

**FACTORS AFFECTING THE RATIO
OF CURRENCY DEMAND TO
TOTAL MONETARY ASSETS IN MALTA**

by

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Paper presented at the International Conference on Applied Statistics
Organised by the Middle East Business and Economic Research Association
Cairo, Egypt. January 1989

I. INTRODUCTION

There are a number of factors influencing individuals` and firms decisions to hold currency rather than other forms of monetary assets. An important motive is to buy consumer goods and services in the case of individuals, and to pay wages and salaries and other short term business expenses in the case of firms. This can be loosely be called the "transactions" motive. Another reason, loosely termed here as the "asset" motive, is related to changes in the rate of interest. In macroeconomic theory, we also encounter the "speculative" motive which is related to expected, rather than actual changes in interest rates.

Another reason, which is of some importance in the Maltese economy, is to conceal economic activity for tax evasion. Thus underground activity covers production which is not, but should be, included in the computation of GDP. The purpose of this paper is to propose a model which associates currency demand with the underground economy and which quantitatively estimates the elasticities associated with currency demand. An attempt will be made also to estimate the size off the underground economy in Malta.¹

II. CURRENCY TRENDS IN MALTA

The Maltese economy is characterized by a very large ratio of currency in circulation to GDP, amounting to over 50%, and a very high ratio of currency in circulation to total monetary assets (M2), as can be seen from Table 1

Table 1
Currency in Circulation in relation to GDP and to Total Monetary Assets (1985)

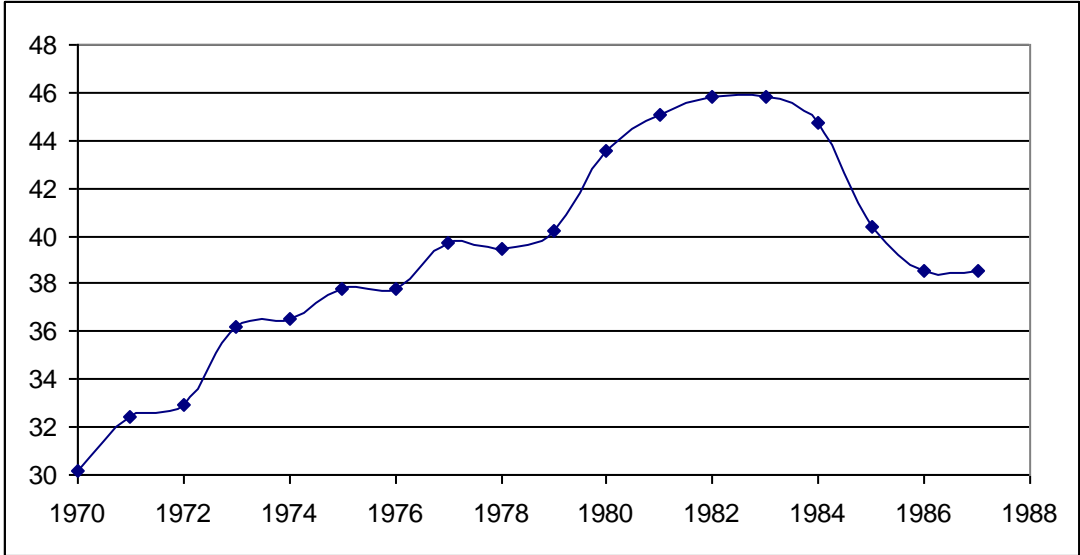
Country	Currency GDP Ratio	Currency M2 Ratio
Malta	53.0	42.0
Cyprus	9.1	12.9
Germany	5.7	9.7
Greece	11.5	17.4
Italy	7.0	9.1
Portugal	11.5	10.8
Spain	7.3	11.0
Turkey	5.0	12.3
Britain	3.6	8.4
USA	4.3	7.0

Source: International Financial Statistics (1986)

¹ Other terms used to refer to underground economic activity include submerged, subterranean, hidden, clandestine, unofficial, shadow and parallel.

