CHAPTER 6

MODELS USED TO MEASURE THE HIDDEN ECONOMY AND TAX EVASION

6.1 Introduction

The objective of this chapter is to describe models of economic activity that are capable of providing estimates of the size of the hidden economy in Malaysia by using several of the macro variants of the monetary approach. The choice of these monetary variants has been determined on the basis of availability and reliability of data for Malaysia. As explained in Chapter 2 (section 2.7), proponents of the monetary approach question the accuracy of estimates derived from such sources as tax records and self-reports, with the assertion that these approaches are likely to lead to an understatement of actual unreported income, thereby highlighting the need to use the monetary approach.

The usefulness of the monetary model is derived from the fact that the best-quality data in most developing countries, such as Malaysia, are characteristically monetary statistics. It was also pointed out in Chapter 2 (section 2.7) that currency statistics are
reliable since the Central Bank of Malaysia must maintain accurate records of the issuance and redemption of notes and coins.

The next section outlines several variants of the monetary approach used to measure the hidden economy. A critical review of the models with a view to arrive at an appropriate model specification for the purpose of an empirical estimation undertaken in this study is covered in Section 6.4.

6.2 Monetary Approach

The monetary approach focuses upon discovering the traces which hidden activities leave in an economy. In this regard, several researchers have asserted that transactions in a hidden economy are essentially paid for by cash in an effort to elude detection [Gutmann (1977), Tanzi (1983a), Hepburn (1992), Kanbur (1994) and Spiro (1994)]. An expanding hidden economy should consequently exhibit a growing demand for currency. This phenomenon has led to several studies (see Section 6.2.1 and 6.2.2) of the demand for currency, from which efforts are made to estimate the magnitude of the hidden economy as well as the amount of income tax evaded.

The studies that relate to the monetary approach initially attempt to discover the amount of currency in circulation assuming that there was no hidden economy in a base year or a benchmark period. The discrepancy between this figure and the actual amount of currency in circulation, in some other year, is presumed to be due to illegal transactions in the hidden economy. The amount of hidden income can then be assessed if one is able to determine the amount of such activity that can be supported
by each unit of currency, that is, if one is able to determine the income velocity of circulation. The problems associated with these monetary approaches are examined in Sections 6.2.1 and 6.2.2.

The three different measures of the currency ratio which were popularly applied are:

(i) currency-deposit (C/D) ratio,
(ii) currency to narrow money (C/M1) ratio and
(iii) currency to M2 (C/M2) ratio.

The narrow definition of money (M₁), comprises notes and coins in circulation with the public plus domestic demand deposits held by the non-bank private sector. A broader definition of money (M2) is the sum of narrow money (M1) plus time, savings and foreign currency deposits held in banks.

Demand deposits are checking account balances in banks. They are called demand deposits because the customer can receive currency on demand.

In this study, the following notations are used to represent the variables included in different variants of the monetary models to be discussed in Sections 6.2.1 and 6.2.2:

\[ C = \text{Currency in circulation.} \]
\[ D = \text{Demand deposits.} \]
\[ (C/D)_t = \text{C/D ratio in period, } t. \]
\[ T = \text{average income tax rate, marginal tax rate, ratio of income tax paid to household income, or total taxes as a share of GDP.} \]

\[ R = \text{the rate of interest on time deposits, nominal interest rate, or three months fixed deposit rate.} \]

\[ Y = \text{the real per capita income.} \]

\[ \text{WS/GNP} = \text{the share of wages and salaries to GNP.} \]

\[ \text{WS/HI} = \text{the share of wages and salaries to household income.} \]

\[ \text{CON/GDP} = \text{private consumption as a share of GDP.} \]

\[ \pi = \text{inflation rate.} \]

\[ P = \text{general price level.} \]

\[ \text{CPI} = \text{consumer price index.} \]

Several variants of the monetary approach are examined in this section. These variants are divided into two categories; namely non-econometric studies and econometric studies. Only the major studies in each category are discussed below.

The main non-econometric studies to measure the size of the hidden economy can be sub-divided into two categories:

(i) Currency-demand deposit ratio method of Gutmann (1977, 1979), and

The main econometric studies used to measure the hidden economy are sub-divided into three categories:

(i) Currency-money ratio method of Tanzi (1980, 1982 and 1983a),

(ii) Currency ratio method of Hepburn (1992), and


Both the non-econometric and econometric studies are based on monetary data and provide estimates of the size of the hidden economy in the monetary sector. They do not account for barter activities. However, investigations by Eisner (1978) and Kendrick (1979) for the United States suggest that the non-monetary hidden sector may be large and shows a dramatic increase relative to the official economy. Comparable estimates of the non-monetary hidden sector are not available in Malaysia. Therefore, this study concentrates only on the monetary hidden sector.

In Malaysia the fiscal year is the calendar year, that is, from January 1 to December 31 each year. Money supply data is therefore measured at the beginning of every calendar year.

6.2.1 Non-Econometric Studies

6.2.1.1 Gutmann’s Method

This monetary approach variant devised by Gutmann (1977) assumed that the sole medium of exchange in the underground economy (an alternative term for hidden economy) is currency. The use of currency would minimise contact with the banking
sector, and its use leave no ‘traces’ that can be investigated by tax authorities to detect evasion. An increase in activity in the hidden economy would be evidenced by an increase in the ratio of currency, $C$, to demand deposits, $D^2$. The argument is that a rising $C/D$ ratio reflects the greater relative use of currency as the hidden economy expands.

It was earlier postulated by Gutmann (1977) that the underground economy uses currency as the exclusive medium of exchange. Three other key assumptions in his analysis are:

(i) there is a base period (between 1937 and 1941) during which the underground economy is assumed to have been non-existent,

(ii) the velocity of money in the underground economy is the same as that in the official economy, and

(iii) the ratio of currency in circulation to demand deposits is constant if there is no hidden activity. If it changes over the years, then the change has to be due to the underground economy.

(a) Methodology

The Gutmann (1977) approach does not involve any regression analysis. Nevertheless, this simple currency-demand method has been applied in several countries to derive a first approximation of the size of the hidden economy.

As mentioned earlier, Gutmann’s approach considered the ratio of currency in circulation to demand deposits ($C/D^2$). This $C/D$ ratio is compared to the $C/D$ ratio in
some base year. If \((C/D)_t\) is greater than \((C/D)_{\text{base year}}\), then the excess currency in
circulation is estimated. This excess currency is assumed to be the money required to
finance transactions in the hidden economy. Finally, by assuming the velocity of
circulation to be the same in both the legal and the hidden economy, the size of the
hidden economy can be estimated. For this approach to be meaningful, \((C/D)_t\) must
be greater than \((C/D)_{\text{base year}}\). Hence, an increasing \((C/D)\) ratio may be expected to
indicate a growing hidden economy.

