

Monetary estimates of the underground economy: a critical evaluation

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I. TANZI'S MONETARY APPROACH TO ESTIMATING THE UNDERGROUND ECONOMY

Recent estimates of the size of the underground economy in Canada run from roughly 3 percent to 22 percent of GDP. This study finds that a more critical scrutiny of the monetary techniques used can considerably refine the previous estimates and narrow the range of uncertainty about the underground economy. Various monetary methodologies have been applied to Canada, most recently by Mirus, Smith and Karoleff (1994). The model that is most plausible from the viewpoint of economic theory is Tanzi's (1983) variant of the currency-ratio approach, and it will be used in the present study. Granger causality testing finds $F=30$ for the one-year lagged effect of the change in tax rates on growth in currency, implying that the probability of the tax rate being non-causal is 0.0000.

Tanzi's methodology, which has been followed by other Canadian researchers, expresses currency as a fraction of some other monetary variable, and has been followed in this by previous Canadian researchers. In fact, M2 is an inappropriate scale variable, as currency is used for transactions purposes, whereas M2 contains substantial amounts that represent long-term wealth accumulation. A better alternative, first used for Canada by Spiro (1993), is consumer expenditure. The introduction of advances in financial technology is likely to be uncorrelated with changes in consumer expenditure, implying that the estimated coefficient on consumer expenditure as an explanatory variable would be unbiased. U.S. studies, such as Dotsey (1988), have also found that consumer expenditure or retail sales work better as the scale variable than personal income or total GDP.

II. REGRESSION ESTIMATES

The regressions in the present study express variables in first-difference form so as to minimize the risk of spurious correlation. The dependent variable is the change in currency outside banks, rather than its ratio to another variable (personal

income is included as an independent variable). The tax variable chosen is the first difference of total personal taxes as a percent of personal income. This variable comes closest to representing the taxes that people evade when they enter the underground economy. It leaves out the old manufacturer's sales tax. Spiro (1993) points out that this tax probably did not suffer from much evasion, as compared to the Goods and Services Tax (GST).

The first three equations in the table are the ones used for gauging the size of the underground economy. Equations no. 1 and 2 employ the same specification over different time horizons. Equation no. 3 expresses currency growth and consumption growth as real per capita values. The tax rate variable is highly significant, and remarkably similar in all three of them, suggesting that a reliable structural relationship has been identified. The change in the interest rate is quite significant, but its coefficient suggests a low interest elasticity of demand for currency, of about -0.09 in equation no. 1.

Equations 4 and 5 have alternative monetary aggregates as their dependent variables: M1 and M2 redefined to exclude currency. It can be seen that these residuals behave quite differently. Moreover, it was found that M1 excluding cash was better in a reduced form equation at predicting the medium-term growth of nominal GDP than was total M1. This is a fact of which monetarists who use M1 need to take note.

III. THE SIZE OF THE UNDERGROUND ECONOMY

These equations can be used to simulate what the demand for currency would have been if there had been no tax increases. The difference between the actual currency in circulation and the simulated value can be considered "excess currency," indicating the size of the underground economy. The estimates of excess currency based on each of equations 1, 2 and 3 are all quite similar. They indicate that, out of total currency of \$23 billion in 1993, about \$11 billion existed to meet the demands of the underground economy.

The figures on excess currency can be multiplied by the velocity of circulation of cash to estimate the trend of the underground economy as a percent of Canadian GDP. An estimated velocity of 5 is suggested as an appropriate number. This was the approximate average velocity of M1 in Canada for the years from 1926 to 1959, before changes in financial technology and banking practice led to a growing trend of velocity.

Using a velocity of 5 implies that the underground economy was equal to at least 8 percent of Canadian GDP in 1993. During the three year span from 1991 to 1993, the underground economy is estimated to have increased in total by 1.6 to 1.9 percentage points of GDP. This is based purely on the econometric impact of increases in the direct personal tax rate, in which the

TABLE 1
Regressions explaining the growth of currency and related monetary aggregates

