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Currency Demand Modeling in Estimating the Underground Economy in Turkey: An Error Correction Framework

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Abstract

Underground economic activities are one of the most important problems, especially in developing countries. Since it's size is not known exactly, the determination and implementation of macroeconomic and social policies become very critical. The measurement of the underground economy has been the subject of intense debate in the literature. Some authors have used the direct method to assess the underground economy while others have attempted an indirect method, known as the non-monetary approach and monetary approach, respectively. A commonly used approach to measure the size of the underground economy, known as the monetary method, is based on econometric estimates of the demand for currency. The currency demand approach provides some insight into the size and development of the underground economy in Turkey. This study follows the monetary approach based on a monetary indicator and in particular the amount of currency in circulation. It differs however from previous studies by introducing technological variables related to banking activities to demand for currency function and the use of quarterly data instead of end of year figures for the 2002-2010 period.

Keywords: Underground Economy, Currency Demand, Error Correction Model
JEL Classification Codes: C51, E26, E41.

1. Introduction

The underground economy, which consists of all commerce on which applicable taxes are being evaded, leads to misleading macroeconomic indicators and thus the application of irrational economic policies. During the 1960's, the underground economy was started to be discussed as an important economic and social issue in western economies and in the U.S.A. In the 1980's it became a problem discussed in all economies worldwide.

During the last few years there has been growing concern about the phenomenon of the hidden (or shadow) economy among the public, politicians and social scientists. A useful and commonly used working definition of the underground economy is: All economic activities that contribute to value added and should be included in national income in terms of national accounting conventions but are presently not registered by national measurement agencies (Schneider, 1986:643). The underground economy is essentially unrecorded, so official national accounts statistics inaccurately reflect the true state of the economy. Basic macroeconomic principles dictate that without accurate accounting, central banks and other monetary policymakers must establish an effective monetary policy in an atmosphere of significant uncertainty (Houston, 1990:27-37). Effective monetary and fiscal policy design requires

a level of precision in the estimates of key statistics, such as output and unemployment, and the presence of non-trivial production in the shadow economy can distort these measures. Consequently, efforts should be made to supplement official national accounts statistics with estimates of shadow economic activity (Farrell et al, 2000).

This paper tries to estimate the size of the underground economy in Turkey by using the currency demand approach for the period 2002 – 2010 along with the relationship between legal economic activities. The rest of the paper is organized as follows: Section 2 deals with the definition and main determinants of the underground economy; Section 3 provides basic information on estimation methods for the size of the underground economy discussed and applied in the literature; Section 4 gives a short literature review related to Turkey and develops a currency demand model to estimate the size of the Turkish underground economy and tests its relation with legal activities. Finally, Section 5 concludes the paper.

2. Definition and Determinants of the Underground Economy

The phenomenon is known, and has been discussed in the literature, under many different names: informal, unofficial, irregular, parallel, second, underground, subterranean, hidden, invisible, unrecorded and shadow economy or moonlighting. In several languages the term most often used is black economy (Frey and Schneider, 2000). In this paper we are going to use a number of these terms.

Most authors trying to measure the unrecorded economy face the difficulty of how to define it. When the literature for the underground economy is analyzed, some basic definitions are observed. According to the definition of Smith (1994), the underground or shadow economy consists of "market-based production of goods and services, whether legal or illegal that escapes detection in the official estimates of GDP". Schneider and Enste (2000) define the underground economy in a similar manner as all economic activities which contribute to the officially calculated (or observed) gross national product. According to Schneider (1986) the underground economy is the all economic activities that contribute to value added and should be included in national income in terms of national accounting conventions but are presently not registered by national measurement agencies.

It is clear that the underground economy includes unreported income from otherwise official trade in goods and services, e.g. through monetary or barter transactions, and so includes all economic activities that would generally be taxable when they reported to the state (tax) authorities. Consequently, it includes all market-based legal production of goods and services that are deliberately concealed from public authorities for any of the following reasons:

- to avoid payment of income, value added or other taxes,
- to avoid payment of social security contributions,
- to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, and,
- to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms (Schneider et al, 2009: 701-722).