On a time series basis, currency in circulation expressed as a percentage to total monetary assets (M2), has tended to increase rapidly during the seventies and to decrease during the eighties, as shown in Figure 1 (see also data appendix).

Figure 1
Currency in Circulation as a Percentage of GDP in Malta (%)



Of interest is that available data shows that most of the increase occurred in the form of high denomination notes. This can be interpreted as a sign of cash hoarding for tax evasion and can be associated with the underground economy.²

III. EMPIRICAL INVESTIGATION

A line of approach that has attracted much attention in estimating the size of the underground economy is the so called monetary approach, which is based on the assumption that underground activities are transacted in currency, so as to minimize the chances of tax detection.³

This approach was first popularized by Cagan (1958) who argued that an increase in tax evasion is likely to increase demand for currency. In another study, Gutmann (1977) attributed the changes in the income velocity of currency to changes in unreported economic activity for the purpose of evading

² Between 1973 and 1985, the highest denomination note in Malta was the Lm10 note. In 1973 the proportion of Lm10 to total note currency in circulation amounted to 33%. This proportion increased to 55% in 1980 and to 77% in 1985. In 1986, when the Lm20 note was introduced, the proportion of notes denominated over Lm10 amounted to 89% of total note currency.

³ Other approaches have been used in this regard. These include methods based on (a) sample surveys of underground activities (b) information of tax evasion estimates by tax authorities (c) statistical discrepancy between national expenditure and national income (d) comparisons of labour force participation rates between the official rates and those obtained by individual research.

taxation and escaping government regulation. More recently Tanzi (1982) attempted to derive a more firmly based analysis of currency demand, by making such demand a function of several variables.

IV. DEMAND FOR CURRENCY IN MALTA

Demand for currency is likely to increase as total monetary assets (M2) increase. However, if these two variables increase at the same rate, the ratio would remain constant. As has already been observed, this has not been the case in Malta. There are various factors which give rise to changes in this ratio. These may be classified under two main headings, namely tax-related and non-tax related variables.

It is generally accepted that in Malta a large number of gainfully occupied workers, especially own-account workers, second-job holders and part-time workers indulge in underground economic activity to evade taxation. It may be hypothesized that as tax rates increase participation in the underground economy becomes more attractive (or to put it differently, the opportunity cost of participating in the underground economy decreases). As a result, currency demand increases, everything else remaining constant.

As already noted, currency demand is likely to be influenced by non-tax variables. One such variable is related to banking services. It can be argued that improvements in banking facilities and the proliferation of bank branches in Malta tend to encourage the public to keep a larger proportion of their monetary assets in the bank, in the form of current, savings or fixed accounts. In the case of Malta, such developments should have given rise to a decrease in demand for currency, in relation to total monetary assets, other things remaining constant.

Another bank related variable affecting currency demand is the rate of interest, which may be regarded as the opportunity cost of holding currency in relation to savings and fixed deposits. In Malta, interest rates do not respond to market forces in the formal economy. There have been periodic discretionary changes by the Monetary Authorities, but these have been marginal. It is therefore not likely that changes in interest rate had a significant effect on currency demand.⁴

The cyclical pattern of economic activity may also be considered as a factor in this regard as during a recession the average propensity to consume is likely to increase. For some households, particularly those hit by the unemployment problem, this may necessitate the drawing on past savings. This

⁴ The rate of interest in Malta is fixed by the monetary authorities. The rate of interest of fixed "one-year" deposits was kept constant at 5% between 1970 and 1981, was raised to 6% between 1982 and 1984 and lowered to 5.5% between 1985 and 1987. (Source: Central Bank of Malta, Quarterly Review).

implies a redistribution of aggregate monetary assets in the short run, with a reduction in the share of savings and fixed deposits, and an increase in the share of currency.