Eq. No.	Dependent Variable	Sample Period	Constant	Unemployment	Log of time	Interest Rate	Consumption	Tax Rate	D-W	R ²
1	Currency	1950-93	-3.48 (-3.50)	-0.19 (-0.54)	0.69 (2.4)	-0.91 (-4.04)	0.83 (9.17)	4.08 (6.18)	1.93	0.86
2	Currency	1970-93	-11.40 (-1.7)	0.11 (0.34)	3.08 (2.01)	-0.95 (-6.15)	0.80 (5.50)	3.48 (4.83)	1.92	0.93
3	Real currency per capita	1950-93	-3.25 (-2.39)	0.10 (0.29)	0.39 (1.02)	-1.17 (-5.11)	0.70 (3.12)	3.56 (5.53)	1.96	0.80
4	M1 excluding currency	1970-93	6.01 (0.15)	-2.00 (-0.99)	-0.82 (-0.09)	-2.43 (-2.62)	0.37 (0.43)	0.98 (0.23)	2.31	0.49
5	M2 excluding currency	1970-93	27.3 (1.44)	-0.98 (-1.03)	-5.07 (-1.17)	1.84 (4.21)	0.21 (0.52)	0.04 (0.02)	2.75	0.81

Note: T-statistics in parentheses. Dependent variable and consumption are percent changes. Unemployment rate, interest rate and tax rate are first differences. Interest rate and consumption are second order polynomial distributed lags from t to t-2. The tax rate is a second order polynomial distributed lag from t to t-7.

introduction of the GST had the largest role.

IV. IMPLICATIONS

Including the tax rate as an explanatory variable for currency was a profound insight by Tanzi. Economic theory itself is ambiguous about the effects of tax rates on evasion, as there are both substitution and income effects. Empirical evidence on the relationship is sparse, because accurate data on the amount of tax evasion are scarce. The results coming out of the Tanzi model, implying a significant effect of tax rates on tax evasion, are the closest thing to hard evidence that economists have on this subject. The implication from Equation 2 is that tax increases in Canada produce net revenue of roughly 85 cents on the dollar after increased evasion is taken into account.

The change in the unemployment rate was included as an explanatory variable in all the equations, and it was found to be insignificant. Some analysts have suggested that unemployment contributes to more underground activity, as there are more unemployed workers available and willing to work in it (to supplement their unemployment insurance or welfare benefits). However, many of the services that take place underground represent discretionary expenditure on the part of consumers, and that means the demand for these services falls in a recession. The regression results here suggest that falling demand offsets the rising willingness to supply, and recessions do not increase the underground sector's share of the total economy.

V. COMPARISON WITH STATISTICS CANADA'S STUDIES

Gervais (1994, 56) of Statistics Canada conducted a sector by sector adding up of missing activity, and concluded that 2.7 percent was the "upper limit" by which GDP could be understated due to the underground economy. Gervais also made a distinction between underground activity which is unrecorded by Statistics Canada's GDP figures versus the total value of underground activity that is unreported for tax purposes, which can be considerably larger. The estimates of the underground economy in the present study are for total unreported activity, and so are not in any direct conflict with Gervais's estimate. The velocity of circulation of cash in the underground economy is considerably smaller than in the regular economy. Therefore, dollar for dollar, an increase in underground activity will give rise to a greater demand for cash than a dollar of ordinary GDP. Hence, a substantial part of the growth in the demand for cash would not be explained by the growth in GDP even if GDP actually included all the underground activity.

However, there is no *a priori* reason for supposing that a sector-by-sector approach provides a superior estimate of the aggregate size of the underground economy. A Norwegian study (Isachsen and Strom, 1989, 255-56) found that almost twice as many people admitted to underground activity when the questions were asked on an anonymous mail-in survey versus a direct interview. Statistics Canada's surveys of such things as homeowner spending on repairs and renovation are not anonymous, leading to a likelihood of downward bias.

VI. CONCLUSIONS

The Tanzi model, which predicts currency demand based on tax rates, holds up very well for the Canadian data when the proper scale variable is chosen. There is a significant, causal effect of tax rates on the demand for currency in Canada. This can only be due to the use of cash in the underground economy, which grows in response to higher tax rates.

Using a cautious estimate of the velocity of circulation, the currency equations imply that the Canadian underground economy was in excess of 8 percent of GDP in 1993. An increase of up to 2 percentage points occurred after 1990, mainly due to the introduction of the GST. The empirical results do not support the hypothesis that the recession was a major factor behind recent growth of the underground economy. The results imply that roughly half of Canada's currency stock is in use in the underground economy. This represents a substantial proportion of total M1, and indicates that this monetary aggregate should be used with caution in the analysis of monetary policy.

NOTES

* The opinions expressed in this paper are those of the author, and do not necessarily reflect the policy of the Ontario Ministry of Finance. The author has benefitted from the comments of numerous individuals, especially David Longworth, the discussant, and Rolf Mirus, who also provided data.

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