It is a well-known fact that, beyond the above cited factors, low and fixed income consumers whose income is eroded by inflation and producers who face increase in their costs due to inflation (and also economic crises) tend to go for various elements of the informal economy, in particular informal employment in order to cover their losses and reduce their costs, respectively. Therefore, it is observed that in countries with high inflation rates, the size and scope of informal economic activities tend to increase.

When one considers the development of the economy the causes of the informal economy differ. In developed countries, these are generally conditional on such factors as tax related factors and labor market regulations; in developing countries, on the other hand, such factors as population growth and migration to urban areas should be taken into consideration in addition to the above mentioned factors.

Following Halıcıoglu and Dell Anno (2009: 2), methodologies of calculating the underground economy may be classified into three categories:

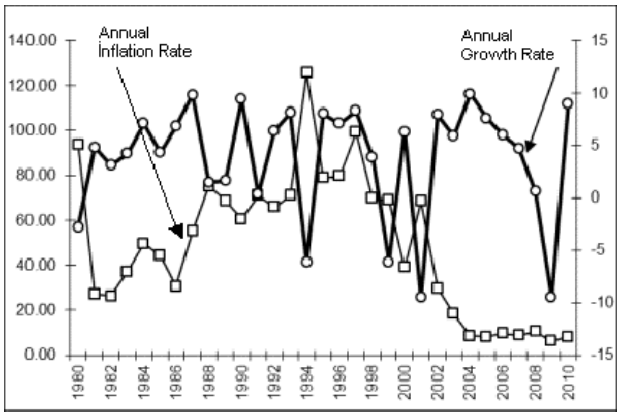
- direct approaches,
- indirect approaches and
- model-based approach

The direct approaches are based on contacts with or observations of people and/or firms to gather direct information about undeclared income. Two kinds of such methods exist: (1) the auditing of tax returns and (2) the questionnaire surveys. The indirect approaches try to determine the size of the underground economy by measuring the traces that it leaves in official statistics. They are often called indicator approaches and use mainly macroeconomic data. We distinguish among three sub-categories of indirect methods: (1) approaches based on national accounts (e.g., discrepancy between income and expenditure, and discrepancy between official and actual employment); (2) monetary approaches; and (3) physical input methods. Finally, the model approach (or MIMIC method) is based on the statistical theory of latent variables, which considers several causes and several indicators of the underground economy. The model approach considers the dimension of the underground economy like a "latent variable", therefore it applies the statistical modelling, usually utilised by social research to explore unobservable variables. The MIMIC approach is based on two parts: (1) a measurement model; (2) a structural model. While the first part links the latent variable to observable indicators, the second specities the relationship between the causes and the unobservable variable.

3. Estimating the Size of the Underground Economy in Turkey

As a result of its high inflation rates and a couple of severe economic crises experienced, Turkey has been characterized by economic instability during the last thirty years. After the most harmful banking sector driven crises of 2001 with the almost 140% annual inflation rate and -10% annual economic growth rate, Turkey has carried out some structural reforms within a heterodox stabilization program. Because of the stabilization measures (specifically related with the fiscal discipline) and reforms (specifically related with implementing monetary policy) inflation rates were reduced to single digit levels as can be seen from the following graph:

Figure 1: Annual Inflation and Economic Growth Rates 1980-2010



As a consequence of the economic instability, it is claimed that the Turkish underground economy has enlarged faster than the formal economic activities during this period. Many researchers, academics and policymakers are interested in the underground economy and its measurement in Turkey. Table 1 below summarizes the measurement efforts that have been conducted by various authors.