Another factor that may be associated with currency demand is tourism. In Malta, tourist expenditure accounts for a large percentage of total final expenditure, and it is to a very large extent effected in cash. Tourism in Malta tended to increase during the seventies and to decrease during the first half of the eighties. On the assumption that, everything else remaining constant, an increase in tourism is likely to give rise to increases in currency demand.

In studies about the underground economy of other countries, the relative changes in incomes received in cash, such as wages, are sometimes assumed to influence currency demand. However, in Malta, this variable did not probably have an impact on currency demand since it did not change much during the past 16 years – a period during which currency demand has increased at a very fast rate.⁵

A non-tax variable that may be associated with currency demand are inflationary expectations, since inflation reduces the value of the currency, and therefore renders it a less attractive asset. However, this argument applies to all monetary assets, and not just to currency in circulation, since all monetary assets devalue with inflation. In other words, although inflationary expectations may give rise to a reduction in currency demand, there is no reason to assume that they affect the ratio of currency demand to total monetary assets.

V. THE MODEL

The model of currency demand presented in this paper is a modified version of that proposed by Tanzi (1982) and it is based on the assumption that the ratio of currency to total monetary assets (defined broadly as M2) is influenced by tax related and non-tax related variables. This method permits the estimation of taxed induced changes in currency demand. In turn, these can be associated with changes in the underground economy.

It should be noted that this study is concerned with changes in the ratio of currency to total monetary assets (C/M2) and not with the ratio of money, however defined, to GDP. We are taking money, in our case M2, as being determined outside the model. We do not probe this relationship further. In other words, the problem being investigated here relates to the factors that motivates people to change the currency content of a given amount of total monetary assets.

⁵ The ratio of wages and salaries to total personal income averaged 49% between 1971 and 1987, the lowest percentage being 47.5% in 1984 and the highest being 50.8% in 1971. Thus the maximum variation from the average was around 1.5 percentage point each way. There was no marked tendency for this ratio to increase or decrease.

It is being postulated that the $C/M2$ ratio should remain constant over time unless being influenced by factors which make holding currency more (or less) attractive. It is further assumed that an important motive for holding currency is to transact in the underground economy with the purposes of evading taxation, and that the higher the tax rates, the higher would be inducement to participate in the underground economy.

Two variables that are often utilized in models of this type to capture the effect of changes in tax liability are the average tax rate (ATR). In this study ATR is measured as the ratio of aggregate income tax paid (including employers contribution to social security) to aggregate personal income. This variable has a number of shortcomings, including that aggregate income tax paid excludes that which is evaded and that personal income excludes unreported earnings. Moreover, it may remain unchanged even when marginal tax rates increase.

The Marginal Tax Rate (MTR) is likely to be more directly related to changes in the size of the underground economy than the ATR, since it is associated with tax evasion on additional earnings. This variable, however, also has a serious shortcoming in that it is difficult to measure it accurately, since, amongst other things, it requires careful weighting of income groups. The method used to construct the MTR variable is explained in the data appendix.

In the model to be presented below, both variables were utilized, and the estimates obtained were broadly similar, although ATR produced superior results in terms of econometrics tests of significance.

The non-tax variables assumed to affect currency demand in Malta, and utilized in the model, can be divided into long run and short run factors. It is hypothesized that everything else remaining constant, currency demand in the long run would decrease due to improvements in banking facilities in the formal economy. Several variables could be used to capture this effect. Cagan (1958) and Tanzi (1982) used real GDP per capita for this purpose. An alternative variable which will be used in the model presented below, is a time trend.

The present author considers that a time trend is better than GDP per capita to capture long run influences on currency demand, since GDP per capita is affected by short run changes associated with the trade cycle.

As already noted, short-run business fluctuations are likely to influence currency in relation to total monetary assets, since the Average Propensity to consume is likely to increase during a downswing, implying a decrease in the share of savings and fixed deposits. In this study, short-run economic activity is measured by the rate of unemployment.

