FISCAL REGIME AND ESTIMATES OF THE UNDERGROUND ECONOMY IN MALAYSIA: THE CURRENCY DEMAND APPROACH IN DYNAMIC GENERAL EQUILBRIUM MODEL

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Abstract

The purpose of present paper is to complement the conventional currency demand approach in the estimates of the size of underground economy by integrating it into a dynamic general equilibrium model. Our analysis demonstrated that it is not the *current* taxation burden that matters, but rather, it is the fiscal regime that affects both current and *future* taxation burdens that matters. Whether increasing current tax rates could have induced households to participate in underground activities depends on the path of government expenditure. Higher current tax rates along with a cut in government spending that signal a lower future tax burdens may indeed produce a smaller size of underground economy. On the flip side, lower current tax rates combined with increasing government spending that hint at greater future tax burdens could kick off a rising size of underground economy. We also uncover that the trend of the size of underground economy, after taking the fiscal condition into account, is in line with the existing literature on the role of underground economy as risk-sharing mechanism. After the adjustment for fiscal regime, we find that the size of underground economy in Malaysia, on general, is relatively smaller vis-à-vis the conventional measurement.

Keywords: Underground economy; Currency demand; Taxation; Fiscal regime

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1. Introduction

The existence of underground economy around the world is beyond doubt. Quantifying the size of the underground economy, from a conceptual and practical nature, however, is likely to be no better than "guesstimation" (Dixon 1999). Despite the significant number of measuring methods to date that has been used to estimate the size of underground economy[1], the currency demand approach has stand out by virtue of her well established presence in the empirical literature[2].The simplicity in estimation procedure, coupled with its well grounded assumption that cash is the vital if not solely mean of payments used in the underground economy, has undoubtedly underlay the widely acceptance of currency demand approach. Its often-criticized single focus on tax rate as the driving force of underground economy has indeed turned out to be the foolproof resistance to the fragility that the more complicated MIMIC approach encounters, that is, high sensitivity to the causes and indicators under contemplation[3]. Furthermore, this approach has been resurfacing recently, as shown by the works of Hill and Kabir (2000), Schneider (1997, 1999) and Gadea and Serrano-Sanz (2002).

In this vein, the present paper attempts to contribute to improving the estimates of the size of underground economy by integrating this most widely used currency demand approach into a dynamic general equilibrium model. From there we derive a currency demand function to be estimated econometrically, in which the coefficients of average tax revenue and output will determine the relative size of the underground economy.

In retrospect, Tanzi (1980, 1982) regressed on a currency demand function that contains weighted average tax rate, proportion of wages and salaries in national income, interest rate on saving deposits, and per capital income as a function of share of circulated currency in broad money. The main idea is that a rise in the size of underground economy will cause an increase in demand for currency. In other words, an excess demand for currency, thanks to the tax-driven underground activities, provides estimates of the size of the underground economy. Following Tanzi's line of thought, we try to figure out a distinction between the behavior of circulated currency M, nominal GDP, and tax revenue in Malaysia from 1970 to 2005, as depicted in Table 1.

Given the assumption of constant velocity of circulation, for an economy without underground sectors we should witness both circulated currency and nominal GDP sharing identical cyclical movements

$$E_{t-1}\hat{M}_t = E_{t-1}G\hat{D}P_t$$

[1] See Schneider and Enste (2000) for an excellent survey on different estimation methods proposed in the literature.

[2] Cagan (1958) and Guttman (1977) first initiated the currency demand approach, which, subsequently improved by Tanzi (1980, 1983).

[3] It should be noted that the MIMIC approach needs an external source of cardinal reference value or benchmark to transform its ordinal estimates to cardinal values, to which, the currency demand approach has been referred by most of the researchers using MIMIC approach.

where E denotes the expectation operator, and a hat over the variable refers to its deviation from steady state. By the same token, the cyclical components of circulated currency should be as fluctuate as those of nominal income

$$Var(\hat{M}_t) = Var(G\hat{D}P_t).$$

Table 1: Some facts on currency demand and taxation

	Correlation		
	*Cyclical components**	*Growth rate*	*3-year standard deviation*
GDP and currency	0.563	-0.414	0.631
Tax revenue and currency	0.244	0.223	0.773

* The data is detrended by using Hodrick-Prescott filter at $\lambda = 100$.