Table 1: The Size of the Underground Economy in Turkey from Various Studies

Author(s)	Period	Underground Economy as % of 'Official' GDP	Methodology
Kasnakoğlu (1993)	1968-1990	4 - 35	Currency Ratio
Temel et.al. (1994)	1975-1992	6 - 20	Currency Demand Approach
Yayla(1995)	1968-1993	0 - 42	Currency Demand Approach
Öğünç-Yılmaz (2000)	1971-1999	11 - 22	Currency Demand Approach
Çetintaş-Vergil (2003)	1971-2000	17 - 31	Currency Demand Approach
Savaşan (2003)	1970-1998	10 - 45	MIMIC Randomized Response
Us (2004)	1987-2003	3 - 12	Currency Demand Approach
Dorukkaya(2005)	1998-2004	29 - 37	Tax Evasion Rate
Baldemir et.al. (2005)	1980-2003	11 - 28	MIMIC Randomized Response
Yılmaz (2006)	1970-2004	0 - 178	Simple Currency Ratio
Akalın – Kesikoğlu (2007)	1975-2005	0 - 47	Monetary Approach
Karanfil- Özkaya (2007)	1973-2003	12 - 30	Kalman Filter
Savaşan-Altındemir (2007)	1970-1998	10 - 45	MIMIC Model
Savaşan – Schneıder (2007)	1999-2005	31	DYMIMIC Estimation Approach
Davutyan (2008)	2005	21	Expenditure-based Approach
Karagöz-Erkuş (2009)	1970-2005	86 - 73	Tax Evasion Rate

The measurement of the underground economy has been the subject of intense debate in the literature. Some authors have used the direct method to assess the underground economy while others have attempted an indirect method, known as the non-monetary approach and monetary approach, respectively. As the table shows, the estimated size of the shadow economy ranges from 3% to 178% depending on the time period investigated and the methodology used. Most of the studies cited in the table used one of the indirect (macroeconomic indicator) approaches by using the annual data. This study follows the monetary approach based on a monetary indicator and, in particular, the amount of currency in circulation. The approach basically originates from the model of Tanzi (1983: 283-305). It differs however from previous studies by introducing technological variables related to banking activities to demand for currency function and the use of quarterly data instead of end of year figures.

As discussed in the introduction of this paper, the approach is applied with three main assumptions. First, the underground economy is generated through tax evasion. Second, currency alone is used as a medium to carry out transactions in the underground economy. Third, velocity of illegal money is the same as that of legal money. See the underlying factors and further explanations of these assumptions; Jhonsen and Kaufmann(1998),Freidrich and Enste(2002), Yasmin and Rauf(2004).

As currency is part of money demand, our model has the standard demand for money arguments (income, prices and opportunity costs of holding currency) and also incorporates the average tax rates and variables to capture financial innovations and other structural changes in the financial sector. In the estimation procedure, first the currency demand equation is estimated with the justification that most of the transactions are carried out in the form of cash in the underground economy in order to reduce the chances of detection. The demand for currency is measured by the Turkish Republic Central Bank's currency in circulation definition. This definition is the simple total of the banknotes issued plus coins and minus bank vaults. The following is the model applied to estimate the currency demand equation:

$$C = f\left(Y^d, i, tax, ATM, CCARD\right)P \tag{1}$$

Where C is the nominal demand for currency, P is the price level, Y^d is the real disposable income level out of direct taxes, i is the nominal rate of interest, *tax* is the defacto average tax ratio for direct taxes, *ATM* is the number of automated teller machines and *CCARD* is the number of credit cards issued. According to the conventional demand for money specification, (C) is the sum of currency demanded for the economy as a whole (both official and underground). A rise in the real disposable income level will increase currency demand, while a rise in the opportunity costs of holding money -nominal interest rate- and financial innovations will reduce demand for currency. Given the key assumption in the Tanzi (1983) approach that the underground economy is more cash intensive

than the official economy, an increase in taxes is expected to increase demand for currency. From the very beginning of the 90s the Turkish banking system has been subject to significant innovations and technological changes. Computerization of banking services, proliferation of automatic teller machines (ATMs) and a rapidly expanding credit card usage were key advances. These factors together seriously affected the cost of obtaining, and therefore, demand for currency in the economy. In order to see the possible effects of these factors separately, we included two different variables (the number of ATMs and credit cards) into the demand for currency function. As can be seen from equation (1) the price level variable enters the equation with a positive unit coefficient. To test whether the theoretical argument regarding the incomplete transmission mechanism is verified we included this variable with the coefficient of β in a theoretical expectation equaling 1.

