C'' or (b) he is detected, caught, convicted and punished in which case his consumption is C'.

Note that if he chooses to be perfectly honest, then $C''=C'$ otherwise $C''>C'$.

5) The taxpayer has a von Neumann-Morgenstern utility function which is strictly concave in consumption so that the individual taxpayer is risk averse. Then the taxpayer's expected utility is given by,

$$EU = (1-P)U(C'') + PU(C') \qquad (5.1)$$

where, U, denotes a concave utility function and P denotes the probabilty of detection etc..

The exact nature of the choice will depend on three factors, (1) the taxpayer's income (2) the tax system and (3) the penalty system and how it is enforced, that is how severe it is and how vigorously it is enforced.

The following further assumptions on the three factors outlined above are made; they are,

1) The taxpayer has a fixed gross income, Y, within the time period which is liable to tax,

2) There is a proportional income tax rate, T,

3) (a) The penalty on any income found to have been concealed from the authorities is the evaded tax plus a surcharge. This number is S times the amount of unreported income.

Let the system of tax evasion and enforcement be represented by the collection of parameters, $\lambda = (P, S, T)$, that is the tax enforcement parameters. Also, let, X, denote the amount of income concealed from the tax authorities.

Consider the situation which faces each taxpayer. His consumption can be represented as a schismatic variable,

$$C = Y - T(Y - RX) \tag{5.2}$$

where, R, is the rate of return to a dollar of evaded tax and is given by,

$$R = \begin{matrix} 1 \text{ with probability of } 1-P \\ -S \text{ with probability of } P \end{matrix} \tag{5.3}$$

so that the expected rate of return, $\bar{R}$, is,

$$\bar{R} = ER = 1 - P - PS \tag{5.4}$$

It will be consumed $\bar{k} > 0$.

Thus the expected utility, EU, is given by,

$$EU = U(C'')(1-P) + U(C')P \tag{5.5}$$

where $C'' = (1-T)Y + TX$

$C' = (1-T)Y - STX$

The first order condition for maximizing EU(C) with respect to X is given by,

$$\partial EU/\partial X = \begin{cases} \leq 0 \text{ if } X = 0 & (5.6a) \\ \geq 0 \text{ if } X = Y & (5.6b) \\ = 0 \text{ if } 0 < X < Y & (5.6c) \end{cases}$$

Inequalities (5.6a) and (5.6b), represent, respectively, two cases where the taxpayer chooses to be absolutely honest and pays his income taxes fully, and blatantly dishonest where he chooses to report none of his income.

If, however, we adhere to assumption (5) - the von Neumann utility function - if the taxpayer is not satiated in consumption goods and if $\bar{R} > 0$, then case (5.6a) becomes irrelevant. This is because given this structure of preferences, the marginal impact of evasion on expected utility, evaluated at the point of zero evasion must be,

$$\partial EU\Big|_{X=0} = U_C\{(1-T)Y\}T\bar{R} > 0 \qquad (5.7)$$

Since from (5.7) the marginal utility, U_C, and the expected rate of return, $\bar{R}$, are both positive, it is therefore clear that an increase (away from zero) in evasion would increase expected utility.
Thus (5.8a) is the condition the taxpayer will use to determine his optimal level of evasion.

$$\partial EU/\partial X = U_C(C'')(1-P)T - U_C(C')PST = 0 \qquad (5.8a)$$

The second order condition for maximization is,

$$\partial^2 EU/\partial X^2 = U_{CC}(C'')(1-P)T^2 + U_{CC}(C')PS^2T^2 < 0 \qquad (5.8b)$$

and this is satisfied since $U_{CC} < 0$ by the concavity of the utility function.

The method of comparative statics can then be used to determine the effect of changes in the parameters, (P, S, T).
First, note that,

$$\partial^2 EU/\partial X\,\partial P = -U_C(C'')T - U_C(C')ST < 0 \qquad (5.8c)$$

Thus,

$$\partial E^*/\partial P = -\frac{(\partial^2 EU)/\partial X \partial P}{(\partial^2 EU)/\partial X^2} < 0 \qquad (5.5d)$$

Secondly,

$$\partial^2 EU/\partial X\,\partial S = U_{CC}\,\partial C''/\partial S\,(1-P)T - \{U_{CC}\,\partial C'/\partial S\,PST\} + \{U_C(C')(PT)\}$$

$$= + \{U_{CC}\,(-TX)\,PST + U_C\,(C')PT\}$$

$$= PT\,\{U_{CC}\,STX - U_C\,(C')\} < 0$$

Finally,

$$\partial^2 EU/\partial X \partial T = -U_{CC}(C'')(1-P)T(Y-X) + U_{CC}(C')PST(Y + SX) + U_C(C'')(1-P) - U_C(C')PS \qquad (5.6)$$

$$= U_{CC}(C'')(1-P)T(Y-X) + U_{CC}(C')PST(Y + SX) \qquad \text{by (5.8a).}$$

The problem with (5.6) is that its sign is indeterminate. An increase in tax rate will harm the individual whether or not his evasion is detected. This implies that it is difficult to determine in which state of the world, C'' or C', the taxpayer will be harmed most as the government increases income tax for every member of the society. In sum, the model shows that increase in P or S will reducw the amount of tax evasion. However, it is not possible to detemine the effect of changes in tax rates.

In conclusion, equation (5.6c) represents the case where the

taxpayer attempts to conceal just a portion of his income from the authorities. This is the case on which the estimation by the randomized response method in chapter six is based. The assumptions are that (1) there is a general perception that tax rates are high and (2) that the majority of taxpayers have an incentive to under-report their income since the probability of being detected and punished for not fully reporting one's income to the authorities is quite low because of the inability of the law enforcement agencies to detect and punish taxpayers who under-report their income.

5.3 THE INCOME TAX ACT, 1973

The Income Tax Act, 1973 gave the responsibility of income tax assessment, collection and penalty procedures for violation of the Act to the Income Tax Department which is headed by a Commissioner for Income Tax. The department functions under the Ministry of Finance.

For the purpose of the present study, the estimation of unreported income which is done in chapter six is for income earned by employees in the private and public sectors and by small businesses. Most of the large businesses and economic activities in all the sectors of the economy are conducted through the parastatal organizations which are owned by the government. Whereas the public enterprises are part of the public sector, income earned by employees of these enterprises is subject to taxation as long as it is defined as income by the Income Tax Act.

We proceed in chapter six to estimate under-reporting of income by small businessmen such as barbers, electricians, plumbers, beauticians etc as well as employees in the public sector which includes the parastatal subsector and employees in the private sectors.

In the 1973 Act, it is stated that where an individual (1) receives benefit of domestic service from a member of his family, (2) occupies any premises owned by him or (3) utilizes any agricultural or handicraft product produced by him for his own consumption or use or for the consumption or use of the members of his family without receiving any monetary consideration from any such member of his family for such consumption or use; the value of such services, occupation or product so used is deemed not to be income, Income Tax Act, 1973 p.453.

The 1990 Amendment to the Income Tax Act,1973 states that income

up to TShs.2,250 per month is not subject to taxation, (Amendment of the Income Tax Act, 1973 p.240).

In the estimation of under-reporting of income tax in chapter six, each respondent was specifically asked to respond only if his income was more than TShs.2,250 per month, otherwise no interview was conducted for respondents whose income was less than TShs.2,250 per month.