It is hypothesized that currency demand is also influenced by tourist expenditure in Malta, since this type of expenditure in Malta is to a large extent effected in currency. A variable that can be used for this purpose is tourist expenditure, but published data relies on foreign currency exchanged through the banks, which excludes a considerable amount of underground foreign currency transactions. To avoid this problem this study utilizes a variable composed of the product of the number of incoming tourists multiplied by the consumer price index, as a proxy for tourist expenditure at current prices.⁶

As explained earlier, the rate of interest and the ratio of wages and salaries to total income are also likely to influence currency demand, but these factors remained approximately constant during the period under consideration. This would seem to indicate that these factors did not probably bring about significant changes in currency demand in Malta, and they were left out of the model.⁷

Our currency demand model can therefore be summarized as follows:

$$C/M2 = a_0 + a_1 \text{ TAX} + a_2 \text{ TSM} + a_3 \text{ UNE} + a_4 \text{ TIM} + U$$

Where:

C/M2 is the ratio of currency to total monetary assets

TAX is the average (or marginal) tax rate

TSM is tourist expenditure

UNE is the rate of unemployment

TIM is a time trend

U is a random term

All variables with the exception of TIM are measured in logarithms (and defined in Appendix A) so that the coefficients a_1 to a_3 are elasticities of currency demand with respect to the dependent variables. TIM takes the values of 1, 2, ...T is the number of years, so that a_4 represents the annual average rate of growth of C/M2, everything else remains constant. The value of the constant a_0 depends on the scale with which the variables are measured, and no economic meaning is attached to it.

VI. ESTIMATION RESULTS

The coefficients were estimated by the method of Least Squares, using annual data for 1970 to 1987

⁶ The reason for taking this index is that the number of tourists is assumed to represent expenditures in real terms which when multiplied by the Consumer Price Index would give tourist expenditure in normal terms.

⁷ Attempts to estimate the currency demand equation with these two variables produced non-statistically significant coefficients and/or unexpected signs on the coefficients.

(see Appendix A). the following results were obtained when the average tax rate (ATR) was used as a tax variable.

**Table 2
Regression Results**

Variable	Coefficient	Elasticity Estimate	T Value
ATR	a ₁	0.13	4.5
TSM	a ₂	0.22	5.2
UNE	a ₃	0.16	4.9
TIM	a ₄	-0.03	-4.5

R² = 0.95 D.W.=1.5 N= 18

The elasticity estimates are all statistically significant at the 95% level, as indicated by the value of the T statistic. The D.W. statistic does not indicate the presence of autocorrelation, although it falls in the inconclusive range.

The results indicate that currency demand as a proportion of total monetary assets tended to decrease by approximately 3% per annum due to long run factors, everything else remaining constant, as indicated by the coefficient on TIM.

The coefficient on UNE would seem to suggest that for every 10% increase in the rate of unemployment, currency demand as a proportion of M2 increases by approximately 1.6%, everything else remaining constant. This would seem to confirm the hypothesis that during a recession, the portfolio of monetary assets tends to be diversified such that the share of currency increases, possibly due to an increase in the average propensity to consume.

The assumption that tourism affects currency demand is also confirmed by the results, which indicate that a 10% increase in tourist expenditure gives rise to an increase of approximately 2.2% in currency demand, *ceteris paribus*.

The coefficient on ATR indicates that a 10% increase in the tax rate brings about an increase of 1.3% in currency demand, everything else remaining constant. As stated above, this increase is assumed to be related to the tax evasion motive, through participation in the underground economy.

Alternative regression results, using the Marginal Tax Rate (MTR), reported in Appendix B, gave similar results, but with lower "t" statistics and correlation coefficient, and with a Durbin Watson Statistic indicating the presence of autocorrelation. For these reasons, the model utilising ATR was preferred and will be used in the next section for the purpose of predicting currency demand.