All the data were obtained from the Turkish Central Bank's electronic data base except the number of ATMs and credit cards. Related data for these variables came from the Interbank Card Center. We used quarterly data for the period 2002:1 – 2010:2 for the subsequent currency demand analysis since the quarterly data representing technological innovation and banking services variables are only available for this period.

Sriram (1999b), Cziraky and Gillman (2006), and Mishkin (2007) argue that the stability of money demand helps predict the effect of monetary policy on interest rates, output and inflation, and therefore reduces the possibility of an inflation bias. Central banks increasingly regard stable money demand as an important condition for conducting monetary policy, and more researchers have devoted their efforts to examining this issue. One prevailing argument is that stable money demand exists if the demand for money has a long-run cointegrating relationship with its determinants (Granger, 1986). Following Granger, the error correction model (ECM) has proven to be the most useful method for estimating the real demand for money, because the cointegration in ECMs means that whenever the demand for money diverges from its steady-state, a short-run adjustment pushes it toward equilibrium. Some studies conclude that money demand is stable after finding a long-run relationship in their estimated ECMs (see Lee and Chung, 1995; and Yu and Gan, 2009). Others search further and examine statistical tests for the constancy of parameters, in order to give a robust conclusion about the stability of long-run money demand (e.g., Huang, 1994; Anglingkusumo, 2005; Cziraky and Gillman, 2006; Baharumshah, Mohd and Yol, 2007; and Wu, 2009). Bahmani-Oskooee and Shin (2002) argue that cointegration is not sufficient for stability; rather it is also important to test whether the long-run and short-run estimated elasticities are stable over time. Useful tests for this include the CUSUM and CUSUMSQ tests. Depending on the above cited reasoning, this study employs an error-correction model (ECM) to estimate the determinants of currency demand. The ECM includes both long-run and short-run relationships estimated in two stages. First, the long-run relationship is:

$$c_t = \alpha + \beta(p_t) + \gamma(y_t^d) + \eta(i_t) + \varphi(tax_t) + \phi(atm_t) + \lambda(ccard_t) + \zeta_t \tag{2}$$

Where the lower case letters indicate the log levels of relevant variables defined already, except the interest rate and the average tax ratio. The parameters α and ζ is the constant and error terms, respectively. Next, the short-run dynamic adjustment equation is:

$$\begin{aligned}\Delta c_t = &\sum_{k=1}^{n} \beta \Delta p_{t-k} + \sum_{k=1}^{n} \gamma \Delta y_{t-k} + \sum_{k=1}^{n} \eta \Delta i_{t-k} + \sum_{k=1}^{n} \varphi \Delta tax_{t-k} \\ &+ \sum_{k=1}^{n} \phi \Delta atm_{t-k} + \sum_{k=1}^{n} \lambda \Delta ccard_{t-k} + \psi \zeta_{t-1} + \xi_t\end{aligned} \tag{3}$$

The error-correctionterm ζ_{t-1} is defined as the difference between the actual demand for currency at time t-1 and its estimate from the long-run equation in the same period. The presence of ζ_{t-1} in this equation demonstrates the dynamic short-run adjustment. When the demand for money deviates from its long-run equilibrium, the ζ term will subsequently work to bring it back to the equilibrium level. Therefore, its coefficient is expected to be negative.

To estimate the two-stage ECM, it is necessary to first test for the stationary of the variables and the existence of a vector of cointegration. The variables should be non-stationary but cointegrated to form the long-run relationship, while the short-run dynamic adjustment requires stationary variables. This study uses the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) tests for the stationary of

the model variables. Table 2 provides the test results and shows that unit roots cannot be rejected for all variables in their levels while first level differencing create a stationary in the data.