Thus, the the estimation of unreported income is done on the basis of the information provided in the original legislation-the Income Tax Act, 1973-and the Amendment to the Act, 1990. The amendment enables us to estimate the unreported income for the fiscal year 1991.

For this reason, the survey was not completely random because it was conducted for respondents whose income fell within the definition of income as defined in the Income Tax Act, 1973 and the 1990 Amendment to the Act.

The definition of taxable income in the Act includes monetary income earned by individuals which is higher than TShs.2,250 per month. This definition also excludes income earned by certain categories of people for example, peasants, traditional handicraft makers and the like. The underlying assumption is that such people are not likely to earn more than the minimum taxable income of TShS.2,250 monthly or TShs.27,000 per year.

CHAPTER SIX

THE MICRO, RANDOMISED RESPONSE APPROACH TO ESTIMATION OF THE UNDERGROUND ECONOMY IN TANZANIA

6.1 INTRODUCTION

The objective of this chapter is to estimate the underground economy in Tanzania by applying the randomized response method first developed by Warner (1965) and a modified version of it, the vector response technique due to Bourke and Dalenius (1976). The method in both techniques involves taking random samples from the population of tax payers and estimating the proportion of the respondents' income which is not reported to the tax authorities.

Both techniques involve the use of a randomization device to protect the identity, privacy and confidentiality of the respondents. In theory, the estimates obtained from the use of one technique should differ only randomly from those obtained from the other technique although the vector response technique produces more efficient estimates in the sense that a smaller sample size (number of interviews) is required to produce estimates with equal variances. Both techniques are employed here to illustrate different ways of effecting the randomized response method. In this chapter the estimates of the un-reported income are assumed to represent the size of the underground economy. The sampling exercise was conducted in 1992 yielding results for 1991.

Note that the American IRS (1979, 1980, 1984, 1987) commissioned a number of consulting firms to conduct studies of various aspects of tax

payers behavior. One of the firms which was employed in 1979 used the RR method to ask respondents specific questions with respect to their attitude towards income tax. It submitted its report in 1980. However, the report was not properly done and was therefore not available to the public. Moreover, the study was not meant to estimate the underground economy in the US.

As we have commented earlier, this is the first study to use the RR method to estimate the underground economy in the form of unreported/undereported income.

6.2 How the Survey was Designed and Conducted

The survey was conducted in 1992 to produce results for the 1991 year of income as follows:

First, thirty respondents were interviewed from each of the ten areas (municipalities) of Dar-es-Salaam. Only one respondent was interviewed in a house/apartment. The purpose of this was to make the exercise as extensive as possible to cover all the ten areas/municipalities. The municipalities/areas covered were (i), Kariakoo and Misheni Kota, (ii) Ilala and Buguruni, (iii) Chang'ombe and Temeke, (iv) Kilwa Road and Kurasini, (v) Gongo la Mboto and Pugu Road, (vi) Magomeni (Mapipa, Makuti and Mwembe Chai), (vii) Kinondoni and Mwananyamala, (viii) Manzese and Mburahati, (ix) City Center, Upanga (East and West) and Sea View and (x) Oyster Bay, Msasani and Msasani Peninsular.

Second, in order to cover the area as widely as possible within each municipality/area and obtain as broad representation as possible,

only one respondent was picked for an interview from a house after every five consecutive blocks . In the case of apartments only one respondent was picked after every ten apartments.

Third, interviews were conducted between 1700hrs and 2000hrs, Monday to Friday and all day Saturdays and Sundays. These are the times when most people are at home.

Fourth, since one of the major objectives was to make the sample as representative as possible both with respect to the population and income; we achieved this by interviewing respondents residing in the high income areas such as Oyster Bay, Msasani, Msasani Peninsular, Upanga (East and West), and Kurasini; in the middle income areas, such as Kilwa Road, Pugu Road, Gongo la Mboto and part of Kariakoo; and finally, in the remaining areas located in what are considered to be the low income areas.

6.3 Description of the Warner Randomized Response Version

Three random samples each of 100 income earners were taken by using three decks each containing 100 cards. Each interview was conducted using one of the three decks; each card exhibiting one of the following four statements:

(1) Less than five percent of my income is NOT reported to the tax authorities,

(2) Between 6 and 25 five percent of my income is NOT reported to the tax authorities,

(3) Between 26 and 50 percent of my income is NOT reported to the tax

authorities,

(4) More than 50 percent of my income is NOT reported to the tax authorities.

We have commented in chapter five that the survey was conducted such that only respondents receiving income of TShs.2,250 or higher were interviewed. This is because the minimum taxable income defined in the 1990 Amendment to the Income Tax Act, 1973 is TShs.2,250. In view of this and as we have commented in chapter five, our samples were not completely random.

As is explained below, data from these interviews were used to estimate the proportions, π_j of the population for whom the j^{th} statement above is true. The last three statements are stigmatizing with the last one being the most stigmatizing. To ensure that no biased or false response would be made by respondents, the interviewer took the following steps: (1) He explained clearly to each respondent that the exercise was strictly an academic research undertaking. (2) A respondent was asked to pick one card, read it carefully and quietly and (3) After picking one card from the deck and reading it, he/she was asked to give a 'yes' or 'no' response depending depending on whether or not the statement he/she had read specified the correct percentage of his/her income not reported to the tax authorities. It was stressed beforehand that the interviewer would have no way of knowing the question the respondent was answering.

After reading and giving his/her response, the respondent was asked to put the card back into the deck and shuffle all the cards in the deck to ensure that they were thoroughly mixed to his/her satisfaction

such that his/her response would not be identified or associated with any particular statement/card.

The three decks each contain different numbers of cards according to each of the four statements above. The numbers in each statement are shown in Table 6.1 below:

Table 6.1

Number of cards per deck according to the four statements

Statement Number	Deck 1	Deck 2	Deck 3
(1)	40	20	20
(2)	20	40	20
(3)	20	20	40
(4)	20	20	20
Total number of cards	100	100	100

The number of cards for each sttement were chosen randomly but in such a way as to simplify computation.

For the three decks, a total of 300 respondents were interviewed and from which the total number of 'yes' and 'no' answers were recorded. The 'yes ' responses were used in estimating the underground economy in Tanzania as explained in the estimation procedure below.

As commented earlier, the ratio of two to one males to females was based on the contribution to GDP of males to females as the author was advised by officials of the Bureau of Statistics. On the basis of this information, we made an assumption that the contribution to tax revenue

of males to females follows the same ratio. We attempted to make the random sample as representative as possible of the population and the amount of income earned based on the a priori information and the assumption made above.

6.3.1 Statement of the Problem and Methodology for Estimation

The problem is to estimate the proportions π_1, π_2, π_3 and π_4, where π_1, for example, is the proportion of an income-earning population for whom less than five percent of income is not reported to the tax authorities. Note that these π_js sum up to unity.

