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# **Measuring the Size of the Hidden Economy in Trinidad & Tobago**

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## ABSTRACT

This paper is a prelude to a much larger work aimed at the identification and measurement of the hidden economy in selected Caribbean countries. The first obstacle in an exercise like this is the definition of what constitutes the hidden economy as well as the absence of agreement about the appropriate terminology to be employed. As we will see, there are many other concepts appearing in the literature that are related, and sometimes equivalent, to what we will call in this paper the hidden economy. There is, in particular, the notion of the “informal economy” of the economy which we believe represents a large portion of the hidden economy in the Caribbean.

What are the likely benefits of a study like this one? Studies of the hidden economy in other parts of the world have been carried out for several reasons. An often cited reason is the potential for erroneous policy decisions based on misleading statistical indicators. Indeed, economic policy measures may be of a wrong magnitude or even in a wrong direction if they are based on such indicators of the state of the economy. For example, the official unemployment rate may be overstated if part of the official unemployed do work in the hidden economy. Similarly, the growth rate of real income may be understated if the hidden economy is expanding more quickly than the “measured” economy, or the rate of inflation may be overstated. All of these are valid enough reasons for studying the nature and extent of the hidden economy in the Caribbean.

There are several approaches to measuring the hidden economy, which may be classified as either direct or indirect. Some of these are discussed and their potential usefulness for measuring the Caribbean economy considered. A preliminary estimate of the hidden economy of Trinidad and Tobago is obtained using the Structural Cointegarting VAR approach. We determine that the size of the hidden economy is currently about 10% of measured GDP and it is getting even larger.

## SOMMAIRE

Cet article constitue le premier volet d'un programme de recherche consacré à l'identification, la caractérisation et la mesure de l'économie souterraine dans les pays de la Caraïbe. Le premier obstacle à une telle entreprise réside dans la définition même de ce qui constitue l'économie invisible ainsi que l'absence de consensus sur la terminologie exacte à utiliser. Comme nous le verrons bien, il existe dans la littérature beaucoup d'autres concepts qui sont proches et parfois équivalents à celui d'"économie souterraine" que nous utilisons ici. Parmi les plus cités, la composante "économie informelle" de l'économie fournit souvent une bonne représentation de l'économie souterraine de la Caraïbe.

Quels profits peut-on tirer d'une telle étude ? La recherche sur l'économie souterraine dans d'autres régions du monde s'effectue souvent à la demande des pouvoirs publics. De façon générale, elle est utile pour de multiples raisons. Tout d'abord, il s'agit d'atténuer les erreurs de politique économique qui découleraient d'analyses basées sur de faux indicateurs statistiques. Par exemple, le taux de chômage officiel peut être sur-estimé si des travailleurs officiellement au chômage travaillent dans l'économie souterraine. De même, le taux de croissance du PIB peut être sous-estimé si l'économie souterraine croît à un taux plus rapide que celui de l'économie officielle, ou bien le taux d'inflation peut être sur-estimé. Pour toutes ces raisons, l'étude de l'économie souterraine dans la Caraïbe est une entreprise valable.

Plusieurs techniques existent pour mesurer l'économie souterraine. Une typologie peut être établie en les classant selon qu'elles procèdent directement ou indirectement. Le travail que nous présentons ici discute d'abord des possibilités d'application de ces techniques pour les pays de la Caraïbe. Des investigations méthodologiques et empiriques sont ensuite menées pour illustrer un exemple d'application de ces techniques. Ainsi, une estimation de la taille de l'économie souterraine de Trinidad & Tobago est calculée en retenant une approche basée sur une modélisation SCVAR (VAR structurel cointégré). Nous évaluons la taille actuelle de l'économie souterraine à 10 % du PIB officiel.

## 1. Introduction

Voluminous studies<sup>1</sup> about the size of the underground economy have been carried out for countries throughout the world but the Caribbean region remains a glaring exception. What are the likely benefits of determining the size and structure of the hidden economy in the Caribbean country of Trinidad & Tobago? Several reasons are given for conducting research in this area and perhaps the most widely cited is the potential for erroneous policy decisions based on misleading statistical indicators. Indeed, economic policy measures may be of a wrong magnitude or even in a wrong direction if they are based on such indicators of the state of the economy. For example, the official unemployment rate may be overstated if part of the officially unemployed carry out work in the hidden economy. Similarly, the growth rate of real income may be understated if the hidden economy is expanding more quickly than the “measured” economy, or the rate of inflation may be overstated. Policy mistakes based on erroneous figures are particularly costly for small developing countries like Trinidad and Tobago where resources are very limited. Determining the size of the hidden economy in Trinidad & Tobago and, indeed, in other countries of the Caribbean, is a worthy enterprise for this reason alone.

This paper is the first in an ongoing research project aimed at the identification and measurement of the hidden economy in certain Caribbean countries. In fact it is intended that this work on Trinidad & Tobago serve as a template for future work on other countries of the Caribbean. The first obstacle in an exercise like this one is the definition of what constitutes the hidden economy as well as an agreement about the appropriate terminology to be employed. We use the term “hidden economy” to refer to all the activity that adds value, but escapes the official channels of measurement. In so doing, we divide the total economy into its hidden and measured components.

There are many other concepts appearing in the literature that are related, and sometimes equivalent, to what we will call in this paper the hidden economy. These include terms like “shadow economy”, “black economy” “underground economy” and many others. Of some interest to us in this paper is the notion of the “informal economy” or “informal sector” of the economy which is widely used even in the Caribbean by statistical agencies, non economists or economists with special interests (like the labour market) to describe economic activity that employs a handful of workers who earn low incomes, use rudimentary equipment, and work outside the framework of laws and regulations (Rampersad (1987)). This notion of the informal economy is perhaps better defined as the marginal (or even marginalised) economy and it has long been of interest to Sociologists and Labour Economists, if only for the effect that activity in this sector has on employment and well-being. It implicitly divides the economy into its formal and informal components. The work of Witter and Kirton (1990) represents at least one attempt to measure the size of the informal sector in a Caribbean country. We believe that the informal sector so defined represents a large portion of the hidden economy in the Caribbean. For purposes of this paper we will attempt to maintain a distinction between the two concepts while

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<sup>1</sup> See Schneider and Enste (2000) for a fairly comprehensive survey of the literature.

recognizing that, in the case of the Caribbean, the distinction might be blurred in practice<sup>2</sup>.