However, as clear from Table 1, $G\hat{D}P_t$ is only moderately correlated with $\hat{M}_t$. The missing part could not be well explained even if the assumption of constant velocity of circulation is relaxed. Plus, the cyclical components of tax revenue is also moderately correlated to $\hat{M}_t$, though to lesser extent. More important, a look at the changes and fluctuations clarifies the picture further.

Surprisingly, changes in cyclical GDP are inversely related to the changes in cyclical circulated currency. Put it differently, any additional cyclical demand for cash balances must be from other sources, among others, underground activities. Positive correlations between the cyclical movements of tax revenue, as the major cause of underground economy, and circulated currency, alongside as strong positive correlation between the fluctuation in tax revenue and in circulated currency, signal that currency demand approach remains valid and highly valuable.

Seen from this light, we proposed a *dynamic* currency demand approach, which complements the conventional currency demand approach by offering additional insights. We find that the impact of taxation burden on the size of underground economy is *conditional on* the fiscal regime. In particular, it is not the *current* taxation burden that matters. Rather, it is the fiscal regime that affects both current and *future* taxation burdens that matters. Whether increasing current tax rates could have induced households to participate in underground activities depends on its counterpart, that is, government expenditure. Worsening (improving) fiscal conditions, with limited sources of taxation, tends to raise (lower) the expectation on future distorting direct tax rates, and thus cause larger (smaller) size of underground economy.

Besides, we uncover that the trend of the size of underground economy, after taking the fiscal condition into account, is in line with the existing literature on the role of underground economy as risk-sharing mechanism. In the wave of recession, one should expect a rise in the size of underground economy as the recession-induced unemployed workers have substituted into the underground activities. Note that expansionary fiscal stance, be it rising government expenditure or falling tax collection, more often than not comes after the recession. This means the conventional currency demand approach that depends on falling current tax rates will mistakenly predict the evolution of the size of underground economy. In this respect, the dynamic currency demand approach that also considers future taxation burden, as shown later, has performed better.

The remainder of the paper is organized as follows. Section 2 presents the dynamic general equilibrium model economy with and without underground economy. The dynamic currency demand approach is then derived. Section 3 presents the econometric estimation of the size of underground economy in Malaysia from 1970 to 2005. Section 4 puts the fiscal regime under consideration, and performs the adjusted size of underground economy. Section 5 concludes.

2. The Dynamic General Equilibrium Model

In this section, we present a standard dynamic general equilibrium model and derive the money demand function for an economy with and without underground economy.

2.1 The environment

The sequences of events occur as follows: at the beginning of every date t a continuum of measure one of ex-ante identical households are endowed by real stocks of capital K_{-1} and balances M_{-1}. Given the anticipated realization of the stochastic shock Z_t, the households provide labor services N_t^s and rent their endowed real capital stock to the firms for production Y_t. The real wages W_t / P_t and return on real capital r_t are respectively determined by their marginal products. Firms hire labors and capital according to the combinations as in the standard Cobb-Douglas production function. Funded by the returns of factors, profit Ω_t, and government lump-sum transfer G_t^M via money creation $\frac{M_t - M_{t-1}}{P_t}$, the households will decide how much to spend on the consumption of the unique non-storable goods C_t at the prevailing price P_t, and to save in the form of real stocks of capital and cash balance for next period. Note that unilateral transfer of G_t^M is net wealth for household.

2.2 The standard competitive economy

The household's expected utility at date 0 is given by

$$E_0 \sum_{t=0}^{\infty} \frac{1}{(1+\rho)^t} \left\{ \frac{1}{1-\sigma} \left(C_t^{1-\sigma} - 1 \right) - \log N_t + \theta \log \left(\frac{M_t}{P_t} \right) \right\} \qquad (1)$$

The utility function (1) shares the usual assumptions of concavity and differentiability. The reciprocal of σ and θ, respectively, denote the intertemporal elasticity of substitution between current and future consumptions, and interest elasticity of currency demand. ρ is the subjective discount rate.

The production function takes the form

$$Y_t = Z_t K_{t-1}^{\alpha} N_t^{1-\alpha} \tag{2}$$

Definition 1.