Table 2: Unit Root Tests Results

	ADF Test			PP Test		
Variable	**Lag**	**Test Statistic**	**Marginal Significance**	**Band**	**Test Statistic**	**Marginal Significance**
c	0	2,736*	0,230	3	2,642*	0,266
Δ(*c*)	0	3,421	0,018	1	3,332	0,022
y	0	1,965	0,300	2	1,871	0,341
Δ(*y*)	0	4,341	0,002	2	4,330	0,002
p	1	1,614	0,464	2	1,568	0,487
Δ(*p*)	1	3,478	0,016	5	1,835	0,064
i	0	1,632	0,456	4	1,809	0,370
Δ(*i*)	0	5,762	0,000	3	5,761	0,000
atm	1	1,496*	0,810	3	1,518*	0,802
Δ(*atm*)	0	3,055	0,040	0	3,055	0,040
ccard	3	2,337*	0,403	3	0,821*	0,953
Δ(*ccard*)	2	4,424*	0,007	0	2,994*	0,052
tax	0	1,316	0,610	4	1,608	0,468
Δ(*tax*)	1	4,166	0,003	3	5,400	0,000

***** indicates trend inclusion

Error correction methodology developed in Engle-Granger (1987) depends on the existence of a cointegrating relationship among nonstationary time series. If, at least one cointegrating vector among these nonstationary time series can be found, then ECM is applicable. This requires estimating the static currency demand to test whether a cointegrating relationship exists between error terms obtained and the variables used. The estimated static demand for currency equation therefore includes the nonstationary log level series only. Obtained results for the static equation are shown below in Table 3:

Table 3: Long-run (Static) Demand for Currency Estimation Results

Coefficient	**Estimate**	**t-Value**	**Marginal Significance**
constant	-14,065	4,211	0,000
y^d	0,937	4,502	0,000
P	0,822	3,386	0,002
I	-0,277	1,325	0,197
tax	0,242	2,283	0,031
atm	-0,568	2,318	0,029
ccard	-0,340	2,643	0,014
ADF*		8,129	0,000
PP*		8,016	0,000

***** indicates ADF and PP unit root tests for the residuals obtained, respectively

The estimated long-run model shows that the explanatory variables for the currency demand carry the expected signs and are statistically significant at the 5 percent level except for the interest rate. Reported ADF and PP test statistics show that residuals obtained for a specified currency demand function are stationary; thus one can conclude that at least one cointegrating relationship exists among variables[1]. The implication is that a linear combination of all the series was found to be stationary and thus, are said to be cointegrated. In other words, there is a stable long-run relationship between them and so we can avoid both the spurious and inconsistent regression problems which otherwise would

[1] Although it is not reported in the text, we also performed the traditional "trace" and "maximum eigen value" tests for cointegration among the nonstationary variables in the model. Both test statistics indicate the existence of at least 3 cointegrating vectors in the data after applying small sample correction suggested by Johansen (2002).

occur with regression of non-stationary data series. Having identified the cointegrating vector, we proceed to investigate the dynamics of the short-run currency demand. Table 4 reports the final parsimonious estimated equation using differenced terms of the nonstationary series together with one quarter lagged error term obtained from the long-run currency demand equation covering a set of commonly used diagnostic statistics.

Table 4: Short-run (Dynamic) Demand for Currency Estimation Results

Coefficient	Estimate	t-Value	Marginal Significance
$\Delta(y^d)$	0,437	2,692	0,014
$\Delta(p)$	1,062	1,898	0,072
$\Delta(i)$	-0,366	2,536	0,019
$\Delta(atm)$	-1,356	3,492	0,002
$\Delta(ccard)$	-0,190	1,960	0,064
$\Delta(tax)$	8,712	1,717	0,101
ECT	-0,835	4,186	0,000
$R^2 = 0,677$		SER = 0,020	
Diagnostic Tests			
Test		**Estimation**	**Marginal Significance**
Breusch – Godfrey		6,825	0,787
ARCH		0,159	0,923
White		0,493	0,903
Chow Breakpoint		8,143	0,472
Ramsey Reset		6,341	0,850