There are many approaches to measuring the size of the hidden economy, perhaps as many as there are definitions of the concept, and we briefly survey some of these methods in this paper.

The rest of the paper proceeds as follows. In the following section, we present some of the reasons advanced by commentators for the increase in the size of the hidden economy all over the world. In Section 3, we present some of the stylized facts about hidden economic activity in the Caribbean and in Section 4 we discuss some of the methods that have been used so far to measure the size of the hidden economy and the applicability of these to the Caribbean reality. Section 5 is the central piece of the paper where we set up the SCVAR model, estimate and evaluate it and use it to determine the size of production in the hidden economy over the period 1973-1999. In Section 6 we conclude the paper.

## **2. Reasons for the increase in the size of the hidden economy**

There is no doubt that the phenomenon of the hidden economy is large and growing in almost every country of the world. Schneider and Enste (1999) show that in some countries (notably Nigeria, Thailand, and Egypt) the production of the hidden economy is nearly three quarters the size of officially recorded GDP. In most countries (especially in Central and South America), the size is one quarter to one third of GNP. The smallest hidden economies are estimated to exist in countries with relatively small public sectors (Japan, the US and Switzerland) and a comparatively high tax morality (United States and Switzerland).

Why has this happened? Several reasons have been advanced, all of which find some reflection in the Caribbean reality. These reasons are well documented in the literature but it is worthwhile to repeat those that have a direct bearing on the Caribbean region.

### ***An increase in the burdens imposed on the official economy***

The rise of the hidden economy has been interpreted as a reaction to the overburdening of individuals and firms by the apparatus of state. These burdens may be composed of taxes, national insurance, health contributions and an increasing number of public regulations to be observed in the official economy. There is little doubt that these perceived burdens make activity in the hidden economy more attractive in the Caribbean and elsewhere.

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<sup>2</sup> See Gërkhani (1999) for a very useful survey of studies done on the informal sector as well as for an appreciation of the blurred lines between the concepts of “hidden economy” and “informal sector” even in the developed countries.

### ***Tax morality and government controls***

Tax morality refers to the willingness of workers and traders to pay the right tax at the right time. This factor is clearly related to the increased burdens imposed by the state. A worsening tax morality tends to lead to an increased readiness, even for the most sophisticated of individuals and organizations, to become active in the hidden economy. This morality is worsened by factors such as perceived fairness of tax laws, attitude of taxpayers vis-à-vis their government and their basic religious and cultural characteristics. A growing intensity of public controls, a reduction in the provision of facilities with which taxes can be evaded, and a rise in the severity of penalties imposed on tax evaders that are apprehended, reduce the return on hidden activities and therefore has the opposite effect.

### ***Labour market conditions***

The longer the official work time, the higher are the opportunity costs of taking up additional work in the hidden economy. A reduction in the official participation rate, the forced reduction of weekly working time, earlier retirement, along with increased unemployment signal increasing opportunities to become active in the hidden economy.

### ***Structural factors***

There are certain economic sectors (particularly those with low capital intensity) and industries (e.g. handicraft) that tend to gravitate quite naturally to hidden economic activity. As these sectors of the economy expand, so too will the hidden economy. For certain categories of workers as well (e.g. foreign workers), the probability of working in the hidden economy is quite high.

The worldwide recession of the 1970s and 1980s, resulting mainly from the vagaries of the oil market, took a heavy toll on the Caribbean economy. It resulted, in particular, in failing enterprises, negative growth and high unemployment rates. As a result, the informal sector, and the hidden economy more generally, has become more important as a means of survival for both the unemployed and even the officially employed.

### **3. Features of the hidden economy in the Caribbean: some stylized facts**

It is not easy to classify an economic unit as belonging to the hidden or the measured economy as it is possible for any one productive unit to belong to both at the same time. Instead the hidden economy should be characterized by the activity being performed combined with the conditions under which this activity is being performed.

Units involved in hidden activity may be part of the formal or informal sector. They may operate in this dual economy as a means of tax avoidance as well as to earn extra income. It is very difficult in the absence of empirical data to describe the features or the structure of that part of the formal economy which is hidden. In fact, we may have to be prepared to measure its size without knowing much more and, indeed, many measures have been proposed to do precisely this. Perhaps the best way to

obtain detailed information about the size and structure is either from a survey implemented through a questionnaire or a mandatory tax audit, but the purpose of such an audit may be to put an end to such activity.

In the Caribbean, it is much easier to delineate the activities taking place in the informal sector. This is largely because a lot of it takes place in full view of the public and by and large they enjoy a lot of public sympathy, if not overt support (like the “PH” taxis in Trinidad & Tobago). These will include, but are not limited to, activities like the following:

- Unregistered sole trading;
- Suitcase trading;
- Market/street vending (agricultural, fishing, manufacturing and textiles sectors);
- Private jobs in the professional services (such as are carried out by University lecturers, lawyers, doctors and other professional categories);
- Domestic work (e.g. ironers, maids, gardeners);
- Plumbing, carpentry and mechanical services;
- Guest house accommodation;
- Private vehicles operating for hire (like “PH” taxis in Trinidad & Tobago);
- Transportation of goods;
- Private tuition;
- Private coaching of extra-curricular activities;
- Registered businesses that underestimate their sales or overestimate their expenditures (especially family-run businesses some of which are very large in the Caribbean).

The hidden economy is therefore very heterogeneous comprising both traditional and modern, as well as non-monetary and monetary activities. There is the difficulty of measurement associated with the hidden economy in that there are non-monetary or subsistence activities which are invisible. There are also the visible activities which are difficult to measure either because they are difficult to trace, locate or identify, or because there is a lack of proper records. This is not surprising since the very nature of such activity is that there is a deliberate attempt to mask them from the public view.

#### **4. Methods for estimating the size of the hidden economy**

There are several approaches to measuring the hidden economy<sup>3</sup>. A major problem in estimating its size is that participants have an incentive to conceal their activity. The various approaches used to measure the size of the hidden economy may be classified as either direct or indirect. Once again it is useful to give a brief survey of the literature if only to understand the applicability of some of the methods to the Caribbean reality. Two econometric methods (Tanzi’s (1983) currency demand method and Zellner’s (1970) MIMIC method) will be discussed under the heading of “indirect methods” and both will be adapted and applied to the Trinidad and Tobago case in this paper.

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<sup>3</sup> See Schneider and Enste (1999), Gerxhani (1999), and Giles (1999a), (1999b) for a useful survey of the various methods.