A sequential competitive equilibrium is a sequence of allocations $\{C_t, N_t, M_t, K_t\}_{t=0}^{\infty}$ and prices $\{W_t / P_t, r_t\}_{t=0}^{\infty}$ $\forall t$ such that

(i) Household maximizes (1) subject to

$$(1+r_t)K_{t-1} + \frac{M_{t-1}}{P_t} + \frac{W_t}{P_t} N_t^s + \Omega_t + G_t^M = C_t + \frac{M_t}{P_t} + K_t \tag{3}$$

(ii) Firm solves

$$\max_{K_{-1}, N_t^d} \Omega_t = Z_t K_{t-1}^{\alpha} N_t^{d\,1-\alpha} - \frac{W_t}{P_t} N_t^d - (r_t + \delta) K_{t-1} \tag{4}$$

(iii) Market clearing:

$$N_t^s = N_t^d, \tag{5}$$

(iv) AR(1) Markov process of technological shock in the form

$$Z_t = (1-\rho_Z)\overline{Z} + Z_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim i.i.d.N(0,\sigma) \tag{6}$$

(v) A perpetual inventory model in the form

$$K_t = (1-\delta)K_{t-1} + I_t \tag{7}$$

(vi) Fiscal regime where

$$\frac{M_t - M_{t-1}}{P_t} = G_t^M \tag{8}$$

(vii) Feasibility

$$C_t + K_t = Z_t K_{t-1}^{\alpha} N_t^{d\,1-\alpha} + (1-\delta)K_{t-1} \tag{9}$$

The resultant efficiency conditions are

$$\frac{C_t^{-\sigma}}{(1+\rho)} = q_t \tag{10}$$

$$\frac{1}{(1+\rho)N_t^s} = q_t \frac{W_t}{P_t} \tag{11}$$

$$q_t = q_{t+1}(1+r_{t+1}) \tag{12}$$

$$\frac{\theta}{(1+\rho)}\left(\frac{M_t}{P_t}\right)^{-1} = q_t - q_{t+1}\left(\frac{P_t}{P_{t+1}}\right) \tag{13}$$

$$\frac{W_t}{P_t} = (1-\alpha)\frac{Y_t}{N_t^d} \tag{14}$$

$$r_t = \alpha \frac{Y_t}{K_{t-1}} \tag{15}$$

Simultaneous interpretation of (10) and (11) such that

$$\frac{C_t^\sigma}{N_t^s} = \frac{W_t}{P_t} \tag{16}$$

Equation (12) is the Euler equation. Equation (13) states the optimal condition for holding real balances, while Equations (14) and (15) are the marginal product of labor and capital. The equation (16) has three important features about the labor supply. First, holding real wage constant, household labor supply is directly related to household consumption. Intuitively, to fund more consumption requires more hard works. Here the income effect comes into play. Second, holding consumption fixed, labor supply varies inversely with the real wage. This is because a higher real wage, given hours of work, makes leisure less costly. In other words, household could enjoy more leisure time without compromising the amount of income earned. The substitution effect thus dominates. Third, if both consumption and real wage arise proportionally, both income and substitution effects on labor are counterbalanced. There is no change in the labor supply.

Proposition 1

Demand for cash balances is a function of total income and opportunity cost of holding cash balances.

Proof. First we combine (10), (11) and (14) to rewrite the consumption as a product of labor share of income,

$$C_t^\sigma = (1-\alpha)Y_t \ .$$

Together, (10), and (12)-(13) show that

$$\frac{M_t}{P_t} = \theta(1-\alpha)Y_t \left(\frac{1+i_t}{i_t}\right) \tag{17}$$

Correspondingly, demand for cash balances varies directly and inversely with total income and nominal interest rate. ■

2.3 A dynamic general equilibrium model with tax-driven underground activities

2.3.1 Household

For an economy that comprises underground goods and labor markets, we could rewrite respective utility function and labor disutility as

$$u(C_t) = \frac{(C_t^M)^{\varpi}(C_t^U)^{1-\varpi} - 1}{1-\sigma} \tag{18}$$

$$\log N_t = (N_t^{sM})^{\phi}(N_t^{sU})^{1-\phi} \tag{19}$$

where $\varpi \equiv C_t^M / C_t$, $\phi \equiv N_t^M / N_t$.