Let P_{ij} denote the known proportion of cards with the statement expressing membership in the j^{th} group for the i^{th} sub-sample/deck. The probability of a 'yes' response for any interviewee in the i^{th} sample, that is using the i^{th} deck is:

$$\lambda_i = \sum_{j=1}^{4} P_{ij}\,\pi_j \qquad (i = 1, 2, 3) \qquad (6.1)$$

Using the fact that the π_j sum up to unity to estimate π_4, we get:

$$\lambda_i = P_{i1}\pi_1 + P_{i2}\pi_2 + P_{i3}\pi_3 + P_{i4}\,(1 - \pi_1 - \pi_2 - \pi_3)$$

$$\text{for } i = 1, 2, 3 \qquad (6.2)$$

and thus:

$$\lambda_i - P_{i4} = (P_{i1} - P_{i4})\pi_1 + (P_{i2} - P_{i4})\pi_2 + (P_{i3} - P_{i4})\pi_3$$

$$\text{for } i = 1, 2, 3 \qquad (6.3)$$

The values of P_{ij} from Table 5.1 are:

$$P_{11} = P_{22} = P_{33} = 40 / 100 = 0.4$$
$$P_{12} = P_{13} = P_{14} = 20 / 100 = 0.2$$
$$P_{21} = P_{23} = P_{24} = 20 / 100 = 0.2 \qquad (6.4)$$
$$P_{31} = P_{32} = P_{34} = 20 / 100 = 0.2$$

Inserting these P_{ij} values into the three parts of (5.3) yields

$$\lambda_1 - 0.2 = 0.2\pi_1$$
$$\lambda_2 - 0.2 = 0.2\pi_2 \qquad (6.5)$$
$$\lambda_3 - 0.2 = 0.2\pi_3$$

implying that the π'_js can be estimated as follows:

$$\hat{\pi}_1 = 5\hat{\lambda}_1 - 1$$
$$\hat{\pi}_2 = 5\hat{\lambda}_2 - 1 \qquad (6.6)$$
$$\hat{\pi}_3 = 5\hat{\lambda}_3 - 1$$
$$\hat{\pi}_4 = 1 - \hat{\pi}_1 - \hat{\pi}_2 - \hat{\pi}_3$$

where $\hat{\lambda}_i$ is the proportion of 'yes' answers obtained from the i^{th} deck.

From this, it is easy to see that their variances are given by:

$$V(\hat{\pi}_1) = 25\ V(\hat{\lambda}_1)$$
$$V(\hat{\pi}_2) = 25\ V(\hat{\lambda}_2)$$
$$V(\hat{\pi}_3) = 25\ V(\hat{\lambda}_3) \qquad (6.7)$$
$$V(\hat{\pi}_4) = V(\hat{\pi}_1) + V(\hat{\pi}_2) + V(\hat{\pi}_3)$$

Since $\hat{\lambda}_i$ is just the proportion of 'yes' responses in the i^{th} deck, its variance can be estimated as:

$$\hat{\lambda}_i(1 - \hat{\lambda}_i) / N_i \qquad (6.8)$$

where N = 100, the total number of responses using the i^{th} deck.

The $P'_{ij}s$ for this study were chosen to facilitate estimation. For an explanation of the estimation methodology in its most general form, see Chaudhuri and Mukherjee (1988).

The results of the survey are shown as Appendices 6.1a, 6.1b and 6.1c at the end of this chapter.

At the conclusion of the survey for eaach of the three decks, the total number of the 'yes' responses for the combined sample of male and female respondents were 25, 27 and 22 for the first, second and third decks respectively. With these results at hand, we begin the estimation procedure as follows.

6.3.2 Estimation Procedure for the Combined Sample of Male and Female

The unbiased estimates of λ_i for each of the three decks are:

$$\begin{aligned} \hat{\lambda}_1 &= 25 / 100 = 0.25 \\ \hat{\lambda}_2 &= 27 / 100 = 0.27 \\ \hat{\lambda}_3 &= 22 / 100 = 0.22 \end{aligned} \qquad (6.9)$$

Utilizing (6.6) and (6.9), the estimates of the π_{js} are given by:

$$\hat{\pi}_1 = 5 \times \hat{\lambda}_1 - 1 = 0.250$$
$$\hat{\pi}_2 = 5 \times \hat{\lambda}_2 - 1 = 0.350 \qquad (6.10)$$
$$\hat{\pi}_3 = 5 \times \lambda_3 - 1 = 0.100$$
$$\hat{\pi}_4 = 1 - \hat{\pi}_1 - \hat{\pi}_2 - \hat{\pi}_3 = 0.300$$

and from (6.7), (6.8) and (6.9), the numerical values of their (estimators') variances are given by:

$$V(\hat{\pi}_1) = 25 \times 0.25 \ (1 - 0.25) \ / \ 100 = 0.046875$$
$$V(\hat{\pi}_2) = 25 \times 0.27 \ (1 - 0.27) \ / \ 100 = 0.049275$$
$$V(\hat{\pi}_3) = 25 \times 0.22 \ (1 - 0.22) \ / \ 100 = 0.042900 \qquad (6.11)$$
$$V(\hat{\pi}_4) = V(\hat{\pi}_1) + V(\hat{\pi}_2) + V(\hat{\pi}_3) = 0.139050$$

6.3.3 Estimation Procedure for the Male Only Sample

The unbiased estimates, $\hat{\lambda}_i$ are derived by:

$$\hat{\lambda}_1 = 17 \ / \ 67 = 0.2540$$
$$\hat{\lambda}_2 = 18 \ / \ 67 = 0.2687 \qquad (6.12)$$
$$\hat{\lambda}_3 = 15 \ / \ 67 = 0.2239$$

and utilizing (6.6) and (6.9), the π'_js are estimated by:

$$\hat{\pi}_1 = 5\,\hat{\lambda}_1 - 1 = 0.2700$$
$$\hat{\pi}_2 = 5\,\hat{\lambda}_2 - 1 = 0.3435 \qquad (6.13)$$
$$\hat{\pi}_3 = 5\,\hat{\lambda}_3 = 1 = 0.1180$$
$$\hat{\pi}_4 = 5\,\hat{\lambda}_4 = V(\hat{\pi}_1) + V(\hat{\pi}_2) + V(\hat{\pi}_3) = 0.2685$$

and the numerical values of the variances of the estimators are given by:

$$V(\hat{\pi}_1) = 25 \times 0.2540 \times 0.7460 / 67 = 0.0707$$
$$V(\pi_2) = 25 \times 0.2687 \times 0.7313 / 67 = 0.0733 \qquad (6.14)$$
$$V(\hat{\pi}_3) = 25 \times 0.2239 \times 0.7761 / 67 = 0.0648$$
$$V(\hat{\pi}_4) = V(\hat{\pi}_1) + V(\hat{\pi}_2) + V(\hat{\pi}_3) = 0.2088$$

6.3.4 Estimation Procedure for the Female Only Sample

The unbiased estimates λ_i are derived by:

$$\hat{\lambda}_1 = 8 / 33 = 0.242$$
$$\hat{\lambda}_2 = 9 / 33 = 0.27 \qquad (6.15)$$
$$\hat{\lambda}_3 = 7 / 33 = 0.212$$

and the π_js are estimated by:

$$\hat{\pi}_1 = 5\,\hat{\lambda}_1 - 1 = 0.210$$

$$\hat{\pi}_2 = 5\,\hat{\lambda}_2 - 1 = 0.365$$
$$\hat{\pi}_3 = 5\,\hat{\lambda}_3 - 1 = 0.060 \qquad (6.16)$$
$$\hat{\pi}_4 = 1 - \hat{\pi}_1 - \hat{\pi}_2 - \hat{\pi}_3 = 0.365$$

The variances of the estimators, $\hat{\pi}_i$s are derived by:

$$V(\hat{\pi}_1) = 25 \times 0.242\ (1 - 0.242) / 33 = 0.1390$$
$$V(\hat{\pi}_2) = 25 \times 0.273\ (1 - 0.273) / 33 = 0.1504$$
$$V(\hat{\pi}_3) = 25 \times 0.212\ (1 - 0.212 / 33 = 0.1266 \qquad (6.17)$$
$$V(\hat{\pi}_4) = V(\hat{\pi}_1) + V(\hat{\pi}_2)\ V(\hat{\pi}_3) = 0.4160$$

These variances in each case enable us to form some impression about the sampling fluctuations from the sample. This gives us some idea about the efficiency of each estimator of (6.10). Chaudhuri and Mukherjee (1988 p.5 and Chapter 5) have observed that efficiency (minimum variance) and maintenance of confidentiality, which is a necessary condition for obtaining reliable information from the respondents, tend to conflict when we apply randomized response techniques. This is because as the probability of being asked a stigmatizing question becomes larger, people may tend not to tell the truth, believing that the interviewer knows almost certainly that they are responding to a stigmatizing statement.