(b) Limitations of Gutmann’s method

There are several drawbacks in the currency-demand deposit method of Gutmann
(1977), which are reflected by the restrictive nature of the assumptions. These
drawbacks are explained below.

(i) It is difficult to account for how all the currency is used in an economy.
This is particularly true in the case of the US currency with an unknown quantity of it
being held by foreigners. This point is perhaps also relevant to Malaysia where
migrant workers from neighbouring countries such as Indonesia and Thailand remit
the Ringgit (Malaysian currency) overseas. Consequently, the ratio of currency to
demand deposits may actually be lower than those denoted by published statistics as
some of the currency is held outside the country. As a result, the estimated size of the
underground economy may in fact be higher than the amount calculated by Gutmann’s
method (Tanzi 1982).

(ii) The choice of the base year, during which the underground economy is
assumed to be nil or at least negligible, can be problematic. Determination of a base
year in which the hidden activity can be assumed to be negligible is essentially arbitrary. The wrong choice of a base year can bring about misleading results. As mentioned earlier in Chapter 2 (section 2.6.2), Sandesara’s (1985) use of the currency-deposit ratio method to estimate the size of the hidden economy in India over the period 1952-53 to 1979-80, yielded negative estimates, which is theoretically and conceptually not possible.

(iii) The ratio of currency to demand deposits in the US has been increasing over time (Molefsky, 1982), suggesting that currency has been growing quickly, presumably since part of it is spent in the underground economy. However, critics of Gutmann’s (1977) method are of the view that the increase in the ratio of currency to demand deposits can also be due to checking accounts having grown too slowly rather than cash growing too fast (Garcia and Park, 1979).

(iv) An increase in the use of currency relative to demand deposits can be accounted for by changes in other factors such as interest rates and income, suggesting that even if there was no hidden economy, an increase in currency would still have occurred (See Porter and Thurman, 1979).

6.2.1.2 Feige’s Method

Feige (1979, 1987, 1989a, 1990) developed a non-econometric method of estimating underground activity based on the ratio of total monetary transactions to Gross National Product (GNP). Total transactions incorporate not only purchases of newly produced goods and services but also purchases of intermediate goods and services (including purely financial transactions) and so differ from GNP which covers only sales of final goods and services produced in the current year. According to Feige
(1979), if it were possible to derive independent estimates of the total volume of payments and the total volume of transactions, the discrepancy between the two measures would represent an estimate of the total volume of unrecorded transactions.

(a) Methodology

If one can identify a period and assume that the hidden economy did not exist in that period, then a benchmark transactions/GNP ratio can be established. Dividing this ratio into observed total transactions for any later year provides an estimate of the income level generated by the official and hidden economies in that year. It is then possible to arrive at an estimate of the hidden economy by subtracting measured GNP from this total. Although this assumption is not very realistic, such a move is a prerequisite for the commencement (base year) of estimations. Feige (1989a) selects the year 1939 to be such a benchmark period in the US. He assumed that in 1939, there was an independent estimate of the proportion of total income that was unrecorded.

Feige's (1989a, p.47) approach can be further explained by focusing on the following ratio, \( \frac{pt}{p^i y} \) where:

- \( p \) = the average price of a transaction.
- \( t \) = the total number of transactions undertaken in any period.
- \( p^i \) = the price index of goods included in GNP.
- \( y \) = real GNP.

There are three possible causes of a change in this ratio, namely:

- i) a change in the price ratio \( p/p^i \),

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ii) a structural change in the legitimate economy which alters the ratio $t/y$, and

iii) a change in the scale of transactions in the hidden economy.

Feige contends that in the US over the period commencing 1939, the ratios $p/p^j$ and $t/y$ have been declining and hence the transactions ratio $(pt)/(p^jy)$ must decrease. However, if the transactions ratio rises, then this has to be due to the rise in the size of the hidden economy. In other words, if an observable change in the ratio cannot be explained by observable factors, it is assumed to be explained by (unobservable) changes in the hidden economy.

An important assumption in this approach is that total transactions are proportional to total economic activity, and the term ‘total’ is the aggregate of official (above ground) and hidden economic activity. Total transactions can be divided into three broad components, that is:

(i) transactions involving the exchange of financial assets,

(ii) transactions associated with the production of final output, and

(iii) transactions involving direct transfer payments.

Feige (1979) recognised that, in the US, transfer payments continuously change over time due to numerous financial innovations and that financial transactions associated with asset exchanges have probably risen enormously. Therefore, estimates of gross payments are adjusted to net out major financial transactions and direct transfers. In order to devise a measure of net total transactions suitable for estimating the hidden economy, Feige deducted three primary categories of financial transactions and direct
transfer payments from gross transactions to remove the effect of the increase in
transactions resulting from financial innovations. The primary categories are:

(i) estimated debits to demand deposits for cash withdrawals and withdrawals
to other cheque based deposits,

(ii) estimated transactions in the stock and bond market, and

(iii) debits to demand deposits for the purchases of numerous money market
instruments such as time and savings deposits and repurchase agreements.

Hence, after these deductions have been made, the residue is assumed to be due to
underground activity.

(b) Limitations of Feige’s Method

The major weaknesses of the transactions method are as follows:

(i) Difficulty of obtaining data pertaining to the total number of transactions
undertaken in the economy during a particular time-period. According to Feige
(1989a) it is not readily possible to construct a time series of the total volume of gross
transactions for the US economy. This shortcoming is largely the result of accounting
conventions adopted in the flow-of-funds accounts that report net transaction flows
rather than gross flows.

(ii) This method assumes that the transactions velocity of money is the same
in the hidden economy as in the formal economy.

(iii) The exclusion of the barter economy.

(iv) The role of increased credit market activity on demand deposit turnover
has been ignored. With increasing monetisation of the economy, the ratio of
transactions to income can be expected to rise, since monetisation will tend to increase the numerator without necessarily affecting the denominator.

(v) The assumption that hidden activity was zero in 1939 is untestable.