Household can now work in both official and underground markets with respective real wages of W_t^M / P_t and W_t^U / P_t , with the former enjoys a wage premium $\kappa > 1$ over the latter. Note that labor supply is not indivisible. Rather, household can involve simultaneously in both markets. However, the income tax rate τ_t^W, to which only the official labor market is subjected, will influence household's decision on labor allocation for official and underground labor markets.

Household's budget constraint turns out to be

$$\begin{aligned}&(1+r_t)K_{t-1} + \frac{M_{t-1}}{P_t} + \frac{W_t^M}{P_t}(1-\tau_t^W)N_t^M + \frac{W_t^U}{P_t}N_t^U + G_t^M + G_t^{NM} + \Omega_t \\ &= C_t^M + C_t^U + \frac{M_t}{P_t} + K_t\end{aligned} \tag{20}$$

2.3.2 Firm

Now, let us turn the analysis to the firm, which could employ two *modes* of production. On one hand, firm utilizes capital stocks and official labor services for market goods production Y_t^M, as in (2). On the other hand, firm uses labors from underground labor market N_t^U to produce underground goods Y_t^U in a simple production function that exhibits constant returns to scale[4]. For the sake of simplicity, we assume an identical technological process across the modes of production.

$$Y_t^M = Z_t K_{t-1}^{\ \alpha} N_t^{dM\,1-\alpha}, \quad Y_t^U = Z_t N_t^{dU} \tag{21}$$

Firm's profit function, therefore, is rewritten as

$$\Omega_t = (1-\tau_t^R)Y_t^M + Y_t^U - \frac{W_t^M}{P_t}N_t^{dM} - \frac{W_t^U}{P_t}N_t^{dU} - (r_t + \delta)K_{t-1} \tag{22}$$

Only the revenue of market goods is subject to the revenue taxation.

[4] This assumption is in contrast to the existing practice, for instance, Busato and Chriani (2004), and Conesa et al. (2001, 2002), on modeling underground production that assumes decreasing return on scale. None the less, as we do not consider penalty of being caught, in which its probability is directly related to the scale of production, the assumption of constant return to scale is not inappropriate.

2.3.3 Fiscal regime

Consider the following government budget constraint.

$$\frac{W_t^M N_t^M}{P_t}\tau_t^W + \tau_t^R Y_t^M = \Lambda_t G_t^{NM} \tag{23}$$

Λ_t refers to the share of distorting taxation in the financing of non-monetized government spending G_t^{NM}. Unlike (8), lump-sum government transfer of G_t^{NM} is not a wealth for household as it is financed by taxation. As we will see later, Λ_t conveys the importance of fiscal regime, instead of *current taxation burden per se*, in the determination of the size of underground economy.

Definition 2.

A sequential competitive equilibrium with underground economy is a sequence of allocations $\left\{C_t^M, C_t^U, N_t^{sM}, N_t^{sU}, M_t, K_t\right\}_{t=0}^{\infty}$, and prices $\left\{W_t^M / P_t, r_t, \tau_t^W, \tau_t^R\right\}_{t=0}^{\infty}$ $\forall t$ such that

(i) Household maximizes (1) subject to (17) – (19)

(ii) Firm solves (22) subject to (21)

(iii) Market clearing:

$$N_t^{sM} = N_t^{dM}, \qquad N_t^{sU} = N_t^{dU}$$

(iv) The progress of technology and capital accumulation as in (6) and (7)

(v) Fiscal regime

$$\frac{W_t^M N_t^M}{P_t}\tau_t^W + \tau_t^R Y_t^M + \frac{M_t - M_{t-1}}{P_t} = \Lambda_t G_t^{NM} + G_t^M \tag{24}$$

(vi) Feasibility

$$C_t^M + C_t^U + K_t = Y_t + (1-\delta)K_{t-1} \tag{25}$$

where $\Lambda_t = 1$, $Y_t = Y_t^M + Y_t^U$.