#### 4.1 **Direct approaches**

We consider two such approaches:

- ♦ The voluntary survey approach
- ♦ The compliance method approach

##### ***The voluntary survey approach***

This approach may be considered as one of the more obvious ways to determine the size of the hidden economy. Following this approach, individuals are interviewed and asked whether they have actively participated in the hidden economic activity over a specified period of time in their capacity as buyers or sellers of goods or labour services. If the sample used is representative, and if the questioning technique is designed to overcome as much as possible the incentive to provide incorrect responses, it is possible to derive an estimate of the size and, perhaps more importantly, an indication of the structure of the hidden economy. Use of the survey as a means of estimating the size of the hidden economy is relatively new and has been implemented only within the last two decades, mostly in the European region. It is reasonable to assume that this method is likely to meet with a high degree of success in the Caribbean, since a lot of the so-called hidden activity is carried out overtly and the participants may even enjoy public support. The issue is not a particularly sensitive one, nor is it given much exposure by the media except for cases where large organizations are involved and some element of “blue collar” crime may be in evidence. The survey is not likely to pick up such activity and we will have to depend on the compliance method or the indirect methods – both of which are discussed below - to provide such information.

CENSIS (1976) carried out such a survey to determine who was involved in providing labour services in the black market in Italy. The study was carried out in two steps. In the first step, those stating that they provided no such services were separated from those who openly declared that they did. In the second step, those declaring that they did not were asked a month later whether they were not occasionally active ‘simply to put their time to better use,’ and whether they were not able to contribute at least something to the family’s upkeep. The increase in the participation rate was taken as the number of people engaged in the hidden economy. A similar study was undertaken in Norway by Isachsen, Klovland and Strom (1982) and Isachsen and Strom (1985). They combined both the interview and postal survey techniques. They noted that this procedure was rather novel at the time and the questions related solely to unreported income from work. Individuals in the labour force were asked questions relating to their employment of irregular labour services and their own involvement as providers of such services, the number of hours worked, the hourly wage rate and other similar questions. van Eck and Kazemier (1988) used this technique to determine the socio-economic categories, motives and opportunities of participants of the underground economy in the Netherlands.

The sample survey method has the advantage of being able to provide detailed information on the structure of the hidden economy (especially on the composition of

the hidden work force), the characteristics of employment and the quality of work performed. It is doubtful however that the questioning leads all the participants to reveal themselves. This method must therefore be expected to give, at best, lower boundary estimates<sup>4</sup>.

### ***The Compliance Method Approach***

Frey and Pommerehne (1984) suggest that information on the size of the hidden economy may be derived from the efforts of tax authorities to uncover concealed income. The individuals and corporations chosen are forced to reveal their true income under threat of severe punishment (which includes fines and imprisonment). The sample selected for audit is not based on random methods but may be based on the suspicion of the tax authority or on some algorithm derived to select those taxpayers expected to be most worthwhile to audit. The issue that arises with regard to this method is whether the tax collection and administrative systems are developed enough to undertake this approach in the Caribbean. It will require the initiative of the Central Government in all countries and this may not be forthcoming due, among other things, to the bribery and corruption of officials.

Such tax auditing has the advantage of obtaining detailed information on how far particular income groups and corporations underreport their income or do not report at all. However, it does not result in the direct estimation of the full size of unreported income but rather that amount which would be detected if the same intensive audit techniques were applied to the tax population as a whole. This method is better able to identify the overstating of deductible expenses than the underreporting of income, especially the non-reporting from certain sources.

Apart from tax auditing, a number of other compliance methods have been used to uncover parts of the hidden economy. For instance, firms and entrepreneurial associations collect data on employees' theft by undertaking control action and immigration agencies check into the size of illegal work by immigrants.

Tax auditing and other involuntary compliance methods are likely to give higher estimates of the hidden economy compared to extrapolations based on the results of voluntary sample surveys because of the threat of legal sanctions for misreporting. It may be combined with the voluntary service approach discussed above to give a more detailed picture of the size and structure of the underground economy.

## **4.2 Indirect Approaches**

The various indirect approaches appearing in the literature cover a range of techniques which aim at the extraction of information from data not constructed for that purpose. These techniques may give some indication about the size of the hidden economy but say little about its form and structure. In addition, many are based on some very strong assumptions which cannot be tested. Thomas (1999) stated that the existing estimation methods "rely on heroic assumptions to justify the manipulation of certain numbers". Indirect approaches also tend to give quite different estimates of the hidden economy. Despite the many failings that have been identified, there have

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<sup>4</sup> See Mogensen et al. (1995).

been concerted attempts over time to make these methods better and better. Their one main strength is that they do not require the collaboration of individuals in the hidden economy who have an interest in hiding what they do. In fact they represent an attempt to obtain this information despite the efforts made to conceal it. Use of indirect methods of estimation therefore is likely to yield more timely results on the size of the underground economy. Under the heading of “indirect methods” we will discuss four popular “discrepancy” methods as well as two econometric methods. The discrepancy methods are:

- Discrepancy between income and expenditure;
- Discrepancy between Official and Actual Participation Rates;
- Discrepancies in Physical Inputs (Electricity Consumption);
- Discrepancies in the Monetary Balances.

The two econometric methods are:

- Tanzi’s currency demand method;
- Zellner’s MIMIC method.

### ***Discrepancy between Income and Expenditure***

This approach measures the size of the hidden economy as the surplus of expenditure over income. This can be done at the aggregate national income level or at the individual household level. At the aggregate level, the initial statistical discrepancy between national income and expenditure, before any statistical error adjustments are made, gives an estimate of the hidden economy. There can be little doubt about the strong intuitive appeal of this approach, but there are some obvious shortcomings. In the first place, the statistical agencies in the Caribbean do not collect all the data on the expenditure side and private consumption expenditure is obtained as a residual. Even if this were not the case, it is in fact quite possible that other factors influence the national accounts calculations of income and expenditure. Data on the expenditure side are more difficult to collect and the initial estimates may be information obtained from income tax authorities. This places considerable doubt on the independence between the two sides and may result in misleading discrepancies. It is also not impossible for the income estimates to exceed the expenditure estimates in which case we have a negative value for the size of the hidden economy. This discrepancy approach, though useful and easy to apply when expenditure data are available, is therefore likely to give at best a lower bound estimate of the size of the hidden economy.