6.3.5 Estimation Results

The results calculated above are summarized in table 6.2, below

showing the proportions in percentages of the population which did not report part of their income to the tax authorities, both for the female and male respondents, as estimated by the Warner method.

Table 6.2

Summary of Results in Percentages of Income Not Reported to Tax Authorities and of Population

Percentage of Income Not Reported	Percentage of Population		
	Combined	Male	Female
Less than 5	25.0 (.2165)	27.0 (.2659)	21.0 (.3728)
Between 6 and 25	35.0 (.2220)	34.4 (.2707)	36.5 (.3878)
Between 26 and 50	10.0 (.2071)	11.8 (.2546)	06.0 (.3558)
More than 50	30.0 (.3729)	26.9 (.4570)	36.5 (.6450)

Note that the figures in brackets are the standard errors. The fact that they are large reflects the inefficiency of the Warner technique. Fortunately, the vector randomized response method below is much more efficient.

These results will be combined with those obtained using the vector randomized response method (reported below) before employing them for further analysis.

6.4 The Vector Response Randomization Method

The vector response version of the randomization response method is due to Bourke and Dalenius (1976). This technique is slightly more straight forward than the Warner version in that only one deck of cards is employed. Both techniques are versions of the RR method. In theory, the estimates of both versions should be qualitatively the same. However in this study, the vector response version of Bourke and Dalenius appears to produce better results than the Warner version.

6.4.1 Description of the Method

A random sample of 300 income earners, one third of whom were women were interviewed using a single deck of 100 cards marked in five letter groups A, B, C, D and E with 48, 13, 13, 13 and 13 cards respectively. In each group each respondent was asked to pick a card from the deck, the interviewer gave the following written six step explanation in order to solicit truthful responses from the interviewees.

(1) This is purely an academic research exercise, so please be as truthful as possible in your answers

(2) Read the sample cards A, B, C, D and E very carefully, then read different cards in the deck to satisfy yourself that the sample cards represent exactly the same statements as those written on the cards contained in the deck

(3) Pick one card from the deck, turn your back and read the card quietly

(4) If you pick a type A - card, then respond by just stating the number of the category to which you belong #1, #2, #3 or #4. Do not mention you have a type A - card

(5) If you pick a type B, C, D or E - card, read the card and state the relevant number, #1, #2, #3 or #4 written on the card you have picked. Do not mention the letter - type of your card, and

(6) In either case (4) or (5), put the card you have picked back in the deck and shuffle the cards in the deck till you are satisfied that they are mixed well enough and that there is no way anybody can tell which card you have picked and read.

6.4.2 Type A - cards

Each of the 48 type A - cards had the following statement written on it ''To which of the following four categories do you belong: #1, #2, #3 or #4 ?''

The four categories

(1) Less than five percent of my income is NOT reported to the tax authorities

(2) Between 6 and 25 percent of my income is NOT reported to the tax authorities

(3) Between 26 and 50 percent of my income is NOT reported to the tax authorities

(4) More than 50 percent of my income is NOT reported to the tax authorities

6.4.3 Type B - cards

Each of the 13 type B - cards had the following statement written on it:

''Pretend to read this statement very carefully, consider for a moment and then blush momentarily and give your answer as the number (1).''

Number (1): ''This is a fake sentence to make this card look just like the others.''

6.4.4 Type C - cards

Each of the 13 type C - cards had the following statement written on it.

''Pretend to read this statement very carefully, consider for a moment and then blush momentarily and give as your answer the number (2).''

Number (2): ''This is a fake sentence to make this card look just like the others.''

6.4.5 Type D - cards

Each of the 13 type D - cards had the following statement written on it.

''Pretend to read this statement very carefully, consider for a moment and then blush momentarily and give as your answer the number (3).''

Number (3): ''This is a fake sentence to make this card look just like the others.''

6.4.6 Type E - cards

Each of the 13 type E - cards had the following statement written on it.

''Pretend to read this sentence very carefully, consider for a moment and then blush momentarily and give your answer the number (4).''

Number (4): ''This is a fake sentence to make this card look just like the others.''

6.4.7 The Problem and Methodology for Estimation

The problem is to estimate the proportions, π_j, where, for example, π_2, is the proportion of the population for whom between 6 and 25 percent of their income is not reported to the tax authorities.

Let P_i be the probability of getting the answer i = 1, 2, 3, 4 and P(A), P(B), P(C), P(D) and P(E) be the probability of selecting a card of type A, B, C, D, and E respectively.

Then,

$$\begin{aligned} P_1 &= P(A)\pi_1 + P(B) \\ P_2 &= P(A)\pi_2 + P(C) \\ P_3 &= P(A)\pi_3 + P(D) \\ P_4 &= P(A)\pi_4 + P(E) \end{aligned} \qquad (6.2.1)$$

This implies that the π_j's can be estimated by,

$$\begin{aligned} \hat{\pi}_1 &= [\hat{P}_1 - P(B)] \;/\; P(A) \\ \hat{\pi}_2 &= [\hat{P}_2 - P(C)] \;/\; P(A) \\ \hat{\pi}_3 &= [\hat{P}_3 - P(D)] \;/\; P(A) \end{aligned} \qquad (6.2.2)$$

$$\hat{\pi}_4 = [\hat{P}_4 - P(E)] \; / \; P(A)$$

where $\hat{P}$ is the proportion of j answers in the sample. This implies that:

$$V(\hat{\pi}_i) = V(\hat{P}_i) \; / \; P(A)^2 \qquad (6.2.3)$$

where the variances of $\hat{P}_i$ are estimated by:

$$V(\hat{P}_i) = [(\hat{P}_i)(1 - \hat{P}_i] \; / \; 300 \qquad (6.2.4)$$

6.4.8 Estimation Procedure for Combined Sample of Male and Female

The probabilities for the deck of 100 cards of groups A, B, C, D and E are as follows:

$$P(A) = 48 \; / \; 100 = 0.48$$

$$P(B) = P(C) = P(D) = P(E) = 13 \; / \; 100 = 0.13 \qquad (6.3.1)$$

and the size of the combined sample, N = 300 respondents in the ratio of 2:1 for male and female respondents respectively. The results of the survey are shown in Appendix 6.1d.