The efficiency conditions are

$$\frac{\varpi C_t^{1-\sigma}}{(1+\rho)C_t^M} = \frac{(1-\varpi)C_t^{1-\sigma}}{(1+\rho)C_t^U} = q_t \tag{26}$$

$$\frac{1}{(1+\rho)N_t^{sM}} = q_t\left\{\frac{W_t^M}{P_t}(1-(1-\Lambda_t^{-1})\tau_t^W) + (1-\alpha)\frac{Y_t^M}{N_t^M}\Lambda_t^{-1}\tau_t^R\right\} \tag{27}$$

$$\frac{1}{(1+\rho)N_t^U} = q_t \frac{W_t^U}{P_t} \tag{28}$$

$$r_t = \alpha(1-\tau_t^R)\frac{Y_t^M}{K_{t-1}} \tag{29}$$

$$\frac{W_t^M}{P_t} = (1-\tau_t^R)(1-\alpha)\frac{Y_t^M}{N_t^M} \tag{30}$$

Equation (26) indicates that, given the assumption of uniqueness of goods, both marginal utility of consumption on market and underground goods fluctuate according to the marginal utility of wealth. Equation (28) equates the marginal disutility of work in underground labor market and its real wage. Equations (29) and (30) are marginal product of capital and market labor distorted by revenue tax. The standard Euler equation and optimal condition on holding cash balances duplicate (12) and (13).

The product of (26), (27), and (30), as what follows, has altered the decision on labor supply in (16).

$$\frac{C_t^\sigma}{N_t^{sM}} = \frac{W_t^M}{P_t}\left\{1 + (\Lambda_t^{-1} - 1)\tau_t^W + (1-\alpha)\Lambda_t^{-1}\tau_t^R\right\} \tag{31}$$

Assume that $\Lambda_t < 1$. First, holding real wage constant, at the prevailing tax rates, increases in household's consumption may require less hard works in official labor markets. In other words, it is the production of underground goods that attract more labor participations in underground labor market that satisfies the rise in total consumption. The intuition is if government is unable to levy lump sum tax or other non-distorting indirect tax, given G_t^{NM}, $\Lambda_t < 1$ implies higher future taxation burden. Household therefore reacts against the expectation of higher future taxation burden by participating in underground economy.

Second, holding consumption fixed, the inverse relationship between labor supply in market production and real market wage has been strengthened. This is because a higher real wage, given hours of work, implies greater income tax burden, which in turn makes working in official labor market more costly. However, the cost of leisure could remain unchanged. After all, higher market real wage induces labor reallocation from official to underground labor market while leaving total hours of work constant.

Third, if both consumption and real wage arise proportionally, supply of labor in official labor market will fall for the reasons discussed above. (31) is useful as an alternative explanation to account for some important facts of long run economic growth. Among others, consumption and real wage tend to rise over time with relatively stable hours of work, while participation rate is inversely related to market output fluctuation.

Proposition 2

Demand for cash balances is a function of market income, opportunity cost of holding cash balances, and taxation burden conditional on the fiscal regime.

Proof. By applying similar procedures as in the proof of Proposition 1, we obtain

$$\frac{M_t}{P_t} = \theta(1-\alpha)Y_t^M\left(1+(\Lambda_t^{-1}-1)(\tau_t^W+\tau_t^R)\right)\left(\frac{1+i_t}{i_t}\right) \tag{32}$$

Demand for cash balances varies directly with market income and taxation burden, and inversely with nominal interest rate. ■

Taxation affects currency demand in such a way that rising taxation burden induces both household and firm to involve in "cash-only" activities to avoid certain tax payments.

Proposition 3

The size of underground economy, as a share of market economy, is given by

$$\frac{Y_t^U}{Y_t^M} = \left(\Lambda_t^{-1}-1\right)\left(\tau_t^W+\tau_t^R\right) \tag{33}$$

Proof. Divide (32) by (17). As $Y_t = Y_t^M + Y_t^U$, some manipulation of algebra gives (33).■

3. Estimates of the Size of Underground Economy

In this section we will use the dynamic currency demand approach to estimate the size of underground economy in Malaysia spanning 1970-2005. Unlike the existing literature that uses currency demand approach, among others, Pickhardt and Pons (2006), and the reference cited, we derive the functions of demand for currency from dynamic general equilibrium framework.