At the individual household level, data can be obtained from exercises such as the Family Expenditure Survey conducted in the United Kingdom. This survey measures income and expenditure independently of each other by using daily record books as well as by collecting information on credit and hire purchase. Although these figures correspond almost exactly to those obtained at the national income level, this approach gives a higher bound estimate of the hidden economy. It has the added advantage of providing more detailed information about the structure of the hidden economy since it can be used to identify sectors and industries where a large amount of hidden activity is taking place. Some Caribbean countries, including Trinidad and Tobago, conduct Household Budgetary Surveys as well as Continuous Sample

Surveys of the Population. With some amendments, these surveys may be a useful tool for obtaining data required for measurement of the hidden economy.

### ***Discrepancies between Official and Actual Participation Rates***

Contini (1981) argued that the decline in the labour participation rate is an index of the departure of labour from organized, formal labour markets, presumably for better opportunities in the informal labour markets. This approach has been used mainly by Italian economists (see OECD, 1978b) to measure the hidden economy in Italy where the official participation rate observed in the labour market is much lower than that observed in other industrialised countries. There are however difficulties in using this approach. It is dubious to assume that a constant participation rate can be used as a benchmark since a number of different factors influence the participation rate for a country at any one time. Utilising this method in the Caribbean may present some problems since participation in the labour force in most of these countries depends to a large extent on seasonal factors.

Another difficulty arises in defining what constitutes participation in the labour market since workers may provide services in both the measured and hidden economies. It therefore depends on how the participation of second and multiple-job holders is defined. Witter and Kirton (1990) point out that, without an estimate of the average labour productivity in the hidden economy, it is not possible to translate the share of the labour force into a proportion of the GDP. This approach however has the advantage of getting closer to where the concealed activities are taking place.

### ***Discrepancies in Physical Inputs (Electricity Consumption)***

This is in fact the most recently developed discrepancy approach and it looks at physical inputs, in particular the use of electricity. Kaufman and Kaliberda (1996), in an effort to measure overall (official and unofficial) economic activity in an economy, assume that electric-power consumption is regarded as the single best physical indicator of overall economic activity. The electricity/ GDP elasticity has been empirically observed to be close to one. According to this approach, the difference between the gross rate of official GDP and the gross rate of total electricity consumption can be attributed to the growth of the underground economy.

This approach has the great benefit of relying on easily available data, which is a distinct advantage for Caribbean countries. This approach has, however, been criticized on several grounds. Firstly, the use of other energy sources as a substitute for electricity prevents part of the underground economy from being captured. Secondly, the change in technical progress over time affects the efficiency of production and use of electricity. Thirdly, there may be considerable changes in the elasticity of electricity/GDP across countries and over time.

### ***Discrepancies in the Monetary Balances***

It is usually assumed that most activity in the hidden economy is undertaken by using cash as the main medium of exchange so as not to leave any traces of the transactions. Also, due to the nature of the activity or the lack of sophistication of the persons

involved, especially in the informal sector, cash remains the most convenient mode of exchange. These assumptions are likely to hold in the case of the smaller Caribbean economies (like those of the Organisation of Eastern Caribbean states) but may not hold for the larger ones (like Trinidad & Tobago).

The basic idea behind this approach is simple: although there is no trace of individual cash transactions, hidden activities as an aggregate leave a trace. The demand for currency increases in comparison to what one would expect if there were no “underground” or hidden economic activity. This approach measures the size of the hidden economy as the discrepancy between the actual demand for currency and some notion of the expected demand. Below we discuss two such applications of this approach. The first is the *fixed ratio method*, which assumes a fixed ratio for the currency demand relative to some measure of money. The second is the *transactions method*, based on the quantity theory of money.

#### (a) Fixed Ratio Method

This method takes the excess of currency in use compared to a normal expected level as an indicator of the size of the hidden economy, providing that such activities take place using cash as the medium of exchange.

The simple approach proposed by Gutmann (1977) considers the ratio of currency to demand deposits ( $C/D$ ) by making three crucial assumptions:

- (i) There is a one-to-one relationship between transactions and cash payments in the hidden economy, i.e. there are no payments by cheque, and barter is excluded
- (ii) The velocity of circulation is the same in the hidden economy as in the official economy
- (iii) The normal currency-demand deposit ratio is constant.

A number of weaknesses has been identified with this method. They relate to the sensitivity of the  $C/D$  ratio to the velocity of circulation, the constancy of the normal ratio between currency and demand deposits, and the assumption that all changes in this ratio are attributed to the hidden economy. This approach only makes sense if there are no other factors influencing the  $C/D$  ratio. However there are a number of other factors that influence this ratio, namely, interest rates, income levels, changes in institutional arrangements and the levels of taxation among others.

#### (a) Transactions Approach

Activities in both the official and hidden economy require money to undertake the necessary transactions. If, based on the quantity theory of money, a constant relationship between money and transactions is assumed, the total stock of money gives an indication of total transactions in both the official and hidden economy. Relating total nominal GNP to total transactions, the informal economy's GNP can be derived residually by subtracting officially measured GNP from total GNP.

Following the quantity equation:  $MV = pT$

where M = money supply  
V = velocity of money,  
p = price level of transactions  
T = volume of transactions

Assumptions are required about V and about the relationship between the value of total transactions (pT) and nominal total GNP.

This approach was developed by Feige (1989 and 1996). In order to estimate the size of the hidden economy, Feige assumes a base year in which there is no hidden economy, and therefore the ratio of pT to total nominal GNP is normal and constant over time.

This method also has several weaknesses. The most obvious is the assumption of a base year with no hidden economy but there is also the assumption of a normal ratio of transactions constant over time. Moreover, to obtain reliable estimates, precise figures of the total volume of transactions should be available. This might be difficult to achieve for cash transactions because they depend on, among other things, the durability of bank notes. In this approach the assumption is made that all variations in the ratio between the total value of transactions and the officially measured GNP are due to the hidden economy. In general, although this approach is theoretically attractive, its application requires rather strong assumptions. The empirical requirements necessary to obtain reliable estimates are so difficult to fulfill that its application may lead to doubtful results. In order to improve the transactions method it is necessary to develop a theory of what factors may influence the ratio, to develop a test equation, and to econometrically estimate it for the country and period chosen. The quality of the bank notes is only one of the many possible factors.

### ***Tanzi's currency demand approach***

In an attempt to improve Gutmann's simple fixed ratio method, Tanzi (1983) sought to capture the influences of other factors on currency demand to ensure that the extra currency can really be attributed to the working of the hidden economy.