6.2.2 Econometric Studies

6.2.2.1 Tanzi’s Model

Tanzi (1980, 1982 and 1983a) devised a demand for currency equation to estimate the size and growth of the underground economy in the United States for the period 1930 to 1980. The currency-ratio method was originally devised by Cagan (1958) to evaluate the upward movements in the currency ratio in World War II. This method was later adopted by Gutmann (1971) who assumed that currency is the sole medium of exchange in the underground economy, and thus an increase in that sector would be evidenced by an increase in the ratio of currency to checkable deposits. Gutmann’s method, however, relied on an assumption that was not readily appreciated, namely that the ratio of currency to demand deposits is influenced only by changes in taxes and government controls, and by nothing else. Tanzi undertook a new approach and developed an econometric model to derive a more firmly based estimate of the underground economy by making the demand for currency explicitly a function of several variables, including the level of taxes. For example, he took into account factors such as interest rates and income which could influence the currency ratio. Tanzi’s model is explained in further detail in Section 6.2.2.1 (a).

The key assumptions made in Tanzi’s model include the following:

(i) currency is used as the sole medium of exchange in the underground economy.
(ii) the income velocity of money in the underground sector is assumed to be the same as that in the official sector.

(iii) underground economic activities are the direct outcome of high taxes.

Arguments [(i) and (ii)] have already been discussed in Section 6.2.1.1(b). As regards (iii), it should be noted that some underground activities are not the result of taxes; they may be responses to government regulations, or motivated by the need to keep illegal activities hidden, hence estimates will not include these activities. The national accounts figures normally do not include income generated from illegal activities, but such income would likely disappear if it could be detected and taxed.

(a) Methodology

Tanzi fitted an equation of the following form to US data:

\[ \ln \left( \frac{\text{C}}{\text{M2}} \right) = a_0 + a_1 \ln T + a_2 \ln (\text{WS/GNP}) + a_3 \ln (R) + a_4 \ln (Y) + \varepsilon, \]

where \( \varepsilon \) is an error term. He then fitted this equation to annual time series data for the US. Having obtained statistically significant estimates for the equation, next Tanzi estimated the underground economy for a given year, \( t \), as follows.

After deriving his 'best' equation, he obtained the predicted value for currency demand, \( C_t'' \), given the observed value for all the other variables in year \( t \). Tanzi obtained another prediction of currency, \( C_t' \), by setting the value of the tax variable at zero (or at another low value at which the hidden economy is assumed to be zero) while keeping the observed value for all the other variables. The discrepancy \( C_t'' - C_t' \), provides an estimate of illegal currency, that is, the holding of currency as a result
of an increase in taxation. The estimated value of illegal currency is then deducted from the value of narrow money, M1, in year t to determine the size of legal money in year t. Tanzi then divided the nominal GNP in year t by the estimated legal money to derive the income velocity for legal money. By assuming that the income velocity of ‘legal’ currency is identical to that of illegal currency, he made an estimate of unreported income, that is, the underground income for year t, and for each of the remaining years under review.

The approach developed by Tanzi (1983a) is widely acknowledged to be the most plausible of the monetary methodologies (Spiro, 1994).

(b) Expected sign of variables in Tanzi’s model

The variables that were identified earlier are: (i) a tax rate variable, (ii) wages and salaries as a proportion of GNP, (iii) interest rate, and (iv) per capita income. Tanzi’s model, variables and expected sign are summarized in Table 6.1.
Table 6.1
Tanzi’s Model, Variables and Expected Sign

<table>
<thead>
<tr>
<th>Variables</th>
<th>Details</th>
<th>Description</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/M2</td>
<td>Ratio of currency (C) to money (defined as M2)</td>
<td>Demand for currency (dependent variable)</td>
<td>N/A*</td>
</tr>
<tr>
<td>T</td>
<td>Tax rate</td>
<td>Increase in average tax rate increases the C/M2 ratio</td>
<td>+</td>
</tr>
<tr>
<td>WS/GNP</td>
<td>Wages and salaries as a proportion of GNP</td>
<td>An increase in WS/GNP, the greater the demand for currency and hence the greater the CM2 ratio</td>
<td>+</td>
</tr>
<tr>
<td>R</td>
<td>Interest rate</td>
<td>The higher the cost of capital, the lower the demand for currency in circulation</td>
<td>-</td>
</tr>
<tr>
<td>Y</td>
<td>Real per capita income</td>
<td>As the economy grows, other methods of holding wealth would shift the emphasis away from currency, thus reducing the C/M2 ratio</td>
<td>-</td>
</tr>
</tbody>
</table>

*N/A Not Applicable

The expected sign for both taxes and the ratio of wages and salaries in GNP is positive, while the expected sign for both interest rate and per capita income is negative.
(c) Limitations of Tanzi’s model

The model has several weaknesses:

(i) An important assumption in Tanzi’s model is that the velocity of money for currency in the underground economy is similar to that for M2 in the legal economy. This is undoubtedly a debatable assumption and the argument for this assumption is presented in Section 6.4.3.1(b).

(ii) It is assumed that the ratio of currency to demand deposits in the official sector remains constant during the period under review. According to Feige (1989b), a more plausible assumption would be to consider the ratio a stable function of other economic variables. This latter modification requires that the currency ratio be specified as an additive function of the variables affecting the currency-demand deposit ratio.

6.2.2.2 The Hepburn Model

Hepburn provided estimates of the size of the cash-based hidden economy in Australia over the period from 1950/51 to 1983/90. The estimates are derived by investigating the effects of taxation and tax evasion on monetary aggregates. A further aim of Hepburn’s (1992) research was to test whether the generally accepted theoretical determinants of income tax evasion are empirically supported in Australia.

The method adopted by Hepburn (1992) is based on that of Tanzi (1982), who used an econometric model to explain variation in the currency ratio, defined as the ratio of currency in circulation, C, to total money, M2. The currency ratio in Australia is modelled and then used to estimate the cash economy.
The key assumptions made are:

(i) The relationship between the taxation-induced currency holdings and the cash economy is the same as between the legal component of M2 (the legal money supply used for transactions) and measured GDP.

(ii) The velocity of circulation of illegal money in the hidden economy is assumed to be the same as for legal money in the observed economy.

(a) Methodology

As Hepburn’s model is based on that of Tanzi (1982), most of the variables used and the expected signs of the former model are similar to those illustrated in Table 6.1. However, Hepburn (1992) included a lagged dependent variable to allow for lags in agents’ reactions to a change in the variables identified. The incorporation of this lagged variable suggests an adaptation on action whereby an individual is assumed to take some time to adjust their currency ratio to its optimum level.

Similarly, Hepburn also used a tax variable measure as the ratio of income tax paid to household income in his preferred model. However, he also tried alternative tax variables such as the marginal and average tax rates applicable to earnings.