VII. CURRENCY DEMAND IN THE ABSENCE OF TAX EVASION

The estimated coefficients in the demand equation can be used to calculate currency demand, on the assumption that the evasion motive was absent. The method that will be utilised for this purpose follows that proposed by Tanzi (1982). It is a rough and ready method, and the reader is advised to interpret the results with great caution.

Briefly the method consists of computing the predicted values of currency demand from the regression equation using the observed values of the tax rates and comparing the results with the predicted values of currency demand when tax rates are assigned alternative values. These alternatives values are chosen so as to represent tax rates which are assumed not to induce tax evasion.

One can argue that zero tax evasion occurs when the tax rate is zero. However taking a zero tax rate would not be a useful approach, since it is unrealistic to assume a governed economy with a zero tax rate. Moreover the possibility of punishment for tax evaders means that there is an opportunity cost associated with evasion. In other words, it is reasonable to assume that tax evasion occurs at and above some positive tax rate, and that it would not be worth evading taxation when tax rates are below this rate.

We have taken as "zero evasion" tax rate (ZETR) the average tax rate prevailing in the early sixties, which was approximately 2.5%.⁸ It should be emphasised here that alternative assumptions regarding ZETR would yield results different from the ones presented below.

Let C_t be the predicted values of currency demand, obtained from the estimated demand equation, given actual values of the average tax rates (ATR). Let C_f be the predicted values of demand, obtained from the estimated currency demand equation, given that ATR takes a constant value of 2.5%. Table 3 gives the average values of C_t and C_f and their difference C_{ur} , for six three-yearly sub-periods between 1970-1987.

Table 3.
Estimated Currency Demand (Annual Averages: Lm Million)

Years	Total Currency Demand (C_t)	Formal Economy Currency (C_f)	Underground Economy Currency (C_{ur})
1970 – 72	54.8	51.6	3.2
1973 – 75	85.8	71.9	13.9

⁸ This exercise was also performed with the Marginal Tax Rate, which was taken as 10% in 1960. The results are reported in Appendix B.

1976 – 78	134.3	111.6	22.7
1979 – 81	208.0	165.1	42.9
1982- 84	266.3	212.6	53.7
1985 – 87	289.6	234.6	55.0

The estimated values of C_u under the assumptions listed above, would represent “tax-evasion” currency demand, i.e. currency demand assumed to be utilised to finance the underground economy.

VIII. THE INCOME VELOCITY OF MONEY

The income velocity of money in the formal economy can be defined as that which excludes “tax-evasion” currency demand, using the following formula:

$$V_f = \text{GDP}_f / C_f$$

Where:

V_f is the income velocity of money in the formal economy

GDP_f is the gross national product in the formal economy

C_f is currency demand in the formal economy

The relation between currency demand and output in the underground economy may be termed as the velocity of money in the underground economy, which we shall denote by V_u . For the purpose of this study, we shall assume that V_u and V_f are equal. This is a very rough approximation, since income velocity of money is not known.

As an alternative approximation, one can assume that V_u is smaller than V_f , due to the fact that the underground economy tends to be financed by high denomination notes. Such notes are easier to hoard than smaller denomination notes.

On the other hand, one can assume that V_u is greater than V_f , since underground economic activities are mostly in the form of services, which are associated with relatively low outlays on materials and other intermediate inputs, and therefore require a lower cash flow, when compared to manufactured production. Thus, although this study utilizes the assumption that V_f and V_u are equal, the reader should keep in mind that different assumptions regarding the values of these two income velocities can be proposed.