Tanzi, who also assumes that hidden transactions are undertaken in the form of cash payments, isolates this extra currency demand by econometrically estimating a currency demand equation. He controls for all possible factors such as income levels, payment habits, interest rates, and so on. He also takes into consideration variables as the direct and indirect tax burden, government regulation and the complexity of the tax system which are assumed to be the main factors causing people to participate in the hidden economy.

The basic regression equation proposed by Tanzi is the following:

$$\ln(C/M_2)_t = \beta_0 + \beta_1 \ln(1+TW)_t + \beta_2 \ln(W)_t + \beta_3 \ln R_t + \beta_4 \ln(Y)_t + u_t$$

where  $\beta_1 > 0$ ,  $\beta_2 > 0$ ,  $\beta_3 < 0$ ,  $\beta_4 < 0$  and

- $\ln$  denotes the natural logarithm
- $C/M_2$  is the ratio of cash holdings to current plus deposit accounts
- $TW$  is a weighted average tax rate (to proxy changes in the size of the hidden economy)
- $W$  is the proportion of wages and salaries in national income (to capture changing payment and money holding patterns)
- $R$  is the interest rate paid on savings deposits (to capture the opportunity cost of holding cash) and
- $Y$  is the per capita income

The extra increase in currency demand, which is the amount unexplained by the conventional or normal factors (explained above), is then attributed to the rising tax burden and the other reasons leading people to work in the hidden economy.

The size of the hidden economy may be calculated in two steps. Firstly, an estimate is made of the amount of currency used for hidden economic transactions. This is obtained as the difference in the current level of currency balances and the level when the direct and indirect tax burden (and government regulations) is at its lowest value. Secondly, the size of the hidden economy is computed by assuming that the income velocity for currency used in the hidden economy is the same as that used in the official, formal economy.

This currency demand approach is one of the most commonly used approaches to estimate the size of the hidden economy. However, it has been criticised on various grounds:

- (i) Not all transactions in the hidden economy are paid in cash. The size of this economy may therefore be even larger than estimated;
- (ii) It considers only the tax burden as a cause of the hidden economy. It fails to consider other factors such as the impact of government regulation, taxpayers' attitude towards the state, tax morality, etc, due to the unavailability of reliable data in most countries;
- (iii) It does not take into account the fact that the US dollar is used as an international currency and held as cash reserves in many countries;
- (iv) It assumes the same velocity of money in both types of economies;
- (v) It assumes a base year when the hidden economy was non-existent;

We should also add to the above the critique that the estimation method used is at odds with modern econometric methodology. Estimation of the currency demand equation will be spurious in the sense of Granger and Newbold (1974) if some or all of the variables entering the equation are  $I(1)$  and not cointegrated. Cointegration theory teaches us that, even if the variables are cointegrated, there may be as many as four cointegrating relationships of which the estimated equation is but at best only one. Furthermore, following the results of the Granger Representation theorem (Engle and Granger (1987)), the variables should be cast within the framework of a vector error correction model in which are embedded the long-run (cointegrating) relations.

We pursue this matter in Section 6 below and estimate a structural cointegrating VAR (SCVAR) model based on the five variables proposed by Tanzi. SCVAR models were introduced into the literature by Garratt et al. (1998, 1999). Other useful methodological references are Pesaran (1997), Pesaran and Smith (1998), Pesaran et al. (1999) and Pesaran and Shin (1998, 1999). A major attraction of this approach is that it allows for the estimation of theory-consistent long-run relationships between the variables in the system. The short-run dynamics are freely estimated within a VAR framework. The properties of the system and are evaluated on the basis of Persistence Profiles and Generalised Impulse Response Functions.

### ***Zellner's MIMIC approach***

The MIMIC (multiple indicators, multiple causes) model was introduced into the literature by Zellner (1970)<sup>5</sup>. The pioneers of the MIMIC approach in the estimation of the size of the hidden economy are Weck (1983), Frey and Weck (1983a, 1983b) and Frey and Weck-Hannemann (1984), who applied this approach to cross-section data from the twenty-four OECD countries for various years.

The approach based on the MIMIC model explicitly considers multiple causes as well as the multiple effects of the hidden economy over time. The empirical model used is quite different from those used so far. It is based on the statistical theory of unobserved variables which considers multiple causes and multiple indicators of the phenomenon to be measured. For the estimation, a factor-analytic approach is used to measure the hidden economy as an observed variable over time. The unknown coefficients are estimated in a set of structural equations within which the unobserved variable cannot be measured directly.

The MIMIC model consists of two parts, the unobserved variables and the observed indicators. The measurement model links the two parts. The structural equations model specifies causal relationships among the unobserved variables. In this case there is one unobserved variable, the size of the hidden economy. It is assumed to be influenced by a set of indicators for the hidden economy's size, thus capturing the structural dependence of the hidden economy on variables that may be useful in predicting its movement and size in the future.

The three main causes identified are:

- (i) The burden of direct and indirect taxation
- (ii) The burden of regulation
- (iii) The tax morality

The three main indicators identified are:

- (i) Development of monetary indicators
- (ii) Development of the labour market
- (iii) Development of the production market

Recent applications of the MIMIC approach include work by Giles (1999a and 1999b) and by Giles, Tedds and Werkneh (1999). Unlike earlier empirical studies of the

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<sup>5</sup> See also Goldberger (1972), Jöreskog and Goldberger (1975) and Jöreskog and Sörbom (1993) for details on the estimation of MIMIC models.



hidden economy, they paid appropriate attention to the non-stationarity, and possible co-integration, of time series data in both models.

While this approach is the most comprehensive and builds on a well-structured behavioral model, it requires a large amount of data. As these are often not available, especially in some Caribbean countries, there may be some difficulty in applying this approach to some of the smaller Caribbean countries. However, it has a lot of possibilities for the larger ones like Trinidad & Tobago.