Unlike Tanzi’s (1983a) log linear model, Hepburn (1992) estimated a linear currency demand equation of the following form to Australian monetary data:

\[(C/M2)_t = a_0 + a_1 Y_t + a_2 W/S/HI_t + a_3 T_t + a_4 R_t + a_5 (C/M2)_{t-1} + \epsilon.\]
The estimation was done by using ordinary least squares. The most significant departure from the Tanzi (1983a) model is the inclusion of a lagged variable \((C/M_2)_{t-1}\).

In their respective models, Tanzi (1983a) used share of wages and salaries in GNP \((WS/GNP)\), while Hepburn (1992) used share of wages and salaries in household income \((WS/HI)\).

(b) Expected sign of variables in Hepburn’s Model

The variables that were identified earlier are: (i) \(Y\) = real per capita income, (ii) \(WS/HI\) = share of wages and salaries in household income (iii) \(T\) = income tax rate, (iv) \(R\) = Three (3) month fixed deposit rate (v) \((C/M_2)_{t-1}\) = Currency-M2 ratio lagged one period.
Table 6.2
Hepburn’s Model, Variables and Expected Sign

<table>
<thead>
<tr>
<th>Variables</th>
<th>Details</th>
<th>Description</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/M2</td>
<td>Ratio of currency (C) to money (defined as M2)</td>
<td>Demand for currency (dependent variable)</td>
<td>N/A*</td>
</tr>
<tr>
<td>Y</td>
<td>Real per capita income (proxy for level of economic development in the country)</td>
<td>As the economy grows, other methods of holding wealth would shift the emphasis away from currency, thus reducing the C/M2 ratio</td>
<td>-</td>
</tr>
<tr>
<td>WS/HI</td>
<td>Wages and salaries as a percentage of household income</td>
<td>An increase in the ratio produces a greater demand for currency and hence a greater CM2 ratio</td>
<td>+</td>
</tr>
<tr>
<td>T</td>
<td>Tax variable is ratio of income tax paid to household income</td>
<td>Increase in average tax rate, more activity in cash economy, hence, increase in C/M2 ratio</td>
<td>+</td>
</tr>
<tr>
<td>R</td>
<td>Nominal interest rate</td>
<td>Higher the cost of capital, the lower the demand for currency in circulation</td>
<td>-</td>
</tr>
<tr>
<td>(C/M2)_{t-1}</td>
<td>Lagged value of (C/M2)</td>
<td>See note**</td>
<td>+</td>
</tr>
</tbody>
</table>

*N/A  Not Applicable

** Lagged dependent variable has been added to take account of any lags in the adjustment of the actual currency to its desired level. In fact \( a_5 \) determines the long-run and short-run dynamics and therefore it should be positive.
6.2.2.3 Kanbur’s Models

Kanbur (1994) developed two different models and provided estimates of the size of the cash based hidden economy in Malaysia for the period 1980 to 1985. The results based on the second model are not different from those derived from the first model. Kanbur (1994) postulated that high tax rates are incentives to encourage tax evasion, and therefore he derived estimates of the hidden economy by investigating the effects of taxation on monetary aggregates.

Kanbur’s approach to estimate the hidden economy depended on several assumptions. These assumptions are:

(i) transactions in the hidden economy are paid in cash.

(ii) the income velocity of money is the same in the hidden economy as in the recorded economy.

(iii) there is a stable demand for currency over the sample period.

(a) Methodology

Kanbur (1994) identified two different measures of the currency-demand ratio to estimate the growth of the hidden economy in Malaysia. The two measures are:

(i) the ratio of currency to demand deposits (C/D).

(ii) the ratio of currency to the M2 measure of the money supply (C/M2) and M1 measure of the money supply (C/M1).

The second measure was applied in addition to the first measure because Kirchgassner’s (1983) studies had indicated that significantly better results were obtained for C/M2 than for C/M1 or C/D.
As two different measures of the currency-demand ratio were identified, Kanbur (1994) devised two log linear models. The currency-demand equation of the first model which followed a monetary approach, broadly based on the work of Klovland (1980), takes the following form:

\[ \ln \left( \frac{C}{P} \right) = a_0 + a_1 \ln Y + a_2 R + a_3 \pi + a_4 (\text{CON/GDP}) + a_5 T + a_6 \ln \left( \frac{C}{P} \right)_{-1} + \varepsilon. \]

The underlying methodology of Kanbur’s second model is based on the technique used by Gutmann (1977), Klovland (1980) and Tanzi (1983a). The currency-demand equation of this model takes the following form:

\[ \ln \left( \frac{C}{M2} \right) = b_0 + b_1 \ln Y + b_2 R + b_3 \pi + b_4 (\text{CON/GDP}) + b_5 T + b_6 \ln \left( \frac{C}{M2} \right)_{-1} + \varepsilon. \]

**(b) Expected sign of variables in Kanbur’s model**

The variables that were identified earlier are: (i) per capita income, (ii) interest rate, (iii) private consumption as a share of GDP, and (vi) a tax variable. Kanbur’s (1994) models, variables and expected signs are shown in Table 6.3.
Table 6.3

Kanbur's Models, Variables and Expected Sign

<table>
<thead>
<tr>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Ratio of currency to demand deposits (C/D)</td>
</tr>
<tr>
<td>(ii) Ratio of currency to the M2 measure of the money supply (C/M2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) $\ln (C/P) = a_0 + a_1 \ln Y + a_2 R + a_3 \pi + a_4 (\text{CON/GDP}) + a_5 T + a_6 \ln (C/P)_{t-1} + \varepsilon$</td>
</tr>
<tr>
<td>(ii) $\ln (C/M2) = b_0 + b_1 \ln Y + b_2 R + b_3 \pi + b_4 (\text{CON/GDP}) + b_5 T + b_6 \ln (C/M2)_{t-1} + \varepsilon$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Details</th>
<th>Description</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/P</td>
<td>Ratio of currency (C) to demand deposits</td>
<td>Demand for real currency (dependent variable)</td>
<td>N/A*</td>
</tr>
<tr>
<td>C/M2</td>
<td>Ratio of currency (C) to money (defined as M2)</td>
<td>Demand for currency (dependent variable)</td>
<td>N/A</td>
</tr>
<tr>
<td>Y</td>
<td>Per capita income</td>
<td>As the economy grows, other methods of holding wealth would shift the emphasis away from currency, thus reducing the C/M2 ratio.</td>
<td>-</td>
</tr>
<tr>
<td>R</td>
<td>Interest rate</td>
<td>The higher the cost of capital, the lower the demand for currency in circulation</td>
<td>-</td>
</tr>
<tr>
<td>$\pi$</td>
<td>Inflation rate</td>
<td>The higher the inflation rate, the greater is the possibility to move away from time deposits into currency</td>
<td>+</td>
</tr>
<tr>
<td>CON/GDP</td>
<td>Private consumption as a share of GDP</td>
<td>An increase in private consumption produces a greater demand for currency</td>
<td>+</td>
</tr>
<tr>
<td>T</td>
<td>Total taxes as a share of GDP</td>
<td>An increase in the share of taxes to GDP increases the C/M2 ratio</td>
<td>+</td>
</tr>
<tr>
<td>$(C/P)_{t-1}$</td>
<td>Lagged value of C/P</td>
<td>See note **</td>
<td>+</td>
</tr>
<tr>
<td>$(C/M2)_{t-1}$</td>
<td>Lagged value of (C/M2)</td>
<td>See note **</td>
<td>+</td>
</tr>
</tbody>
</table>