We specify equation (17) and (32), respectively, in log-log terms, that is:

$$\log\left(\frac{M}{P}\right)_t = \beta_0 + \beta_1 \log Y_t + \beta_2 \log\left(\frac{1+i_t}{i_t}\right)_t + u_t \tag{34}$$

$$\log\left(\frac{M}{P}\right)_t = \beta_0 + \beta_1 \log Y_t^M + \beta_2 \log\left(\frac{1+i}{i}\right)_t + \beta_3 \log\left(1+(\tau_t^W+\tau_t^R)\right) + u_t \tag{35}$$

Here, let $\log(1+\tau_t^W+\tau_t^R) \approx \tau_t^W+\tau_t^R$. Equating (34) and (35), and rearranging it yields

$$\frac{Y_t^U}{Y_t^M} = \frac{\beta_3}{\beta_1}(\tau_{t-j+1}^W+\tau_{t-j+1}^R) \tag{36}$$

3.1. The dynamic currency demand model estimates

The dynamic currency demand model as in Equation (35) is estimated using annual data from 1970 to 2005 for Malaysia. In its most general form, demand for real currency can be written as:

$$RCC = f(RGDP, IR, ATR)$$

The real currency, RCC, is measured by the currency in circulation deflated by consumer price index (2000 =100). The real currency demand function is modeled as a function of scale variable, for which we use real income, RGDP. To obtain a measurement of real income, the gross domestic product is deflated by consumer price index. Interest rate, IR, the opportunity cost on which the currency demand depends, refers to 3 month Treasury bill rate. Last but not least, we use average tax revenue ATR, as a proxy to taxation burden. All the data are sourced from International Financial Statistics of International Monetary Fund, except for currency in circulation and tax revenue obtained from Asia Development Banks' key indicators on various issues.

To ensure that the dynamic currency demand regression does not suffer from spurious regression, we examine the stationarity assumption for each and every variable under consideration. Table 2 reports the result of Augmented Dickey Fuller (ADF) unit root test, both in levels and first difference. The test result indicates that all the variables involved are only stationary in first difference. Upon this evidence, the OLS estimate of the dynamic currency demand regression in Equation (35) that assumes stationarity seems to be inappropriate and likely to produce spurious results. However, the possibility of cointegration among these variables in the model would allow further investigation of long run currency demand model. This is in view of what is coined the 'superconsistency' property of the OLS estimator for cointegrated series.

Table 2: Results for ADF unit root test

	Levels		First Differences	
	Constant without trend	Constant with trend	Constant without trend	Constant with trend
RCC	-2.4639 (1)	-2.5515 (1)	-7.8015 (0)	-8.3987 (0)***
RGDP	-0.8249 (0)	-2.5383 (0)	-5.0560 (1)***	-5.0880 (1)***
ATR	-2.3077 (0)	-2.7715 (0)	-6.2715 (0)***	-6.3030 (0)***
IR	-1.8370 (0)	-2.0256 (0)	-5.7654 (0)***	-5.7486 (0)***

Notes: RCC = currency in circulation/ CPI, RGDP = gross domestic product/ CPI, ATR = 1 + tax revenue / GDP), IR = (1 + 3-month Treasury bill rate)/3-month Treasury bill rate. All variables are in natural logarithms, D denotes the first difference operator. Figure in brackets denotes the proper lag structure based on the AIC criteria. ***, **,* indicates rejection of the null hypothesis of nonstationary at the 1, 5, 10% level of significance.

We then use Johansen and Jeselius (JJ) method in multivariate setting to examine the likely cointegration among the model variables. Table 3 assembles the results from the trace and maximal eigenvalue version of the JJ test. The evidence clearly suggests the presence of one nonzero cointegrating vector among the model variables, which, after all, allow us to estimate the long run currency demand model as in Equation (35). Table 4 shows the estimated result of the dynamic currency demand model with the Newey-West corrections[5].

Table 3: Johansen Juselius (1992) Multivariate cointegration test results

Hypothesized number of cointegrating vector(s)	Max-Eigen Statistics	Max-Eigen C.V.(95%)	Trace Statistics	Trace C.V.(95%)
None	33.9899***	27.5843	55.3261***	47.8561
At most 1	16.8815	21.1316	21.3361	29.7971
At most 2	3.2515	14.2646	4.4547	15.4947
At most 3	1.2032	3.8415	1.2032	3.8415

Notes: see notes to Table 2. The tested cointegration contains for variables (RCDD, TAX, RGDP, and IR). All variables in natural logarithms form.