## 5. Estimates of the size of the Hidden Economy for Trinidad and Tobago in an SCVAR framework

### 5.1 Estimation and Evaluation of the Model

Our point of departure is the five variables employed in Tanzi's model viz.  $\ln(C/M_2)_t$ ,  $\ln(1+TW)_t$ ,  $\ln W_t$ ,  $\ln R_t$ , and  $\ln Y_t$ . Annual data will be used to set up a model within the SCVAR framework. The data used, and the source of the data, are as follows:

- C is cash in active circulation, TT\$ million. *Source: Quartely Statistical Digest of the Central Bank of Trinidad & Tobago;*
- $M_2$  is the money supply broadly defined, TT\$ million. *Source: Quartely Statistical Digest of the Central Bank of Trinidad & Tobago;*
- TW is the ratio of the overall tax burden (direct taxes plus indirect taxes) to Gross National Product at current prices. *Source: National Income Accounts of Trinidad & Tobago published by the Central Statistical Office of Trinidad & Tobago;*
- W is the wages and salaries bill. *Source: National Income Accounts of Trinidad & Tobago published by the Central Statistical Office of Trinidad & Tobago;*
- R is measured as  $(1+r/100)$  where r is the rate on savings deposits expressed in percentage form. *Source: Quartely Statistical Digest of the Central Bank of Trinidad & Tobago;*
- Y is measured as the per capita Gross Domestic Product at market prices. *Source: National Income Accounts of Trinidad & Tobago published by the Central Statistical Office of Trinidad & Tobago.*

The first step in the approach is to determine the order of integration of each of the variables in the system. The procedure proposed by Dickey and Pantula (1987) is used and tests are conducted to determine whether the variables are I(1). This is the null hypothesis and the alternative is that they are I(0).

**Table 1**  
Dickey-Pantula Tests

Variable	$\ln(C/M_2)_t$	$\ln(1+TW)_t$	$\ln W_t$	$\ln R_t$	$\ln Y_t$
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ADF level	-2.913***	-1.970***	-2.339***	-2.963**	-2.965***
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\*\*\* Not significant even at 10% level of significance.

\*\* Not significant at 5% level.

The tests include a constant and a trend term and they will have us conclude that the variables are all I(1). This is required for application of the SCVAR method. In four out of the five cases the null of a unit root could not be rejected even at 10% while in the case of the interest rate variable it could not be rejected at 5%.

The SCVAR method requires a priori specification of possible long run relations among the variables. We identify two possible long-run relations. The first is Tanzi's equation which has been so widely estimated:

$$\ln(C/M_2)_t = \beta_{21}\ln TW_t + \beta_{31}\ln W_t + \beta_{41}\ln R_t + \beta_{51}\ln Y_t + \beta_{61} + \varepsilon_{1t} \quad (1)$$

The expected signs of the coefficients are  $\beta_{21}>0$ ,  $\beta_{31}>0$ ,  $\beta_{41}<0$ , and  $\beta_{51}<0$ .

The second is based on the literature that deals with the money-income causal nexus:

$$\ln Y_t = \beta_{12}\ln(C/M_2)_t + \beta_{42}\ln R_t + \beta_{62} + \varepsilon_{2t} \quad (2)$$

The expected signs here are  $\beta_{12}<0$ , and  $\beta_{42}<0$ .

The AIC and SBC criteria, as well as the well known test for variable lag length outlined in Enders (1995), p. 312-315, are used to select the underlying VAR for cointegration analysis. We decide on a VAR(2) model. Using this model with unrestricted intercepts we proceed with the cointegration analysis. The summary results of this analysis, obtained using EViews 4.0, appear in Table 2 below:

**Table 2**  
**Tests for Cointegration Rank**

(a) Trace Statistic

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.796269	125.0949	68.52	76.07
At most 1 **	0.758266	80.54817	47.21	54.46
At most 2 **	0.598686	40.79043	29.68	35.65
At most 3	0.385271	15.22612	15.41	20.04
At most 4	0.055611	1.602070	3.76	6.65

(b) Maximum Eigenvalue Statistic

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.796269	44.54671	33.46	38.77
At most 1 **	0.758266	39.75774	27.07	32.24
At most 2 **	0.598686	25.56431	20.97	25.52
At most 3	0.385271	13.62405	14.07	18.63
At most 4	0.055611	1.602070	3.76	6.65

\*(\*\*) denotes rejection of the hypothesis at the 5%(1%) level

The evidence seems to suggest the existence of three cointegrating vectors, one more than we had anticipated. We note, however, that the Maximum Eigenvalue statistic just barely rejects the null at the 1% level. We will therefore accept the existence of exactly two cointegrating vectors.

The next step is to obtain exactly identified equations corresponding to equations (1) and (2) above. These were obtained as:

$$\ln(C/M_2)_t = 1.08 \ln TW_t + 0.343 \ln W_t - 0.292 \ln Y_t + 0.3597 + \hat{\varepsilon}_{1t} \quad (3.248) \quad (5.466) \quad (19.36)$$

$$\ln Y_t = -2.820 \ln(C/M_2)_t + 1.554 \ln TW_t - 5.815 \ln R_t + 2.630 + \hat{\varepsilon}_{2t} \quad (13.67) \quad (1.147) \quad (1.23)$$

Asymptotic t-statistics are shown in parentheses. One of the variables (the interest rate variable) had to be dropped from the first equation to achieve exact identification and one had to be added to the second (the tax variable).

As a second step, we impose a further constraint on the second equation (removal of the tax variable which did not appear in the initial specification) and we tested for the validity of this over identified system. The equations were estimated as:

$$\ln(C/M_2)_t = 1.091 \ln TW_t + 0.4920 \ln W_t - 0.2679 \ln Y_t + 0.2416 + \hat{\varepsilon}_{1t} \quad (1') \quad (4.608) \quad (5.792) \quad (16.06)$$

$$\ln Y_t = -2.755 \ln(C/M_2)_t - 11.97 \ln R_t + 3.459 + \hat{\varepsilon}_{2t} \quad (2') \quad (9.361) \quad (1.602)$$

All variables carry the correct sign and all but one are highly significant. The interest rate variable is just barely significant at the 10% level. The  $\chi^2$  statistic for the overidentification test does not reject the null (p-value of 0.65).

The associated Error Correction model, which constitutes the SCVAR model, was then estimated. The results of this exercise are shown in Table 3 below. These include the estimated coefficient values, their corresponding t-statistics, the value of  $\bar{R}^2$  and a collection of diagnostic multivariate statistics used to evaluate the goodness-of-fit of the overall model.