On the basis of this assumption, one can work backwards and compute output in the underground economy (GDP_u) given that we know the underground currency demand C_u , since:

$$\text{GDP}_u = C_u \times V_u$$

Table 4
Estimates of the Underground Economy Annual Averages

Years	Under ground Currency (C_u)	Income Velocity of Money (V_u)	Underground GDP (GDP_u)	Tax Revenue Lost	Ratio of GDP (GDP_u / GDP_f)
1970 - 72	3.2	2.1	6.3	0.3	5.9
1973 - 75	13.9	2.1	29.2	2.9	19.4
1976 - 78	22.7	2.3	52.5	5.6	20.3
1979 - 81	42.9	2.5	107.3	16.4	25.9
1982 - 84	53.7	2.4	127.6	18.7	25.3
1985 - 87	55.0	2.5	130.8	17.9	25.0

Table 4 gives estimates of yearly averages of C_u , V_u and GDP_u for six three-yearly sub-periods between 1970 and 1987. It can be seen that the underground GDP is estimated to have increased from an annual average of Lm6.3 million between 1972 and 1973 to an annual average of Lm130.8 million between 1985 and 1987.

The table also shows the average annual amount of tax revenue lost as a result of tax evasion, given the average tax rates prevailing during the four sub-periods. It can be seen that during the last sub-period, tax-revenue lost estimated to have amount to about Lm18 million annually.

Finally, in its last column, Table 4 gives estimates of the ratio of GDP_u to GDP_f . This ratio indicates that there has been a tendency for underground activity to increase in relative terms during the seventies and to remain relatively stable during the eighties. During the eighties, underground GDP is estimated to have averaged around 25% of formal GDP.

IX. CONCLUSION

This study is an attempt to identify the factors affecting currency demand, by constructing a model which included tax rates as one of the explanatory variables. The estimates of the underground GDP were derived from this model.

As emphasised on a number of occasions throughout this paper, the estimates of the underground economy rely on a number of assumptions which may be challenged and modified.⁹ We have

⁹ In most studies of the Underground economy, it is acknowledged that the estimates produced can, at best, be considered amount of research. As Frey and Pommerehne (1982) put it, "in view of the extraordinary problem of estimating such a complex phenomenon as the unobserved economy, where the participants make a strong effect to conceal the income – producing activity, one would not be surprised if a science confronted with this problem would just give up. It is a tribute to economics as a science that this has not been the case, but that ingenious methods have nevertheless been developed to measure the hidden economy.

assumed that the underground economy is related to currency held for tax evasion purposes. As a benchmark, it was assumed that the 1960 average tax rate was low enough so as not to induce tax-evasion. It was also assumed that the income velocity of money in the underground economy is equal to the income velocity of money in the formal economy. These are crucial assumptions and to an extent arbitrary. Unfortunately, given the clandestine nature of the subject under study, research in this area has to be based on assumptions which make sense, but which cannot be fully empirically verified. The ones used in this study are not implausible, and the results produced by the model are not improbable.

Another consideration to keep in mind is that the variables used to estimate the model could be measured in alternative ways. The present authors have experienced with alternative methods of measuring tax-rates, tourism and cyclical fluctuations. As expected, different methods of measurements produced different estimated estimates of the underground economy. However, in all cases, the general patterns shown in Tables 2, 3, and 4 were confirmed.

That the Maltese economy contains a relatively large underground component is generally taken for granted, although to date, very few studies have been produced to confirm this presumption. The present study is an attempt to shed some light on the relative size of the underground economy, but the shortcomings noted above warrant further research on the subject. It is hoped that this will be forthcoming with the aim of improving our knowledge on this very important aspect of the Maltese economy.

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**APPENDIX A.
THE VARIABLES USED IN THE MODEL**

Symbols and Definition of Variables

C/M2: The ratio (percentage) of currency in circulation to total monetary assets.
Source: Central Bank of Malta Quarterly Review

ATR: The Average Tax Rate, measured as the ratio (percentage) of personal income tax to total personal income.