Table 4: OLS estimations with Newey-west corrections for dynamic currency demand model

Variables	Coefficient	t-statistics
Constant (β_0)	-1.771***	-5.615
RGDP (β_1)	0.865***	36.771
IR (β_2)	-0.301	-1.671
ATR (β_3)	1.742*	1.837
DUM87	0.177***	4.823
DUM99	0.186***	5.786

Notes: see notes to Table 2.N = 36. DUM = dummy variable.

3.2 Estimation of underground economy

From equation (36), an estimation of the size of the underground economy in Malaysia can be obtained, as shown in Figure 1. The estimated size is in the range of 27 to 48 percent of GDP with standard deviation of 5 percent, in line with the findings of Habibullah and Eng (2006), and Schneider (2005).

[5] The results of diagnostic tests are available upon request.

4. Fiscal regime consideration

The *ad hoc* currency demand approach is often criticized for considering taxation as the only cause and fiscal pressure induced by tax system as the only indicator of underground activities (Scheneider and Enste, 2000, Pickhardt and Pons, 2006). Increasing tax rates drive households into underground activities to avoid the resultant higher tax burden, and vice versa.

However, the *dynamic* currency demand approach that also considers distorting taxation as the only cause of underground activities has offered new insight. Whether increasing tax rates could have induced households to participate in underground activities depends on its counterpart, that is, government expenditure. According to (33), if at date *t* the tax revenue collected is completely dispensed via government transfer, $\Lambda_t = 1$, there is no room for underground economy. Put it differently, underground economy is consistent with any level of tax rates as long as the tax burden is offset by equivalent government transfer.

However, Λ_t rarely equals one. If the government is not able to levy non-distorting lump sum tax, reducing distorting tax rates accompanied by rising government expenditure may contribute to larger size of underground economy. The intuition is simple. As discussed in (31), households that react to even higher expected tax rate at date *t + 1* will participate in underground activities. Unless ensued by a shrink in government expenditure at faster pace, one should not jump into the conclusion that lower tax rate could end in smaller size of underground economy.

On the flip side, increasing tax rates accompanied by shrinking government expenditure at date *t* would lead to a fall in the size of underground economy seeing that households expect a lower tax rate at date *t + 1*. Higher tax rates drives households and firms into underground activities only if the fiscal condition deteriorates as the government expenditure explodes simultaneously.

After all, based on (31) and (33), we infer that it is not the *current* taxation burden that matters. Rather, it is the fiscal regime that affects both current and *future* taxation burdens that matters. Worsening (improving) fiscal conditions, with limited sources of taxation, tends to raise (lower) the expectation on future distorting tax rates, and thus cause larger (smaller) size of underground economy. Nevertheless, fiscal condition is less worrying if the government could impose other lump sum tax or less distorting indirect tax.

4.1 Simulated size of underground economy adjusted for fiscal condition

To compute the size of underground economy adjusted for fiscal regime, we first equate (33) and (36). Given the estimation results, we know that $\beta_3 / \beta_1 = 2.01$ implies an approximate $\Lambda_t = 0.33$. Second, as (33) uses the concept of average marginal tax rate while (36) the average tax rates, to improve the comparability between (33) and (36) we compute the average marginal tax rate (AMTR) according to[6]

$$AMTR_t = (1 + |\varepsilon_t|) ATR_t \tag{37}$$

What follows next is the calculation of the annual Λ_t from 1970 to 2005. Indexed by $\Lambda_t = 0.33$, and together with (37), we finally recompute the hypothetical size of underground economy adjusted for fiscal condition, shown in Figure 1.

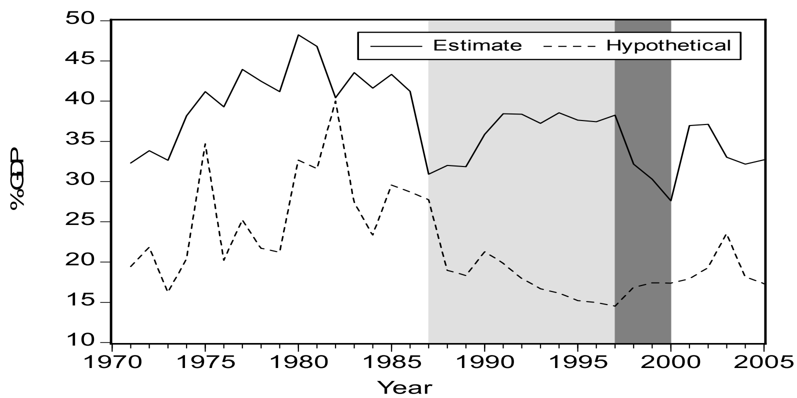

Figure 1: The size of underground economy adjusted for fiscal regime

One could observe that the size of underground economy turns out to be relatively smaller, technically thanks to higher share of distorting tax revenue in total government spending. It is unsurprising, however, if we consider the government transfers to the household that partially offset the taxation burden in estimations.