* N/A Not Applicable
** Lagged dependent variable has been added to take account of any lags in the adjustment of the actual currency to its desired level.
6.3 Results of Monetary Variants

All the models discussed in Section 6.2 provided estimates of cash based income tax evasion. Therefore, these estimates are not a measure of total income tax evasion. The ratio of cash-based evasion to total income tax evasion were not identified in these studies, possibly due to data limitations. According to Hepburn (1992), this is a specific criticism of his model.

The results of the various models that were examined in Section 6.2 are summarised in Table 6.4.

**Table 6.4**

Results of Monetary Variants Examined in this Study to Measure Size of Hidden Economy

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Period of Analysis</th>
<th>Size of Hidden Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gutmann</td>
<td>United States</td>
<td>1976</td>
<td>10.0% of GNP</td>
</tr>
<tr>
<td>(1977)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feige</td>
<td>United States</td>
<td>1939-1982</td>
<td>0 to 49.0% of GNP</td>
</tr>
<tr>
<td>(1979)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzi</td>
<td>United States</td>
<td>1930-1980</td>
<td>0 to 4.7% of GNP</td>
</tr>
<tr>
<td>(1983a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepburn</td>
<td>Australia</td>
<td>1950/51 to 1989/1990</td>
<td>3.3 to 7.8% of GDP</td>
</tr>
<tr>
<td>(1992)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kanbur</td>
<td>Malaysia</td>
<td>1980 to 1985</td>
<td>0.2 to 1.2% of GDP</td>
</tr>
<tr>
<td>(1994)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Various sources.
According to Gutmann’s (1977) estimates, the ‘subterranean’ (or hidden) economy of the United States amounted to almost 10 per cent of official GNP in 1976. The results of Feige’s (1989a) estimates suggest that unrecorded income rose during the latter half of the 1960’s and reached a temporary peak in excess of 25 per cent of GNP by 1975. Although the percentage of unrecorded income temporarily declined in 1976 and 1977, it rose tremendously from 1979 to 1982. The estimated figure for 1982 was 49 percent of GNP. According to Feige (1989a, p.52), the results for the years 1980 to 1982 seem highly improbable as they indicate a huge sudden rise in unreported activity.

The results of Tanzi’s (1983a) research suggest that the underground economy has been increasing in the US since the mid-1960’s. In 1980, the underground economy, expressed as a percentage of GNP, was somewhere between 4.5 and 6.1 per cent. According to Tanzi (1983a), the rising trend was probably due to an increase in marginal tax rates over the period 1975 to 1980 and also due to inflation. In Australia, the cash economy also rose steadily as a percentage of GDP, since the early 1960’s (Hepburn, 1992). The cash economy varied in magnitude from a low of 3.3 per cent of measured GDP in 1958/59 and a peak of 7.8 per cent at the end of 1980’s.

As indicated in Chapter 2 (section 2.6.1), Kanbur (1994) estimated the percentage of hidden economy to GDP for Malaysia to range from a high of 1.2 per cent in 1980 to a low of 0.23 per cent in 1984. It is observed that the overall estimated size of the hidden economy is unusually small. Comparable estimates suggest that the size of the hidden economy in Thailand is 57 per cent of GDP (International Business Asia,
but this figure seems excessive as it indicates an improbably huge hidden sector.

The results of the monetary variants indicated in Table 6.4 revealed a wide range of estimates of the hidden economy. As mentioned in Chapter 2, (Section 2.6.2), the divergence in the size of the estimates suggests a major doubt on the reliability of the procedures used. At best, the results provide an indication of trends and of orders of magnitude. This is because, the estimates are a function of the level and quantity of available data and they are also sensitive to the assumptions made.

6.4 A Critical Evaluation of the Econometric Models

The models used in the literature to estimate the size of the hidden economy were examined in Section 6.2. The models that were examined included the models of Gutmann, Tanzi, Hepburn and Kanbiri. This section reviews the relative strengths and weaknesses of the econometric models that were examined. The criteria for reviewing these models are:

(i) definitional issues,

(ii) theoretical structure of the models, and

(iii) procedural problems.

6.4.1 Definitional Issues

The terms ‘underground’, ‘hidden’, ‘unreported’ or ‘unaccounted’ economy is too abstract to define what precisely is being measured. For example, in assessing the consistency of empirical evidence on the monetary sector, different approaches
estimate different components of the hidden activity. In the US, the term ‘unreported income’ is used to refer to the discrepancy between the amount of income that should have been reported to the tax authority under full compliance with the tax code and the amount actually reported (Feige, 1986).

Tanzi (1983a) used the currency demand equation technique to estimate the ‘unaccounted’ economy in the US for the years 1930 to 1980. Researchers such as Acharya (1984) have criticised Tanzi’s inability to state clearly what he sets out to measure. Although Acharya (1984) criticised several of Tanzi’s assumptions but he did not provide alternative procedures.

6.4.2 Theoretical Structure of the Models

Feige (1980) has also specified another model referred to as the general currency ratio (GCR) model for estimating the size and growth of unreported income. The GCR model is important because it categorically makes clear the weaknesses of the Tanzi model. The identification of the weaknesses in Tanzi’s model will enable a re-examination of other studies based on his approach. It was earlier pointed out in Section 6.2.2.2 that Hepburn (1992) had adopted Tanzi’s (1982) approach to estimate an econometric model to explain variation in the currency ratio, using Australian data. Likewise, it was also pointed in Section 6.2.2.3 that Kanbur (1994) too based the underlying methodology of his second model to that which was used by Tanzi (1983a).
It is useful to review Feige’s GCR model in detail to describe the theoretical framework underlying various models to estimate the size of the hidden economy. After describing the models, this study will attempt to link each of the models in the literature to the GCR model.