Therefore

$$P_1 = 111 \; / \; 300 = 0.370$$

$$P_2 = 62 \; / \; 300 = 0.207$$

$$P_3 = 60 \; / \; 300 = 0.200 \qquad (6.3.2)$$

$$P_4 = 67 \; / \; 300 = 0.223$$

From (6.2.3), the π_i's are estimated by:

$$\hat{\pi}_1 = [\hat{P}_1 - P(B)] \;/\; P(A) = (0.370 - 0.13 \;/\; 0.48 = 0.5000$$
$$\hat{\pi}_2 = [\hat{P}_2 - P(C)] \;/\; P(A) = (0.207 - 0.13 \;/\; 0.48 = 0.1604$$
$$\hat{\pi}_3 = [\hat{P}_3 - P(D)] \;/\; P(A) = (0.200 - 0.13 \;/\; 0.48 = 0.1458 \qquad (6.3.3)$$
$$\hat{\pi}_4 = [\hat{P}_4 - P(E)] \;/\; P(A) = (0.223 - 0.13 \;/\; 0.48 = 0.1938$$

and the variances of the estimators are estimated by:

$$V(\hat{\pi}_i) = \frac{[\hat{P}_i (1 - \hat{P}_i) \;/\; N]}{P(A)^2} \qquad (6.3.4)$$

or,

$$V(\hat{\pi}_1) = \frac{(0.370 \times 0.63) \;/\; 300}{(0.48)^2} = 0.0034$$

$$V(\hat{\pi}_2) = \frac{(0.207 \times 0.793) \;/300}{(0.48)^2} = 0.0024$$

$$V(\hat{\pi}_3) = \frac{(0.200 \times 0.800 \;/\; 300}{(0.48)^2} = 0.0023$$

$$V(\hat{\pi}_4) = \frac{(0.223 \times 0.777) \;/\; 300}{(0.48)^2} = 0.0025 \qquad (6.3.5)$$

6.4.9 Estimation Procedure for the Male only Sample

As before the probabilities here are given by:

$P(A) = 0.48,$

$$P(B) = P(C) = P(D) = P(E) = 0.13 \qquad (6.3.6)$$

and the sample size, N = 200,

Therefore,

$$P_1 = 75 / 200 = 0.375$$
$$P_2 = 45 / 200 = 0.225$$
$$P_3 = 38 / 200 = 0.190 \qquad (6.3.7)$$
$$P_4 = 42 / 200 = 0.210$$

From (6.3.3) the $\hat{\pi}_i$'s are derived by:

$$\hat{\pi}_1 = [\hat{P}_1 - P(B)] / P(A) = (0.375 - 0.13) / 0.48 = 0.5104$$
$$\hat{\pi}_2 = [\hat{P}_2 - P(C)] / P(A) = (0.225 - 0.13) / 0.48 = 0.1979$$
$$\hat{\pi}_3 = [\hat{P}_3 - P(D)] / P(A) = (0.190 - 0.13) / 0.48 = 0.1250 \qquad (6.3.8)$$
$$\hat{\pi}_4 = [\hat{P}_4 - P(E)] / P(A) = (0.210 - 0.13) / 0.48 = 0.1667$$

and the variances of the estimators are estimated by:

$$V(\hat{\pi}_i) = \frac{\hat{P}_i (1 - \hat{P}_i) / N}{P(A)^2} \qquad (6.3.9)$$

or

$$V(\hat{\pi}_1) = \frac{0.375 \times 0.625 / 200}{(0.48)^2} = 0.0051$$

$$V(\hat{\pi}_2) = \frac{(0.225 \times 0.775) / 200}{(0.48)^2} = 0.0038$$

$$V(\hat{\pi}_3) = \frac{(0.190 \times 0.810) / 200}{(0.48)^2} = 0.0033 \qquad (6.3.10)$$

$$V(\hat{\pi}_4) = \frac{(0.210 \times 0.790) / 200}{(0.48)^2} = 0.0036$$

6.4.10 Estimation Procedure for the Female Only Sample

The probabilities here are given by,

$$P(A) = 0.48,$$

$$P(B) = P(C) = P(D) = P(E) = 0.13 \qquad (6.3.11)$$

and the sample size, N = 100, and as before:

$$P_1 = 36 / 100 = 0.36$$

$$P_2 = 17 / 100 = 0.17$$

$$P_3 = 22 / 100 = 0.22 \qquad (6.3.12)$$

$$P_4 = 25 / 100 = 0.25$$

and the π_i's are estimated by,

$$\hat{\pi}_1 = [\hat{P}_1 - P(B)] / P(A) = (0.36 - 0.13) / 0.48 = 0.4792$$

$$\hat{\pi}_2 = [\hat{P}_2 - P(C)] / P(A) = (0.17 - 0.13) / 0.48 = 0.0833$$

$$\hat{\pi}_3 = [\hat{P}_3 - P(D)] / P(A) = (0.22 - 0.13 / 0.48 = 0.1875 \qquad (6.3.13)$$

$$\hat{\pi}_4 = [\hat{P}_4 - P(E)] / P(A) = (0.25 - 0.13 / 0.48 = 0.2600$$

and the variances of the estimators are estimated by:

$$V(\hat{\pi}_i) = \frac{\hat{P}_i(1 - \hat{P}_i) / N}{P(A)^2} \qquad (6.3.14)$$

that is,

$$V(\hat{\pi}_1) = \frac{(0.36 \times 0.64) / 100}{(0.48)^2} = 0.0100$$

$$V(\hat{\pi}_2) = \frac{(0.17 \times 0.83) / 100}{(0.48)^2} = 0.0060$$

$$V(\hat{\pi}_3) = \frac{(0.22 \times 0.78) / 100}{(0.48)^2} = 0.0075 \qquad (6.3.15)$$

and,

$$V(\hat{\pi}_4) = \frac{(0.25 \times 0.75) / 100}{(0.48)^2} = 0.0081$$

6.5. Estimation Results

Table 6.3 below summarizes the results of the estimates of the vector response technique in percentages of the population which did not report part of their income to the tax authorities. The results are broken down in terms of combined, male and female respondents in line with the way the sampling procedure was conducted.

Table 6.3

Summary of Results in Percentages of Income Not Reported to Tax Authorities and of Population

Percentage of Income Not Reported	Percentage of Population		
	Combined	Male	Female
Less than 5	50.00 (.0583)	51.04 (.0714)	47.92 (.1000)
Between 6 and 25	16.04 (.0490)	19.79 (.0616)	8.33 (.0775)
Between 26 and 50	14.58 (.0480)	12.50 (.0575)	18.75 (.0866)
More than 50	19.38 (.0500)	16.67 (.0600)	26.00 (.0900)

Note that the figures in brackets are the standard errors. Notice how much more efficient these estimates are compared to those of the Warner estimates given earlier for the same sample size of 300.