MTR: The Marginal Tax Rate. Computed by the author as explained below.
Source: Department of Inland Revenue, Malta

TSM: An index of tourist expenditure, with 1970 = 100, computed by multiplying the number of incoming tourists, by the consumer price index.
Sources: Malta Economic Survey and National Accounts of the Maltese Islands

UNE: The rate of unemployment (percent)
Source: Annual Abstract of Statistics, Malta

The Data

YEAR	C/M2	ATR	MTR	TSM	UNE
1970	30.2	2.5	22.5	100.0	4.7
1971	32.4	3.4	22.5	106.3	5.4
1972	32.9	6.2	22.5	92.0	6.0
1973	36.2	10.4	22.5	141.8	4.5
1974	36.5	9.2	22.5	203.6	5.8
1975	37.8	10.3	32.5	261.7	4.4
1976	37.8	9.6	32.5	272.2	4.2
1977	39.7	10.5	32.5	320.8	4.2
1978	39.5	11.5	32.5	438.8	3.5
1979	40.2	14.4	40.0	609.4	2.7
1980	43.6	15.4	40.0	832.3	3.4
1981	45.1	16.0	30.0	860.0	4.8
1982	45.8	15.0	30.0	661.9	8.7
1983	45.8	15.1	30.0	629.0	8.7
1984	44.7	14.0	30.0	612.1	8.7
1985	40.4	14.3	30.0	660.8	8.2
1986	38.5	13.6	30.0	744.1	6.9
1987	38.5	11.6	30.0	1074.8	4.4

APPENDIX B: ALTERNATIVE RESULTS USING THE MARGINAL TAX RATE

The results shown in the main text were produced using the Average Tax Rate (ATR) as an index of taxation. The following results were obtained when the Marginal Tax Rate was used instead of Average Tax Rate.

For the purpose of this study, the Marginal Tax Rate was computed for incomes three times the current minimum wage, for a family with two children. This tax rate will be denoted by MTR3. This relatively high income bracket was chosen on the assumption that participants in the underground economy try to evade taxation when tax rates are relatively high. Other relatively high income brackets ranging from two times the minimum wage, were used to compute MTR. A weighted average of Marginal Tax Rates on different income brackets, with income weights taken from the 1985 census, was also computed. The regression results did not differ much from the ones reported below.

The regression results obtained with MTR3 differed only slightly from those with the tax index ATR (reported in the main text). The main difference is that R^2 , the T statistics and the DW statistics for the MTR regression were not as satisfactory as those pertaining to the regression results using ATR. The elasticity estimates were however very similar, as shown in the following table:

Table 2a. Regression Results using MTR3

Variable	Coefficient	Elasticity Estimate	T Value
MTR3	a_1	0.19	1.6
TSM	a_2	0.25	4.1
UNE	a_3	0.22	4.1
TIM	a_4	-0.03	-3.2

$$R^2 = 0.88 \quad D.W. = 1.3$$

This regression result was used to compute the following estimates of currency demand and of the Underground economy (which can be compared with those obtained by using ATR reported in Table 3 and Table 4 in the main text).

Table 3a. Estimated Currency Demand, Using MTR3
(Annual Averages: Lm Million)

Years	Total Currency Demand	Formal Economy Currency	Underground Economy Currency
1970 - 72	56.5	48.3	8.2
1973 - 75	82.5	68.6	13.9
1976 - 78	134.3	108.0	27.3
1979 - 81	207.3	162.2	40.4
1982 - 84	267.5	216.5	48.8
1985 - 87	291.7	235.6	55.7

Table 4a. Estimates of the Underground Economy.
Using MTR3 (Annual Averages)

Years	Under-Ground Currency	Income Velocity o f Money	Under – ground GDP	Tax Revenue Lost	Ratio GDPu/GDPf
	Lm Million	Lm Million	Lm Million	Lm Million	%
1970 - 72	8.2	2.1	17.9	0.7	16.9
1973 - 75	13.9	2.1	30.7	3.0	19.8
1976 -78	27.3	2.4	65.8	6.9	25.5
1979 -81	40.4	2.5	115.3	17.5	28.3
1982 - 84	48.8	2.3	119.1	17.5	23.6
1985 - 87	55.7	2.3	128.4	17.2	23.6

The general results produced in the main text, when ATR was used as a tax index are confirmed, although there are some differences in the magnitudes of the estimated underground GDP.