**Table 3**  
**(a) SCVAR Model**

Equation	$\Delta \ln (C/M_2)_t$	$\Delta \ln TW_t$	$\Delta W_t$	$\Delta R_t$	$\Delta \ln Y_t$
$\hat{\varepsilon}_{1,t-1}$	-0.7137 [2.612]	0.1869 [2.761]	-0.1568 [0.8969]	0.0521 [2.132]	1.0387 [5.848]
$\hat{\varepsilon}_{2,t-1}$	0.0244 [0.481]	-0.0400 [3.174]	0.1202 [3.693]	-0.0075 [1.647]	-0.2782 [8.415]
$\Delta \ln (C/M_2)_{t-1}$	0.2157 [0.906]	-0.0205 [0.348]	-0.1827 [1.199]	-0.0136 [0.640]	-0.2528 [1.634]
$\Delta \ln TW_{t-1}$	0.9320 [0.922]	-0.5277 [2.106]	2.4470 [3.784]	-0.0675 [0.744]	-2.028 [3.086]
$\Delta \ln W_{t-1}$	0.8839 [3.273]	-0.1657 [2.476]	0.5050 [2.923]	-0.0081 [0.334]	-0.3662 [2.086]
$\Delta \ln R_{t-1}$	3.6064 [1.486]	0.9568 [1.590]	-6.4647 [4.163]	-0.0632 [0.291]	9.7413 [6.157]
$\Delta \ln Y_{t-1}$	0.6138 [2.136]	-0.0538 [0.756]	0.1005 [0.547]	-0.0404 [1.571]	-0.1596 [0.855]
Constant	-0.0764	0.0069	-0.0226	0.0045	0.1117
$\bar{R}^2$	0.262	0.400	0.687	0.052	0.839

The error correction terms  $\hat{\varepsilon}_{1,t-1}$  and  $\hat{\varepsilon}_{2,t-1}$  are derived from equations (1') and (2') respectively.

### (b) Diagnostic Statistics

Residual Portmanteau Tests for Autocorrelations

H<sub>0</sub>: no residual autocorrelations up to lag h

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
4	65.23731	0.7822	71.84918	0.5817	75
8	148.7987	0.9252	179.6932	0.3881	175
12	222.9080	0.9906	296.0908	0.1826	275

\*The test is valid only for lags larger than the VAR lag order.  
df is degrees of freedom for (approximate) chi-square distribution

Residual Serial Correlation LM Tests

H<sub>0</sub>: no serial correlation at lag order h

Lags	LM-Stat	Prob
4	15.55315	0.9275
8	23.09808	0.5718
12	15.18197	0.9370

Probs from chi-square with 25 df.

Residual Normality Tests

Orthogonalization: Residual Covariance (Urzua)

H<sub>0</sub>: residuals are multivariate normal

Jarque-Bera Statistic	58.32505	Prob.	0.9999
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Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

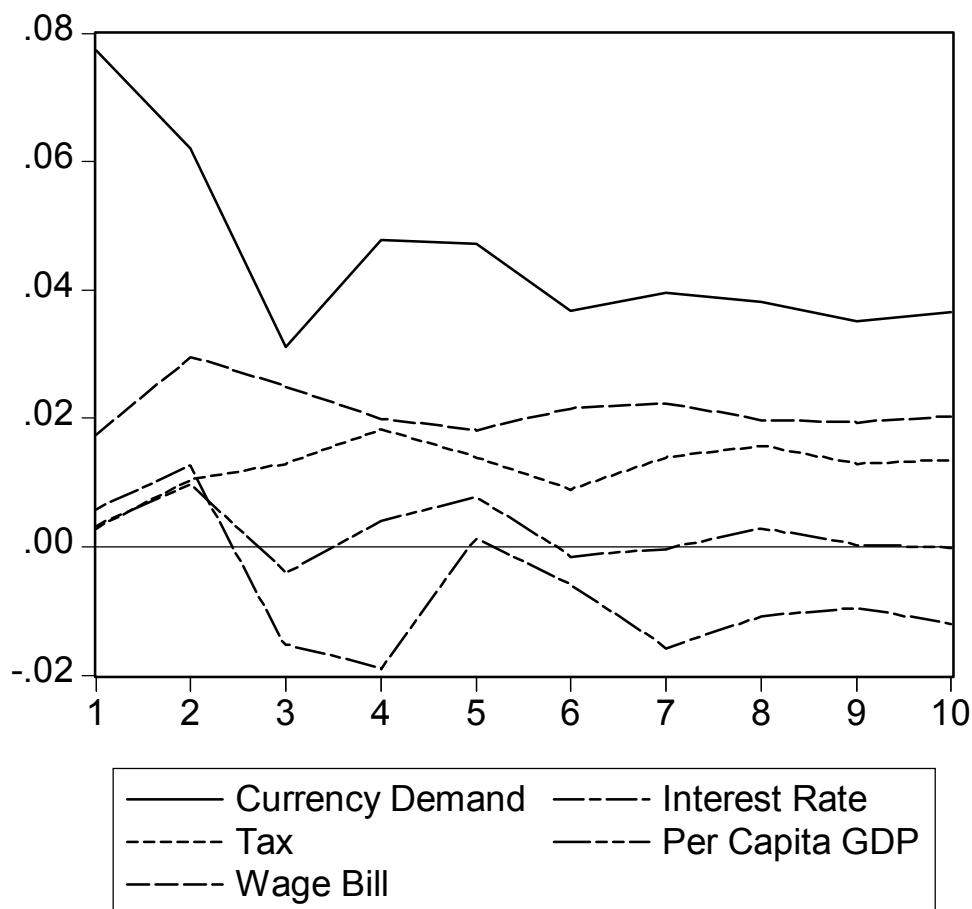
Chi-sq = 219.7500	df = 210	Prob.	0.3082
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The diagnostic statistics indicate that the model residuals are normally distributed as well being untainted by serial correlation and heteroscedasticity. At least one of the two error correction terms is significant in all five equations and both are significant in three of the five cases (if we accept the use of a 10% level of significance).