6.6 Combining the Estimates of the Size of the Underground Economy of the Warner and the Vector Response Methods.

Both the Warner, (W) and the Vector response (V) estimates are produced by a randomized response (RR) technique. They should be appropriately combined to produce an 'RR' estimate of the πs. This is accomplished by taking a weighted average of the two estimates using formula (6.5.1) below. Since both estimates are unbiased, the weights should sum to unity so that the weighted average π_{RR} is unbiased producing,

$$\hat{\pi}_{RR} = a\hat{\pi}_W + (1 - a)\hat{\pi}_V \qquad (6.4.1)$$

where $\hat{\pi}_W$ and $\hat{\pi}_V$ are the Warner and Vector response estimates respectively. The weight, a, should be chosen so as to minimize the variance of π_{RR}.

$$V(\pi_{RR}) = a^2 V(\pi_W) + (1 - a)^2 V(\pi_V) \qquad (6.4.2)$$

For each of the four categories, the estimates of the π_W and π_V are weighted to obtain the general estimate, (π_{RR}). To solve for a and hence for the weighted (π_{RR}) estimates, we proceed as follows,

$$\frac{\partial V(\pi_{RR})}{\partial a} = 2a V(\pi_W) + 2(1 - a)(-1) V(\pi_V) \qquad (6.4.3)$$

To find the value of a, we set the first order condition of $V(\pi_{RR})$ with respect to ,a, equal to zero as follows and this gives,

$$a V(\pi_W) + a V(\pi_V) = V(\pi_V)$$

$$a = \frac{V(\hat{\pi}_V)}{V(\hat{\pi}_W) + V(\hat{\pi}_V)} \qquad (6.4.4)$$

Hence we can derive the RR estimates for each category as follows,

6.6.1 Combined Sample

Category one: (0 - 5%)

$$(\hat{\pi}_{RR_1}) = \frac{\hat{\pi}_W \times V(\hat{\pi}_V) + \hat{\pi}_V \times V(\hat{\pi})}{V(\hat{\pi}_W) + V(\hat{\pi}_V)} \qquad (6.4.5)$$

$$= \frac{(0.25 \times 0.0034) + (0.50 \times 0.0469)}{(0.0034 + 0.0469)}$$

$\hat{\pi}_W = 0.25, \quad V(\hat{\pi}_W) = 0.0469$

$\hat{\pi}_V = 0.50, \quad V(\hat{\pi}_V) = 0.0034$

$$= \frac{(0.0085 + 0.02345)}{0.0503} \simeq 0.480 \qquad (6.4.5a)$$

Category two (6 -25%)

$$(\hat{\pi}_{RR_2}) = \frac{(0.35 \times 0.0024) + (0.1604 \times 0.0493)}{(0.0024 + 0.0493)}$$

$\hat{\pi}_W = 0.35, \quad V(\hat{\pi}_W) = 0.0493$

$\hat{\pi}_V = 0.1604, \quad V(\hat{\pi}_V) = 0.0024$

$$= \frac{(0.00084 + 0.00791)}{0.0517} = \frac{0.008744}{0.0517}$$

$$= 0.169 \qquad (6.4.5b)$$

Category three (26 - 50%)

$$(\hat{\pi}_{RR_3}) = \frac{(0.10 \times 0.0023) + (0.1458 \times 0.0429)}{(0.0429 + 0.0023)}$$

$$\hat{\pi}_W = 0.1000, \quad V(\hat{\pi}_W) = 0.0429$$

$$\hat{\pi}_V = 0.1458, \quad V(\hat{\pi}_V) = 0.0023$$

$$= \frac{(0.10 \times 0.0023) + (0.1458 \times 0.0429)}{0.0452}$$

$$= \frac{0.0064848}{0.0452} = 0.144 \qquad (6.4.5c)$$

Category four (more than 50%)

$$(\hat{\pi}_{RR_4}) = \frac{(0.30 \times 0.0025) + (0.1938 \times 0.13905)}{(0.13905 + 0.0025)}$$

$$\hat{\pi}_W = 0.03, \quad V(\hat{\pi}_W) = 0.13905$$

$$\hat{\pi}_V = 0.1938 \quad V(\hat{\pi}_V) = 0.0025$$

$$= \frac{0.0276979}{0.14155} = 0.1957$$

(6.4.5d)

We can derive $V(\hat{\pi}_{RR_i})$ from (6.5.2) by deriving the value of 'a' first from (6.5.4) as follows:

$$a = 0.0034 / (0.0469 + 0.0034), \qquad V(\hat{\pi}_W) = 0.0469$$

$$= 0.0034 / 0.0503 \qquad V(\hat{\pi}_V) = 0.0034$$

$$= 0.0675944$$

Therefore $V(\hat{\pi}_{RR_1}) = (0.0675944)^2(0.0469) + (0.9324056)^2\ (0.0034)$

$= 0.0029567$ (6.4.6)

Similar calculations for the variances of categories two, three and four yield:

$$V(\hat{\pi}_{RR_2}) = 0.0025005$$

$$V(\hat{\pi}_{RR_3}) = 0.0024050$$

$$V(\hat{\pi}_{RR_4}) = 0.0025425 \quad (6.4.7)$$

6.6.2 The Male Only and Female Only Samples

Similar calculations can be made for the male only and female only samples. The results of such calculations with their standard deviations are summarised in table 5.4 below:

Table 6.4

Weighted averages for the general RR estimates for the Combined, Male Only and Female Only Samples

	Combined	Male Only	Female Only
$(\hat{\pi}_{RR_1})$	0.4800	0.4780	0.4583
	(0.0583)	(0.0714)	(0.1000)
$(\hat{\pi}_{RR_2})$	0.1690	0.1694	0.0975
	(0.0490)	(0.0616)	(0.0775)
$(\hat{\pi}_{RR_3})$	0.1440	0.1247	0.1804
	(0.0480)	(0.0575)	(0.0866)
$(\hat{\pi}_{RR_4})$	0.1957	0.1684	0.2620
	(0.0500)	(0.0600)	(0.0900)

In retrospect we note here that any attempt to test for statistically significant difference between male and female for both techniques of the RR method can not produce any meaningful results since the standard deviations are large.

6.6.3 Estimation of the Size of the Underground Economy from the Weighted Averages of the two Techniques of the RR Method

Now let us take the π_i estimates and use them to create an estimate of the underground economy in Tanzania for 1991. Consider first the people who did not report between zero and five percent of their income. Assuming that on average they did not report 2.5 percent (the mid point between the 0 and 5% range) of their income, then their contribution to the total unreported income, expressed as a percentage of reported plus unreported income, is 0.025 X 0.48 = 0.012 or 1.2 percentage points (because we have established that 48% of income earners fall in this category).

Similar calculations for the other three categories produce 0.155 X 0.169 = 0.026 or 2.6 percentage points for the between six and 25 percent since the mid point of this range is 0.155; 0.38 X 0.144 = 0.05472 or 5.5 percent for the between 26 and 50 percent range as the mid point of this range is 0.38 and finally 0.75 X 0.1957 = 0.148 or 14.8 percentage points for the more than 50 range.

Summing up the above, we have the RR estimates for the four categories (ranges) as:

$$(\hat{\pi}_{RR_1}) = 0.025 \text{ X } 0.480 = 0.012 \text{ or } 1.2 \text{ percent}$$

$$(\hat{\pi}_{RR_2}) = 0.155 \text{ X } 0.169 = 0.026 \text{ or } 2.6 \text{ percent}$$

$$(\hat{\pi}_{RR_3}) = 0.380 \text{ X } 0.144 = 0.05472 \text{ or } 5.5 \text{ percent}$$

$$(\hat{\pi}_{RR_4}) = 0.750 \text{ X } 0.1957 = \underline{0.14} \text{ or } 14.8 \text{ percent} \qquad (5.4.8)$$

$$\text{Total} \qquad 0.241 \text{ or } 24.1 \text{ percent}$$

Note here that we are assuming that the $\hat{\pi}$'s are the same in the different income groups

Alternatively, we can use weighted averages of the RR estimates of the male only and female only samples, sum them up and compare them with the RR estimates obtained by using the combined sample. The weighting is on the basis of the gender contribution to GDP.