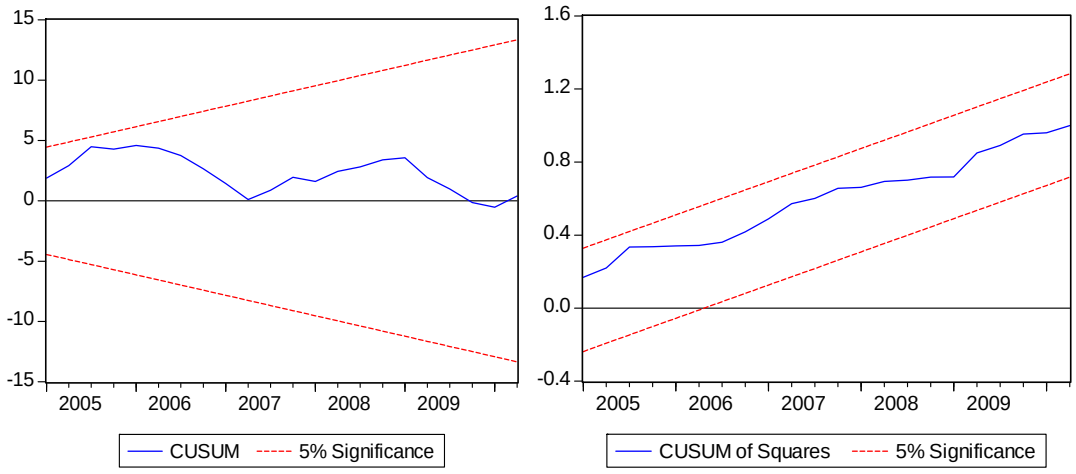
It is worth noting that all the coefficients estimated have expected signs and statistically significant in acceptable levels of significance. As expected, the error correction term carries a negative sign and is highly significant in the short-run dynamic adjustment model, which confirms the long-run relationship in the cointegration analysis. The negative sign and value of ζ_{t-1} implies that currency demand adjusts to restore 84 percent of disequilibrium from the preceding quarter. This correction speed is rather fast compared to the findings for other countries, for example 6 percent in China (Baharumshah et al., 2007), 6.2 percent in Nigeria (Owoye and Onafowora, 2007), and 10 percent in Pakistan (Qayyum, 2005). The rapid adjustment reflects the low cost of portfolio adjustment relative to the cost of being out of equilibrium (Thornton, 1983). Note also that a significant and high error correction term implies long-run causality from the explanatory variables to the dependent variable (Granger, 1988).

Applied t-test for the null hypothesis of unity shows that the coefficient on prices is positive unity and significant, reflecting the theoretical expectations, while both coefficients on financial innovations are negative and significant, in line with expectations. The results also indicate that the tax variable has important effects on currency demand. The short-run elasticity of the average tax rate at 8.70 is extremely large indicating that the underground economy is strongly driven by the incentive for tax evasion. The results indicate that the overall explanatory power of the model is fairly good, with R-squared of 0.67.The model satisfies all of the basic diagnostic tests, as can be seen from Table 4. The test for functional form (Ramsey RESET) shows no evidence of misspecification at the 5 percent significance level. Also, the Breusch-Godfrey and Arch tests indicate no evidence of serial correlation and White test statistic indicates non-heteroskedastic disturbances. The Chow test for parameter stability was conducted by splitting the total sample period into 2002:1-2007:1 and 2007:2-2010:2 and there is no evidence of parameter instability.

If money demand is stable and well-defined, it helps central banks to meet their goals in a money supply targeting or an interest rate targeting mechanism. When researchers investigate this issue, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests have been used most frequently (see Bahmani-Oskooee and Shin, 2002; Qayyum, 2005; and Owoye and Onafowora, 2007). Based on the break points in the dataset, the CUSUM and CUSUMSQ statistics are recursively updated and plotted with 5 percent