That captures the attention here is the trend of the fiscal-regime adjusted size of underground economy that diverges clearly from the conventional measurement since 1987 till 2000. The conventional measurement exhibits a growing size of underground activities from 1987 to 1997, which, however, after being adjusted for fiscal condition, declines over time. In retrospect, this is due to the Malaysian fiscal consolidation after the 1985 sovereign debt crises. In particular, the fiscal stance has been in surplus for the first half of 1990s. The improving fiscal condition, as discussed earlier, should lower the expectation on future taxation burdens, thereby driving the households out of the underground economy.

Worsening fiscal condition after 1997/98 financial crises, partly as an effort to alleviate the pains of recession, that implies an arising future taxation burden has put the underground economy on the path of arising since 1997, in contrast to the falling trend as in conventional measurement from 1997 to 2000 that considers only the lower current average tax rates.

[6] See appendix for the derivation of AMTR from ATR.

We believe that the estimates of the size of underground economy that takes fiscal regime into account offer a better illustration on its role as shock absorber. For instance, Busato and Chiarini (2004) argued that underground activities offer risk sharing opportunities by allowing households to smooth income through a proper labor allocation between market and underground sectors. One should expect rising, not falling, levels of underground activities as the formally unemployed workers substitute into underground economy during the economic recession (1997-98). Likewise, it is hardly acceptable that the households and firms will involve more actively in underground activities during economic good time (1987-1997).

5. Conclusion

The present paper attempts to add values to the use of conventional currency demand approach in estimating the size of underground economy by integrating this most widely used approach into a dynamic general equilibrium model. We then use the derived money demand function to estimate the size of underground economy in Malaysia for the period of 1970 – 2005. What makes the dynamic currency demand approach interesting and insightful is its general equilibrium analysis. In particular, we argue that it is not the *current* taxation burden *per se* as suggested in the conventional currency demand approach that matters. Instead, it is the fiscal regime that affects both current and *future* taxation burdens that matters. Whether increasing current tax rates could have induced households to participate in underground activities depends on the path of government expenditure. Higher current tax rates along with a cut in government spending that signal a lower future tax burdens may indeed produce a smaller size of underground economy. On the flipside, lower current tax rates combined with increasing government spending that hint at greater future tax burdens could kick off a rising size of underground economy.

Also, we uncover that the trend of the size of underground economy, after taking the fiscal condition into account, is in line with the existing literature on the role of underground economy as risk-sharing mechanism. Specifically, expansionary fiscal stance occurs mostly during economic recession. To maintain the living standard one would see a switch of unemployed workers into the underground labor markets at the given wage rate. Similarly, firms should have used informal-labor intensive mode of productions for cost saving in the wave of market retrenchment. After all, the level of underground activities should be arising. In this respect, the dynamic currency demand approach performs better than the conventional currency demand approach that predicts a fall in the level.

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Appendix

By definition,

$$ATR = \frac{TR(Y)}{Y} \tag{A1}$$

where *TR* = total revenue, and is a function of total income, *Y*. Differentiating *ATR* against *Y* gives us

$$\frac{\partial ATR}{\partial Y} = \frac{1}{Y}\left(\frac{\partial TR}{\partial Y}\right) - \frac{TR(Y)}{Y^2} \tag{A2}$$

Given that $AMTR = \frac{\partial TR}{\partial Y}$. Together with (A1), (A2) can be rearranged to yield

$$AMTR = ATR(1 + |\varepsilon|) \tag{A3}$$

where $|\varepsilon| = \left|\frac{\partial ATR}{\partial Y} \times \frac{Y}{ATR}\right|$ denotes the absolute income elasticity of average tax rate.