Theoretically, the weighted and summed RR estimates should be comparable with the estimates of the combined sample derived in the system of equations (6.4.8).

These RR estimates for the male only sample and the female only sample respectively are first derived and then summed up as follows:

6.6.4 Estimates for the Male Only Sample

$$(\hat{\pi}_{RR_1}) = 0.025 \text{ X } 0.478 = 0.011950 \text{ or } 1.195 \text{ percent}$$

$$(\hat{\pi}_{RR_2}) = 0.155 \text{ X } 0.1694 = 0.026257 \text{ or } 2.262 \text{ percent}$$

$$(\hat{\pi}_{RR_3}) = 0.380 \text{ X } 0.1247 = 0.047386 \text{ or } 4.739 \text{ percent}$$

$$(\hat{\pi}_{RR_4}) = 0.75 \times 0.1684 = 0.126300 \text{ or } 12.63 \text{ percent}$$

$$\text{Total} \qquad 0.211893 \text{ or } 21.19 \text{ percent}$$

(6.4.9)

and two thirds of the weighted sum yields 0.141262 or 14.13 percent.

6.6.5 Estimates for the Female Only Sample

$$(\hat{\pi}_{RR_1}) = 0.025 \times 0.4583 = 0.0114575 \text{ or } 1.146 \text{ percent}$$

$$(\hat{\pi}_{RR_2}) = 0.155 \times 0.0975 = 0.0151125 \text{ or } 1.511 \text{ percent}$$

$$(\hat{\pi}_{RR_3}) = 0.380 \times 0.1804 = 0.068552 \text{ or } 6.855 \text{ percent}$$

$$(\hat{\pi}_{RR_4}) = 0.750 \times 0.262 = 0.1965000 \text{ or } 19.65 \text{ percent}$$

$$\text{Total} \qquad 0.29162 \text{ or } 9.016 \text{ percent}$$

(6.4.10)

and one third of the total yields 0.09721 or 9.721 percent.

Summing up (6.4.9) and (6.4.10) yields,

0.141262 or 14.126 percent + 0.09721 or 9.721 = 0.23845 or 23.85 percent which compares closely with the RR estimates of 24.07 percent obtained by using the combined sample. The difference is due to random variations.

6.6.6 Derivation of the Unreported Income and Interpretation of Results of the RR Method

6.6.7 Combined Sample

The RR estimates for the four categories yield a total percentage of 24.1% of total (reported plus unreported) income as not reported. This percentage is (24.2 / 75.8) X 100 = 31.8% of reported or measured income.

6.7 Problem of Bias on Estimates Based on Respondents by Gender

A comment on the problem of bias is important at this point. Bias here can take two forms (1) on the basis of gender and (2) on the basis of income groups: low, middle and high income. Consider for a moment a random sample consisting of respondents equally divided (50% of each sex) between males and females, if for example, females generated (contributed to total income) less than males, then there would be a downward bias in the estimates and therefore in the measure of the size of the underground economy. If on the other hand, females generated more income than males, then there would be an upward bias in the estimates.

Further, suppose (in the unlikely extreme case) we knew that females had no income at all and therefore did not contribute to total income, we still conducted the sampling on the basis of 50% for each gender. In this case the estimates would be heavily biased downwards probably to the extent of yielding meaningless interpretation results.

Hence on the basis of these reasons, we conducted the survey based on the known ratio as provided to the author by the government officials. In this situation this was the most representative approach both in terms of the population and the amount of income earned.

The problem of income differences according to income groups, upper, middle and lower income groups is solved by the fact that since the sample had been pulled randomly, then the various income groups are represented according to their proportion in the population. Hence the estimation results as indicated by the $\hat{t}$ estimates reflect the average behavior across income classes.

For future research, representation would be better captured if the random response method is used to estimate unreported/underreported income on the basis of the actual proportion of each income group to the total population.

6.7.1 Weighted Average of the Male Only Sample and the Female Only Sample

The RR weighted average estimates for the four categories of the male only sample and the female only sample yield a total percentage of 23.85 percent of total (reported plus unreported) income as reported. This percentage is 23.85/76.15 X100 = 31.32 percent of reported or unmeasured income.

6.7.2 Comparison with the Results of the C/D Ratio of Gutman Method

The RR estimates (31.80 percent) in subsection 6.7.1 are close (31.32 percent) to those in subsection 6.7.2. Both of them are comparable with the estimates obtained by the method of Gutmann of 26.21 percent of the measured economy for the year 1991.

The method of Gutman tends to underestimate the size of the underground economy because of one of its strong assumptions that only cash is used in the underground economy transactions whereas the estimates by the RR method captures implicit income which makes its estimates slightly higher than those of the currency/demand deposit ratio of Gutman.

6.8. LIMITATIONS OF THE SURVEY

We consider this method to be superior to the indirect approach methods such as those of Gutmann (1979) Feige (1980), and Tanzi (1982) which have been employed in the literature. This method is less costly/complicated in that one does not have to make the calculations carried in the traditional methods related to monetary data to estimate the underground economy. Many of the methods in the literature rely on the less than fully credible assumptions such as that (in the Gutman method) the ratio of currency to demand deposits in the official economy is constant and that the velocity of 'illegal' currency is identical to the velocity of 'legal' money.

However, there are limitations associated with the actual sampling procedure in the present study. Some of these limitations are outlined below.

First, in general, in most developing countries including Tanzania, a relatively small percentage of the population is subject to taxation, this means that the sample probably reflects less of the income reporting behavior of the population than would be the case for a well developed economy.

Second, care must be taken to ensure that a proper sampling technique is employed. Strictly speaking, an entirely random sample would not be suitable since the survey should convey only income earners as defined in the Income Tax Act, 1973 and the Amendments to it. Further, since there is some extraneous information about the contribution to the production of GDP on the basis of gender, this should be incorporated by modifying the sampling procedure. For example, it is known that females generate one third of Tanzania's GDP, so it is reasonable to ensure that the sample consists of one third of female respondents as well as a proper stratification across income groups.. Unquestionably, however, it is difficult to obtain a properly stratified random sample for a less developed economy; the results of this study are no exception to the problem and must accordingly be treated with caution. In particular, there is the problem that a proportion of the GDP consists of the subsistence sector which includes other informal economic activities.

The income generated from these activities is not legally subject to income tax. This therefore is likely to affect the accuracy of our estimates. The problem is it is not possible to quantify the extent of the effect on the estimates since sources in the national accounts do not

provide explicit data showing the size of the subsistence sector over time, a point we commented on earlier in chapter three.

Third, an arbitrary element of this study was the choice of 'percent of income not reported to the tax authorities' categories in the RR survey. These categories were chosen on the basis of my prior belief concerning the fraction of income earning individuals in each category, in an effort to improve estimation efficiency through making them of roughly equal magnitude. The choice of four categories (rather than five or six, say was made on the basis of the amount of resources available (additional categories would improve results but require a larger sample size) This is part of the reason why the category 'zero percent of my income is not reported' was not included. The main reason this category was not used, however, is because (with the exception of the case considered below) in my judgment very few of the people in Tanzania fall into this category in that even very honest people cheat a small amount. By combining this category with the five percent or less category, I felt more honest answers would be elicited,

Fourth, as we have noted in chapter five that in Tanzania many income earners do not file tax returns because their income is sufficiently low that they are not required to pay any taxes. If such people were included in the survey they would have interpreted the survey in such a way as to conclude that they fall into the category 'more than fifty percent of my income is NOT reported' which would bias the survey results and therefore the estimates upwards. In retrospect I should have made the survey question clearer.