The GCR model is sufficiently general to encompass all previous currency ratio methods (Feige, 1986). These currency ratio methods associate hidden economic activity with currency or money holdings. The GCR model is considered to be an improvement over Tanzi’s model.

The GCR model is specified using the variables listed below.

\[ C = \text{actual currency stock.} \]
\[ D = \text{actual stock of demand deposits.} \]
\[ Y = \text{income.} \]
\[ k = \text{the ratio of currency to demand deposits in the reported sector.} \]
\[ v = \text{income velocity.} \]
\[ u = \text{subscript to denote the unreported sector.} \]
\[ o = \text{subscript to denote the ‘official’ or reported sector.} \]

The general currency ratio model contains the following specifications:

\[ C = C_u + C_o \quad \text{(GCR 1).} \]
\[ D = D_u + D_o \quad \text{(GCR 2).} \]
\[ k_o = C_o / D_o \quad \text{(GCR 3).} \]
\[ k_u = C_u / D_u \quad \text{(GCR 4).} \]
\[ v_o = \frac{Y_o}{C_o + D_o}. \] ..............................(GCR 5).

\[ v_u = \frac{Y_u}{C_u + D_u}. \] ..............................(GCR 6).

\[ \beta = \frac{v_o}{v_u}. \] ..............................(GCR 7).

Equations (GCR 1) and (GCR 2) decompose the actual stocks of currency and demand deposits into unreported and reported parts respectively. Equation (GCR 3) and (GCR 4) are definitions of the ratios \( k_o \) and \( k_u \), which are explained as functions of other variables. Equation (GCR 5) and (GCR 6) define income velocity in the respective sectors.

To determine the independent variable, that is to measure the size of hidden economy \( Y_u \), equation (GCR 6) is assessed in terms of the model’s observable variables, namely \( C, D \) and \( Y_o \). The equation in its final form is as follows:

\[ Y_u = \frac{(1/\beta) (Y_o) (k_u + 1) (C - \zeta D)}{(k_u + 1) (k_u D - C)}. \] ..............................(GCR 8)

which represents unreported income as a function of the observable variables \( Y_o, C \) and \( D \), and three parameters or ratios \( \beta, k_u \) and \( k_o \).

It was earlier pointed out in Section 5.2.1.1 that the currency-demand deposit method employed by Guttmann (1977) made the following key restrictive assumptions.

First, currency is the sole medium of exchange in the underground economy. This would imply that \( D_u \to 0 \) and \( k_u \to \infty \). Secondly, the quantity of hidden income
generated by a dollar of currency transacted in the hidden sector is identical to the quantity of official income generated by a dollar of currency transacted in the official sector. Thirdly, the ratio of currency in circulation to demand deposits is constant. If it changes over the years, then the change has to be due to the underground economy.

The first assumption suggests that underground transactions are never paid by cheques; hence \( k_u \) approaches \( \infty \). The second assumption implies that \( \beta=1 \) and the third assumption is that \( k_o \) is constant over time. If these restrictions are taken into account, then the GCR model can be shown in the following form:

\[
Y_u = \frac{Y_o (C - k_o D)}{(k_o + 1) D}. \quad \text{(GCR 9)}
\]

Equation (GCR 9) is the mathematical equivalent of the simple currency-ratio equation. Feige (1986) has used Equations (GCR 8) and (GCR 9) to show the theoretical weaknesses of the C/D approach when it is used to measure the size of the hidden economy.

Acharya (1984) pointed out that Tanzi (1983a) too had made the first and second assumptions (stated above) in his currency equation model. Acharya questioned Tanzi’s assumptions that \( k_u \) approaches \( \infty \) and \( \beta=1 \). Tanzi’s contribution to the hidden economy literature is his effort to relax the third assumption, that is to consider \( k_o \) as a stable function of observable variables rather than as being constant over time.
6.4.3. Procedural Problems

Feige (1986) pointed out that Tanzi’’s (1983a) empirical implementation of the simple C/D model is incoherent due to the assumptions made and his method for estimating $k_0$. It was pointed out in Section 6.2.2.1 (a) that Tanzi had fitted a currency ratio as C/M2 rather than C/D but had used the income velocity of M1 to compute $Y_u$. According to Feige (1986), Tanzi had not explained the rationale for such an inconsistent approach.

The sub-section below: (i) analyses the problems associated with the assumptions made in the models, and (ii) critically examines the concepts of hidden economy and tax evasion.

6.4.3.1 Problems associated with assumptions

The assumptions made in the models are:

- choice of base year,
- velocity of circulation of legal and illegal currency, and
- currency as the sole medium of exchange.

(a) Choice of base year

A small change in assumptions, particularly regarding the extent of the currency ratio in the official (recorded) sector, the so-called base year assumption, can drastically change the estimated size of the hidden economy. For instance, hidden GNP can result in negative values whenever the actual currency becomes less than the base year ratio. The comparable illustration in Tanzi’s (1983a) currency equation model relates
to the level of taxes whereby he postulates that the underground activity takes place whenever tax is imposed on income. A more reasonable explanation, perhaps would be to define a normal level of taxation and to relate growth in the hidden economy only when tax increases in excess of the normal level.

(b) Velocity of legal and illegal currency

A key issue with Tanzi’s method is his restrictive assumption that the income velocity of illegal currency is the same as that of the legal currency. However, in a real situation, it is possible for the velocity of money in the underground economy to be lower than in the legal (above-ground) economy. This is because, it is highly probable that there is a greater tendency to hoard currency in the former than in the latter. In this regard, Acharya (1984) has pointed out that Tanzi’s (1983a) measure of the income velocity of the ‘official currency’ should be seen as a mere estimation, the closer is the value of ‘official currency’ to recorded GNP, the better is the estimation.

(c) Currency as the sole medium of exchange

Tanzi (1983a) has assumed that the transactions linked with tax evasion are solely done with currency. However, it is possible for some of the illegal transactions to be undertaken via payment of cheques or by barter. Feige (1980) too has maintained that many of the transactions associated with tax evasion occur through the banking system.

As a result of the restrictive assumptions of the GCR model (including Tanzi’s (1983a) model), it is likely that the size of the underground economy, using this
model, is under-estimated. Feige (1986) pointed out that major sources of the under-estimation are Tanzi’s inappropriate use of static rather than dynamic forecasts, and his incorrect specification of the currency ratio as being multiplicative rather than additive.