The generalized impulse responses of the currency demand variable to shocks to the innovations in all the variables are shown in Figure 1 below:

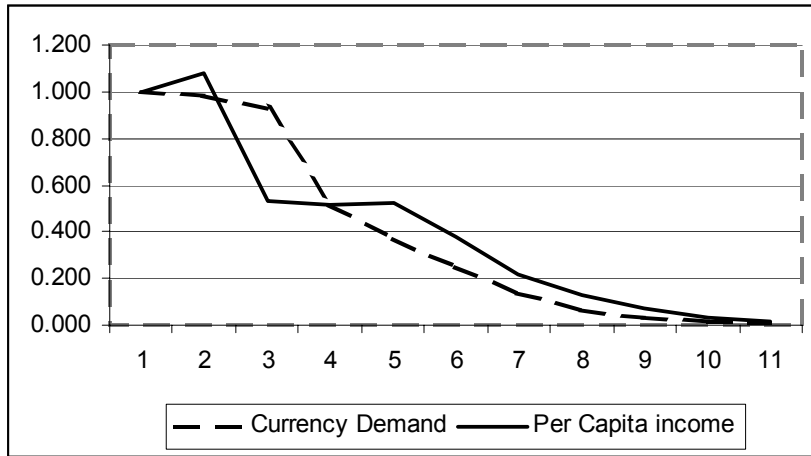
**Figure 1**

**Response of Currency Demand to Generalized One Standard Deviation Shock to Innovations**



The stability of the model is evident from the fact that currency demand returns to a new equilibrium level following the shocks in a relatively short space of time. The Persistence Profiles of the two cointegrating vectors following a system-wide shock are shown in Figure 2 below

**Figure 2**  
Persistence Profiles following a system-wide shock



The half-life is less than five years in both cases.

### 5.1 Calculating the size of the Hidden Economy

In many empirical studies aimed at measuring the size of the underground economy based on the Tanzi approach, the demand for “illegal money” is estimated using an econometric model estimated by Ordinary Least Squares. See Feige (1989). Today, however, such estimation may be carried out within the cointegration framework and, in particular, using an error-correction model. See, for instance, the work of Faal (2003) using Guyana data.

In this study, in addition to employing the more sophisticated SCVAR framework which is a multiple equation system with embedded pre-identified long-run relations, we go one step further and solve the system as a whole using the Gauss-Seidel algorithm of Eviews 4.0. This procedure is often carried out within the framework of structural econometric models and we use it to calculate the series of “illegal money” over the period covered by the data. The SCVAR model is first solved to obtain values for the total amount of cash circulating in the economy over the period 1973-1999. Denote this series as  $C_t$ ,  $t=1973, 1974, \dots, 1999$ . In a second step, the total tax is set equal to zero and the system solved again to yield the estimated value of “illegal” currency, noted  $C_{Ht}$ ,  $t= 1973, 1974, \dots, 2000$ .

Assuming that the velocity of this “illegal” money is the same as that of legal money, an estimate of the hidden economy is obtained by multiplying illegal money by the velocity of money. The velocity of money is obtained by dividing GNP by legal money:

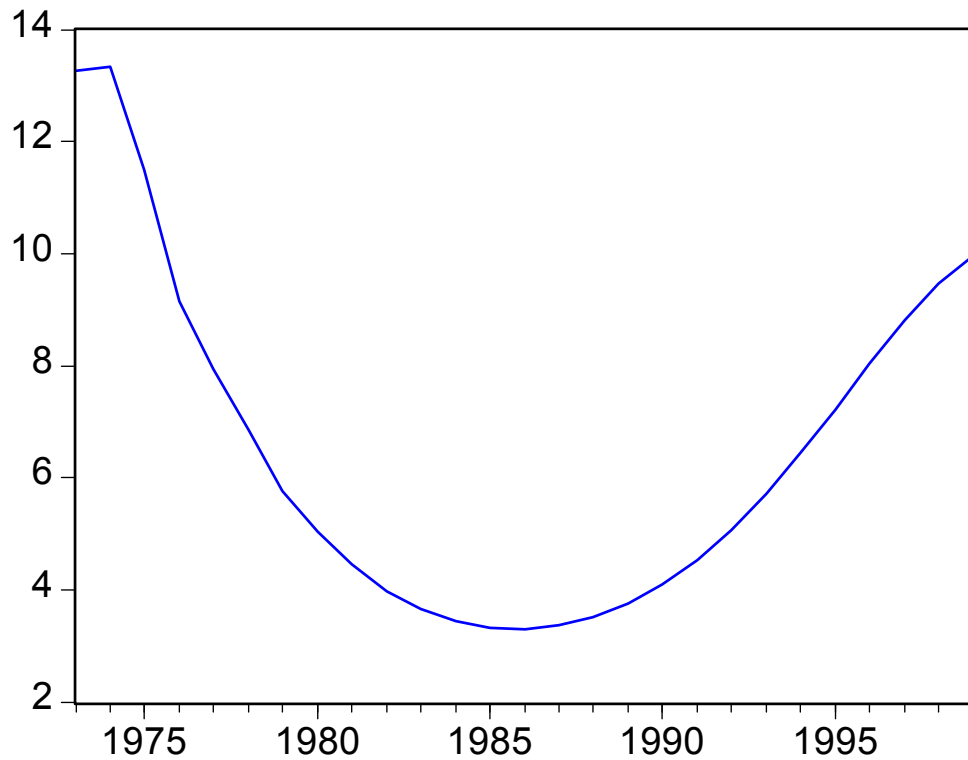
$$V = \text{GNP}/(M_2 - C_H)$$

Thus, the estimate of the hidden economy is derived as:

$$\text{GNP}_H = C_H * V$$

Figure 3 below shows the time path of the estimated size of the hidden economy of Trinidad & Tobago, as a percentage of measured GDP, over the period 1973 to 1999.

**Figure 3**  
Size of the Hidden Economy of Trinidad & Tobago 1973-1999 (% of Measured GDP)



The hidden economy has an average size of 7.6% of the GDP of Trinidad and Tobago and varies between 3.3% and 15.7%. It was at its highest in the early 1970s before the quadrupling of the price of oil. During the heady days following the oil boom, it would appear to have begun to shrink in size. In the early 1980s, however, when the boom came to an abrupt end and the country entered a deep recession which involved almost a decade of negative growth, the hidden economy began once again to increase in importance. The liberalization of the economy, including the floating of the TT dollar in 1993, may have also contributed to the growth of the hidden economy in recent years. All indications is that is getting bigger and bigger.



## 6. Conclusion

Tanzi (1999) noted that “there cannot be any question that the underground economy is a real phenomenon with important implications that deserve attention and study”. Further, the very existence of elements which affect the underground economy point to the fact that to be successful economic policy must take into consideration all the activities within the underground economy. As a result, research on the underground economy would lead, not only to a more comprehensive view and awareness of the hidden economy, but also to better efficacy of economic policy (Bicanic and Ott (1997)).

The hidden economy of Trinidad & Tobago, as measured in this paper, is large (currently about 10% of measured GDP) and growing. The time has certainly come to undertake even more in depth study of this phenomenon and to relate it to economic policy decisions.

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