APPENDIX 6.1a

100 RESPONDENTS

MALE-FEMALE RATIO 2:1

RESPONSE	MALE	FEMALE
YES	17	8
NO	50	25

APPENDIX 6.1b

100 RESPONDENTS

MALE– FEMALE RATIO 2:1

RESPONSE	MALE	FEMALE
YES	H H H H H H H H H (18)	H H H H I (9)
NO	H H H H H H H H H H H H H H H H H H H H H H H H I (49)	H H H H H H H H H H H H (24)

APPENDIX 6.1c

100 RESPONDENTS

MALE – FEMALE RATIO 2:1

RESPONSE	MALE	FEMALE
YES	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | (15)	𝍸 𝍸 | (7)
NO	𝍸 (52)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 (26)

APPENDIX 6.1d

300 RESPONDENTS

MALE - FEMALE RATIO 2:1

CATEGORY	MALE	FEMALE
#1	H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H H | (75)	H H H H H H H H H H H H H H H H H H (36)
#2	H H H H H H H H H H H H H H H H H H H H H H | (45)	H H H H H H H H | (17)
#3	H H H H H H H H H H H H H H H H H H H (38)	H H H H H H H H H H H (22)
#4	H H H H H H H H H H H H H H H H H H H H H (42)	H H H H H H H H H H H H | (25)

CHAPTER SEVEN

POLICY IMPLICATIONS OF THE UNDERGROUND ECONOMY

7.1 INTRODUCTION

The objective of this chapter is (1) to make some recommendations for future research and (2) to summarize and conclude the study.

7.2 POLICY RECOMMENDATIONS

The theoretical analysis of tax evasion in chapter five and empirical estimation of this economy in chapters four and six can help us understand the link between the underground economy and government economic policy.

In chapter three, we discussed briefly the way government interventionist policies were implemented to control the economy by the use of the parastatal organisations.

One of the major features of interventionism was the imposition of price control mechanism on most of the basic goods and services particularly consumer goods and such crucial inputs as fertiliser, building materials for houses and the like (also discussed in chapter three). This led to two adverse effects on the economy (1) extreme shortage of goods and services in the official market system which inevitably led to (2) strong inflationary pressures in the underground (market) economy. Thus, goods and services such as quality medical treatment were available in the underground economy at prohibitively high

prices and as such only the few well to-do were able to have access to such goods and services.

An important effect of government effort to enforce monopolistic marketing and producer price control system in the late 1970s and early 1980s was to create among others the following problems: (1) smuggling of agricultural produce such as coffee, grains, fish etc to neighboring coutries because of the poor prices paid to peasant producers by the National Milling Corporation, (NMC) the public parastatal whose responsibility, among others, was to purchase produces from the peasant producers, M-B (1990 p.74), (2) deterioration in the official marketing system due to the grossly inefficient, overestablished and almost always with overlapping roles of the public corporations charged with the marketing of various prducts, M-B (1990 p.16)(3) failure to collect produce from the peasant producers in time and to effect payment on their produce [whose prices were ussually far below the underground market (economy) prices] and (4) huge accumulation of financial losses experienced by the public corporations which in turn the government had to make equally huge subsidies to these corporations to compensate for the losses incurred, M-B (1990 p.15)

For example, in the period 1980-1981, the government had to subsidise the NMC close to TShs. one billion (about $25US million) due to losses which had ocurred within the corporation during this period. The government had to deficit finance the subsidy. This put tremendous pressure on real resources in the economy, which in turn, further aggravated strong inflationary pressures leading to continuous decline in real incomes and thence living standards, chapter 3, M - B (1990).

Hence, altough we have not not established quantitatively a direct link between the estimates on the one hand and controls and regulations on the other,the link is implicit and it can reasonably be claimed from the estimates that as regulations were exercised by the government, thee size of the underground economy was increasing particularly during the period of 1981-1990 as the estimates of the undergound economy indicate in table 4.1.

The problem lies in the difficulty of being unable to develop a measure which directly measures and captures quantitatively the impact of controls on the economy and how they helped generate the underground economy

Hence, below we make general policy recommendations without making specific policy stipulation to reduce the size of the underground economy. Recommending specific policy actions is difficult because of the heterogenous nature of underground activities and as commented above the difficulty of quantifying the effect of government controls on the economy.

Some of these recommendations are that the government should:

1) Relax or remove completely most of the incentive inhibiting controls and regulations which are currently exercised on economic institutions

2) Sell / privatise most of the more than 350 public corporations, most of which are functioning inefficiently and incurring huge financial losses

3) Decontrol prices, particularly agricultural goods producer prices, prices of agricultural inputs and those of industrial inputs such as spare parts

4) Create financial incentives to peasant farmers in an effort to improve productivity in the agricultural sector, since the sector accounts for more than 70% of the country's export earnings. This will reduce the temptation for smuggling of agricultural prduce to neigboring countries where the prices may be more attractive

5) Reduce / remove controls and red tape on the export import trade sub-sector to reduce the problem of under-invoicing and over-invoicing of exports and imports

7.3 RECOMMENDATIONS FOR FUTURE STUDY AND RESEARCH

We make two recommendations for future study and research in this area.

First, it would be interesting to make comparative estimates of the underground economy for each of the twenty administrative regions of the country and observe the respective sizes of the underground econoy in each region. This can provide a good background for different policy implementation options based on the size of the underground economy in each region. Note, however, that this can olny be done with the RR method and not with the Gutman one.

Second, a properly designed RR survey should be undertaken to provide a more accurate estimate of the underground economy. The sample size should be larger than 300 and the number of survey categories should be increased. A more carefully designed stratified sample should be designed to reflect better representation of the population and properly capture the income tax reporting behavior of the three main income

groups, the low, middle and high.

7.4 SUMMARY AND CONCLUSION OF THE STUDY

In this study,we have reviewed the traditional methods of estimating the underground economy found in the literature. We have attempted to apply a selected few methods to estimate the underground economy in Tanzania. Of the traditional methods, some of them, Tanzi (1982) and Bhattacharyya; have produced results which are not reasonable. Only the currency-demand deposit ratio method of Gutmann(1977) has produced meaningful results.

We have introduced a new method of estimating the underground economy, the RR method. In this method, we have defined the underground economy to capture income which is either not reported or underreporting to the income tax authorities. The estimates of the RR meethods are qualitatively comparable with those obtained by the more traditional method of the currency-demand deposit ratio of Gutmann.

The RR method is superior to the traditional methods in (1) its simplicity in that it involves simply conducting a survey with a deck or a few decks of cards (2) it is direct in that it involves collecting information directly from the survey data and proceeding to estimate the size of the underground economy in the form of nonreporting or underreporting of taxable income and (3) it is more costly but more reliable in that it does not rely on questionable statistics regarding money supply figures and unrealistic assumptions about base years and

velocity figures in that the researcher does not need to look for information from other sources such as banking and financial institutions or government departments, which is the case with the traditional methods.

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