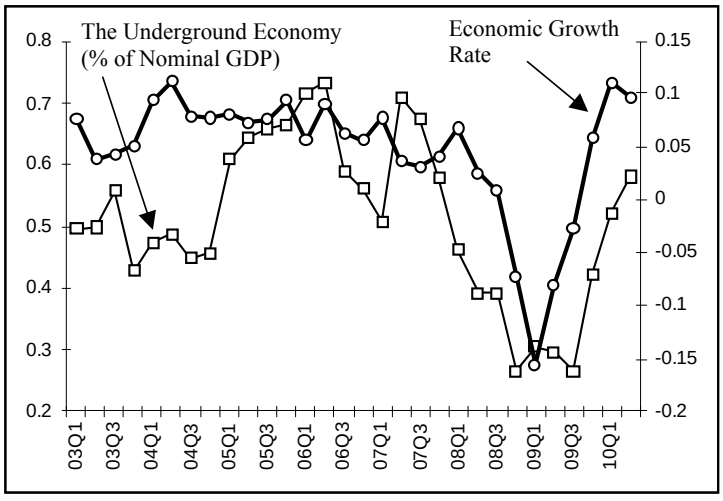
critical boundaries. If the plotted statistics stay within the ±5 percent boundaries during the investigated period, the money demand function is said to be stable. Sriram (1999a) states that testing only for long-run models can result in a specification bias, so it is better to test for the model with both long-run and short-run effects, i.e. the short-run dynamic ECM. Figure 2 displays the results of the CUSUM and CUSUMSQ tests. The recursive statistics move within the boundaries, suggesting that the estimated currency demand function is stable.

Figure 2: Stability Test Results



After estimating the currency demand equation for each year, the predicted levels of the currency with tax variable (C^{tax}) and without tax variable (C^{wotax}) are calculated using the equation (3). The difference between (C^{tax}) and (C^{wotax}) for the respective years shows how much taxes cause people to hold currency that gives the estimates of illegal money. Assuming that the velocity of circulation of currency is the same in both the official and underground economies, the GDP for the underground economy was obtained as the product of the estimated underground currency holdings and the calculated velocity. Figure 3 shows the size of the underground economy expressed as a percentage of official nominal GDP.

Figure 3: The Size of the Underground Economy as a Percentage of Nominal GDP and Real GDP Growth Rate in Turkey



According to calculations depicted above the ratio of the underground economy to nominal GDP changes from 30% to 70% with an average of 51% in the period under investigation. These

figures are closer to ones found by Kasnakoğlu(1993), Temel et al. (1994), Ogunc and Yilmaz (2000), Cetintas and Vergil (2003), Savasan (2003), Karanfil and Ozkaya (2007), Akalın and Kesikoğlu(2007), Schneider and Savasan(2007), and Erkuş and Karagöz(2009). Besides the relative large size of the underground economy, it is interesting to see that it fluctuates with the economic growth trend of the Turkish economy. When the economy grows rapidly, so does the underground economy, and vice versa. This seemingly close relationship suggests that the causality relationship between the underground economy and the economic performance of the economy should be investigated.

On this issue, the literature presents contradictory results. Some studies find some supporting evidence that the underground economy affects the official economic growth positively while the others predict opposite interactions between two types of economic activities. It is claimed that in the developed world a growth rate of 1% in underground activities creates a reduction of 5% in recorded activities. When one considers developing countries, this relationship is reversed and become stronger: A 1% increase in unrecorded economic activities creates an 8-10% increase in official economic activities (Kızılot and Çolaklı, 2004: 7). The main reasoning behind the positive interaction is that almost 60% percent of total income obtained from underground economic activities is spent in legal economic activities in developing countries (Halıcıoğlu and Dell Anno, 2009: 6). To deal with this issue we carried out Granger causality tests between the growth rates of the estimated unrecorded economy and the official economy in nominal terms because of the fact that we had used the nominal income velocity in the calculation of the underground economy[2]. Results shown in Table 5 below indicate that there is an unidirectional causality from underground economic activities to legal economic activities.

Table 5: Granger Causality Test Results

Direction of Causality	F-Statistic	Lag	Probability
Underground Economy ⇒ Recorded Economy	2,616	4	0,075
Recorded Economy ⇒ Underground Economy	1,344	4	0,307

A PDL (Polynomial Distributed Lags) form of simple regression should give the sign and magnitude of this unidirectional causality by estimating the following equation:

$$\Delta y_t = \sigma + \omega \sum_{z=1}^{4} \Delta ue_{t-z} + \Delta y_{t-1} + \xi_t \qquad (4)$$

Where Δy and Δue show the first differences of the log levels of nominal GDP and the underground economy, respectively. According to Table 6, which shows the estimation results of Equation (4), the cumulative coefficient of the underground economy, as expected, has a positive sign with the value of 5.4.