6.4.3.2 The hidden economy and tax evasion

The overlap between the concepts of hidden economy and tax evasion has been well documented by researchers such as Feige (1989b) and Cowell (1990). As mentioned earlier in Chapter 2 (section 2.2), the hidden economy refers to those activities that go unreported or are unmeasured by the current techniques for monitoring economic activity.

One major problem which has hindered the study of the hidden economy has been the confusion between fiscal and economic concepts of income (Feige, 1985, p.22). Fiscal income is defined by legislative tax statutes which identify those types of income which are included in the country’s tax base. However, fiscal income is a broader concept than total economic income since it may include both realized and unrealized gains of assets that have appreciated in value in addition to income derived from goods and services that are produced during the fiscal period. It is also a narrower concept, since economic income includes activities which are excluded by the fiscal definition. For instance, non-market household production and most co-operative activities such as baby-sitting clubs and neighbourhood organisations are excluded from fiscal income although they should be regarded as components of economic income even if not measured in the national accounts. In other respects,
fiscal income excludes certain measured components of economic income which are not taxable. In short, while the size of the hidden economy is closely related to the amount of tax evaded, there is no perfect match. For example, an increase in hidden economic activity by an individual whose income is too low to cross the tax threshold will not result in an increase in tax evaded.

Another manner in which the link between tax evasion and hidden economic activity is tenuous relates to illegal activities. Depending on the tax system being considered, income from illegal activities are normally taxable, as in the case of Malaysia, but such activities are intentionally not captured in the national accounts which exclude them by convention.

The sum of all taxable income sources, less deductible expenses and capital allowances (if any) is the potential tax base. In a fiscal context, hidden income is unreported taxable income, measured as the discrepancy between total taxable income and reported taxable income (Feige, 1985). Consequently, hidden fiscal ‘income’ is not synonymous with hidden economic ‘income’. However, other things being equal, an increase in the size of the hidden economy is likely to lead to an increase in the tax evaded because of the extensive overlap between the concepts of fiscal and economic income.
6.5 Model Specification for the Present Study

This chapter has focussed on four variants of the monetary approach which were outlined in Section 6.2. Due to data limitations, the transactions-ratio method of Feige (1979, 1987, 1989a, 1990) cannot be employed in the Malaysian context. A complete set of data over the sample period covering 1970 to 1994 is not available in Malaysia. Hence, this study uses only three variants of the monetary approach to measure the size of the Malaysian hidden economy. These models primarily differ from each other with respect to the definition of dependent variable and, are based on the standard theory of money demand. Some differences with respect to the specification of the model (that is log linear vis-a-vis linear) and the choice of explanatory variables are also found in the literature.

The standard theory underlying these models is that demand for real cash balances depends on real income and the opportunity cost of holding money (Friedman, 1971). This study uses real per capita Gross Domestic Product (Y) as a measure of the real income variable. Recognising that the money market in Malaysia was not well-developed over the sample period, the expected rate of inflation (π) is used, in addition to the three months fixed deposit rate (R) to reflect the opportunity cost of money. This approach to measuring demand for money is further supported by McKinnon (1973) who is of the view that the estimation of money demand or currency-money ratio functions in developing countries should be conducted by using the rate of inflation as a proxy for the rate of interest. The rationale for this is that the interest rate is a less reliable signal of financial market conditions than the rate of inflation. As the interest rates in most developing countries are institutionally fixed by
monetary authorities and the degree of monetisation is low, the rate of interest might not have a significant impact on the behaviour of economic agents. However, as there is an *a priori* theoretical reason to include the interest rate in the money demand function, this study includes both the three months fixed deposit rate and rate of inflation in the empirical model.

The standard money demand function usually ignores the effects of tax rates and the share of wages and salaries in GNP (Friedman, 1971). However, this study particularly focuses on one component of money demand, that is, the demand for currency. The demand for currency not only depends on real income and the opportunity cost of holding money, it also depends on the marginal tax rate and the share of wages and salaries to GNP. An increase in the marginal tax rate would encourage individuals to engage in tax-evading activities that are facilitated by the use of currency. Such a practise of using currency for transaction purposes leaves no ‘paper trail’ and therefore the use of currency rises. It should be noted that although the marginal tax rate would be a theoretically sound indicator for tax evasion, such a time series is not available for Malaysia. This study, therefore, uses the average income tax rate (T). See Chapter 7, section 7.2.3 for details.

The Malaysian economy has seen an average real GDP growth of 8.9 per cent for the last eight years (1988 to 1995). In addition to this growth in real GDP, there have been structural changes in the financial market over the same period and for earlier years. With the development of non-currency financial instruments, it is reasonable to expect that the demand for currency will be partially replaced by instruments such as
electronic funds transfer at point of sale (EFTPOS) and automated teller machines (ATMs), and greater use of cheque-based payments. Since a time series reflecting these developments in the financial market is difficult to construct, this study uses a dummy variable (SF) which reflects structural changes in the financial market. The dummy variable (SF) takes the value ‘1’ for the years 1970 to 1978 and ‘0’ for 1979 and later years. The year 1978 was a very significant year for the Malaysian banking system. With effect from October 2nd, 1978, commercial banks were allowed to freely determine the interest rates offered on deposits and the lending rate charged to their customers for loans and advances. However, the maximum interest rates levied by banks on loans to the priority sectors (example, agriculture and small-business) continued to be regulated by the Central Bank. The banks were also required to continue the system of preferential rates of interest below the prime rate for loans to the Government and statutory authorities. Prior to this move, interest rates were ‘administered’ by the Central Bank. This market-oriented system resulted in banks responding more flexibly and efficiently to changing market conditions. Greater competition was introduced not only amongst various types of financial institutions but also amongst banks themselves. This boosted deposit mobilisation. For example, term deposits increased by a mere seven per cent between 1976 and 1977. Between 1977 and 1978 the increase was 20 per cent. The corresponding figure between 1978 and 1979 was 39 per cent (BNM, 1994, p. 512). While term deposits increased by 39 per cent, the amount of currency in circulation between 1978 and 1979 only increased by 14 per cent (BNM, 1994, p. 487). This certainly points towards greater usage of the banking system. The freeing of the interest rate determination leading towards more competitive interest rates would have served as an incentive for people to use
the banking system rather than hold and hoard cash which may in turn facilitate activities which contribute towards the hidden economy.