Table 6: PDL Estimation Results

Coefficient	Estimate	t-Value	Marginal Significance
Constant	0,024	3,078	0,006
Sum of $\Delta(ue_{t-z})$	5,399	2,326	0,012
$\Delta(y_{t-1})$	0,133	0,617	0,544
$R^2 = 0,363$		SER = 0,025	
Diagnostic Tests			

[2] Before going further in Granger causality tests, stationarity of the related variables should be considered. As before we used ADF and PP tests and obtained the following summarized results: For the logarithmic levels of the nominal GDP and the underground economy, ADF and PP tests are 3,033 (including trend) and 3,196 (including trend) for official GDP and 2,697 and 1,012 respectively. For the first differences of log levels for the same variables in the same order, we get ADF test statistics as 3,612 and 4,301 and PP test statistic as 3,512 and 4,559. So we conclude that both variables are integrated order one or show I (1) characteristic.

Table 6: PDL Estimation Results - continued

Test	Estimation	Marginal Significance
Breusch – Godfrey	9,147	0,655
ARCH	0,001	0,988
White	0,265	0,979
Chow Breakpoint	8,322	0,582
Ramsey Reset	8,184	0,646

First of all, the positive sign of the cumulative coefficient estimated confirms the theoretical expectation that the underground economy stimulates the official activities in the case of developing countries since income obtained from unrecorded activities is mostly spent on activities that have been included in the official part of the GDP. Second, contrary to our expectation, the magnitude of the estimated coefficient is small indicating that a 1% increase in underground activities creates almost 5.4% increase in recorded activities. It was expected, that in a country with high inflation rates for a long period of time, the elasticity coefficient should have been much greater than estimated. Most probably, since the period under investigation covers a serious disinflationary process in prices side and large fluctuations in economic growth rates in the real side of the Turkish economy, the multiplier effect of the underground economy on the official side seems to decrease when compared with previous studies.

4. Conclusion

Approaches to measuring the size of the underground economy have been an important concern of policymakers since the late 1970s for many reasons. The presence of a large and growing underground economy understates the size of the economy, signals the existence of market distortions and excessive regulations, and raises governance issues. It therefore sends inaccurate signals about the state of the economy and leads to suboptimal policy recommendations and outcomes.

This paper tries to estimate the size of the underground economy in Turkey by using a currency demand approach for the period 2002 – 2010 along with the relationship between legal economic activities. The study differs from earlier studies for Turkey in two important respects. First, to improve on the validity and robustness of previous estimates, we use an alternative econometric method based on a variant of Tanzi's currency demand approach and an error correction model (ECM) to derive estimates of the underground economy. A useful feature of this approach is that it allows for other explanatory variables in modeling the behavior of currency balances. Second, in our model, in addition to the standard demand for money arguments, we incorporate a measure of sensitivity to taxes and financial innovations that theory suggests can be important in explaining currency holdings.

Earlier studies present evidence to suggest that participation in the underground economy in Turkey became widespread in the 1970s and 1980s for several reasons. However, with the liberalization of the economy beginning in 1987, profits in the underground economy were eroded as controls on trade, foreign exchange, and prices were removed. The incentive to engage in underground activity should have been expected to reduce as the supply of commodities increased in official markets. However, our calculations show that this is not the case since the ratio of the underground economy to nominal GDP changes from 30% to 70% with an average of 51% in the 2002-2010 periods. Empirical evidence strongly suggests that causality runs from the underground economy to recorded GDP and that the underground economy stimulates official activities in Turkey since income obtained from unrecorded activities is mostly spent on activities that have been included in the official part of the GDP. We conclude that the underground economy in Turkey thus sustains the growth of the official GDP because it mainly creates additional resources to reinvest in the economy. This characteristic of the underground economy has interesting economic policy implications. It suggests that the underground economy plays a buffer role during economic downturns and accelerates the recoveries in business cycle phases. In this study we did not make any statements of the normative

character since the issue of whether the unrecorded economy is bad or good for economic development of the country was not pursued here and needs a separate study. However, the above outlined conclusion clearly shows that government policies aimed at reducing the underground economy, if any, should mainly be carried out during a positive business cycle.

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