6.6 Models for Estimation

The notation of the variables that we stated in Section 6.2 are re-listed in this section with an outline of variable definition used in this study.

\[ C = \text{currency in circulation}. \]

\[ D = \text{demand deposits}. \]

\[ (C/D)_t = \text{C/D ratio in period, } t. \]

\[ T = \text{average income tax rate}. \]

\[ R = \text{three months fixed deposit rate}. \]

\[ Y = \text{the real per capita GNP}. \]

\[ \text{WS/GNP} = \text{the share of wages and salaries to GNP}. \]

\[ \pi = \text{inflation rate}. \]

\[ SF = \text{dummy variable indicating structural changes in financial market}. \]

\[ \ln (C/D)_{t-1} = \text{lagged value of } \ln (C/D). \]

\[ \ln (C/M1)_{t-1} = \text{lagged value of } \ln (C/M1). \]

\[ \ln (C/M2)_{t-1} = \text{lagged value of } \ln (C/M2). \]

Using the notations given in this section, the empirical models used in this study are presented in the following sub-section.
\[ \ln (C/D) = a_0 + a_1 T + a_2 R + a_3 \pi + a_4 \ln Y + a_5 \text{SF} \]

\[ + a_6 \ln (C/D)_{-1} + u_t \]

(6.1)

where \( u_t \) is an error term.

With regard to the equations [(6.1) to (6.3)], a general preference was towards the use of a log linear specification of the models but the dummy variable (SF) has to be used in its original form. Some experimentation has also shown that empirical estimates of hidden economy or currency demand are sensitive to how the tax variable is specified in the model. It was decided that it is most appropriate to introduce the tax variable in a linear fashion in the model (see Chapter 7, section 7.3.1 for details). As it is possible for the inflation rate (\( \pi \)) to be negative, a log form cannot be used for this variable. The interest rate (\( R \)) was introduced in both linear and log forms and it was finally decided that it is most appropriate to apply this variable in a linear form.

In Equation 6.1, a simple ratio of currency to demand deposits is used to measure the movements in the currency ratio. An econometric model is used to estimate the extent of hidden economic activity by using monetary data based on the movements in the ratio of currency to checkable deposits.

\[ \ln (C/M1) = a_0 + a_1 T + a_2 R + a_3 \pi + a_4 \ln Y + a_5 \text{SF} \]

\[ + \ln a_6(C/M1)_{-1} + u_t \]

(6.2)
In this approach (Equation 6.2), an estimate of the size of the hidden economy is made by using an econometric model to explain variation in the currency ratio, defined as the ratio of currency C to narrow money M1 (comprising of currency and demand deposits).

\[
\ln \left( \frac{C}{M_2} \right) = a_0 + a_1 T + a_2 R + a_3 \pi + a_4 \ln Y + a_5 SF
\]

\[+ a_6 \ln \left( \frac{C}{M_2} \right)_{t-1} + \epsilon_t \]  \hspace{1cm} (6.3)

In this approach (Equation 6.3), an estimate of the size of the hidden economy is made by using an econometric model to explain variation in the currency ratio, defined as the ratio of currency C to broader definition of money M2 (comprising M1 and private time and saving deposits).

All the three equations outlined in this section are modelled as being a function of the average income tax rate (T), nominal interest rate (R), the expected rate of inflation (\(\pi\)), real per capita income (Y) and a dummy variable (SF) that reflects the structural changes in the financial market.

6.6.1 Models in Dynamic Form

The above models are based on the assumption that full adjustment in the demand for real cash balances occurs instantaneously in response to changes in explanatory variables. However, in reality, there might be a time lag in the adjustment of actual demand for currency towards the desired demand for currency. Hence, it is
reasonable to use a partial-adjustment model which suggests the inclusion of a lagged endogenous variable in the model [Doran, (1989), p.217]. Such a model will make it possible to measure short-run and long-run effects of changes in the explanatory variables. For instance, the dynamic properties such as the lagged dependent variable that are incorporated in the model will take account of any lags in the adjustment of the actual currency to its desired level. The criteria for selecting between these models, including distributed lag models, is discussed in Chapter 7.

6.6.2 Statistical Package Used

After pre-estimations with alternative combinations of the hypothesised dependent and independent variables, three single equations of the statistically ‘best’ variables were estimated for measuring the magnitude of the hidden economy in Malaysia using the AUTO program and the OLS technique. The Shazam Statistical Application Package, version 7.0, was employed to conduct all specification tests (White, 1993).
Endnotes

1. A study by the US Inland Revenue Service-IRS-(1979, p. 13) cited in Feige (1986, p. 775) on unreported income found that ‘the unreported income problem extends beyond incomes paid in currency’. According to this (IRS) study, between one fourth and one third of unreported income did not represent proceeds from currency transactions (Feige, 1986).

2. Given C, fixed by money supply, a fall in D represents an expansion in hidden economy.

3. Gutmann (1977) uses the term subterranean economy, a term which is used interchangeably with the terms hidden or underground economy.

4. Cagan’s (1958) measurement approach assumed that the size of the underground economy was reflected in an increase in the ratio of currency relative to demand deposits held with banking institutions. He also believed that unreported income produces an abnormal demand for currency to hoard. However, Cagan (1958) was unable to produce any empirical justification for his claim.

5. Gutmann (1977) used an indirect approach to estimate the underground economy. This is because, he first computed ‘excessive’ currency in circulation (induced by the existence of underground activities) and then, by making assumptions about its income velocity, estimated the underground economy.
6. This view is supported by Cagan (1958) who believed that the amount of currency held against a dollar of unreported income is much greater, on the average, than the amount of money against a dollar of reported income. Although Cagan (1958) also believed that unreported income produces an abnormal demand for currency to hoard, he was unable to produce any empirical justification for his claim.

7. Spiro (1994) too maintained that an increase of a dollar in underground activity will give rise to a greater demand for cash than an increase of a dollar in ordinary GDP. This is because the velocity of circulation of cash in the underground economy is considerably lower than that in the regular economy.

8. In the case of the US, Feige (1979, 1990) decomposed the transactions into three main components, namely:

   (i) transactions involving production of final goods,
   (ii) the exchange of existing real or financial assets, and
   (iii) direct transfer payments.

Such monetary data are not available in Malaysia over the sample period.

9. Feige (1979, 1990) pioneered an approach of enquiry based on the quantity theory of money (that is the total volume of payments must equal total volume of transactions in the economy). According to him, if a reliable estimate of the total volume of transactions (both recorded and unrecorded) is not available, one could use the estimate of the total volume of payments as a proxy. This approach, however, can
only be used if the money stock is known and the velocity of circulation (of currency and checkable deposits) can be computed with some accuracy.

10. The inclusion of a lagged dependent variable indicates an adjustment process whereby individuals are assumed to take some time to adapt their currency ratio to its optimum level.