AN IMPROVEMENT OF THE TANZI METHOD FOR THE ESTIMATION OF ITALIAN UNGERGROUND ECONOMY

Maurizio Bovi*

ABSTRACT

This paper deals with the Tanzi method for the estimation of underground economy. The approach is discussed and modified. Refinements on the variables and on the econometric technique are proposed. The "adjusted" Tanzi method is then used to estimate the shadow economy in Italy along twenty-eight years. Despite the difficulty to obtain point estimates, interpretations of the results are nevertheless possible, trustworthy and interesting. For instance, the model detects the presence of underground economy, an expected finding. On the other hand the model shows no positive trend in the recent period. A very puzzling result, given the mainstream literature and the policymakers claims.

JEL Classification: O17, D78, H26.

∗Institute for Studies and Economic Analyses (ISAE), Roma, Italy. Address: Piazza dell'indipendenza, 4 – 00185 Roma – Italy. E-MAIL: m.bovi@isae.it. I am grateful to Laura Castellucci for her extended support and for the permission to reproduce some parts of our preceding (1999) work (essentially the section III and the empirical results of the Wickens-Breusch approach). The views expressed in this paper are those of the author and are not necessarily shared by the ISAE. This paper is the english version of the paper: "Un miglioramento del metodo di Tanzi per la stima dell'economia sommersa in Italia." Rivista di Statistica Ufficiale dell'ISTAT, vol. 2/99, F. Angeli, Roma.

I. INTRODUCTION

There are several important reasons to analyse the underground economy (u.e.): i) national accounts are biased and mislead policymakers; ii) economic structure is biased towards little dimension and particular branches; iii) competition is biased against the regular agents; iv) u.e. biases the tax system; v) u.e. promotes links between legal and illegal activities.

I used the Tanzi monetary method to measure the size of the underground economy in Italy during the years 1970-1997. In applying this method I exploited recent improvements in time series analysis and I adapted the method to the Italian situation, in a way different from the USA, the country analysed by Tanzi. Most of these ideas are valid for other countries.

Using new econometric techniques and tailoring the procedure to the Italian reality don't make it possible to get indisputable point estimates. Just to give an example, there exist two versions of the Tanzi method which inevitably lead to different estimates. I agree with Tanzi (1999, p. 347): "(…) we are still far from the time when the results of studies of the underground economy can have immediate consequences for policy or for the adjustment of various macroeconomic variables". Nevertheless, in spite of the lack of precision, it is possible to shed some light on very important questions. Is the Italian u.e. growing? Which events, if any, have modified the size of the underground economy? On the other hand the Tanzi method is still one of the most commonly used approaches, hence it seems unclear why so few works have used this procedure for Italy (Castellucci and Bovi 1999, Bovi 1999, Saba 1980, Schneider and Enste, 2000).

The next sections deal with the definition of u.e. and describe the method and how it can be made more suitable to the Italian economic system. Then I underline some critical points of the Tanzi approach. Econometric analysis, empirical results and conclusions close the paper.

II. DEFINITIONS AND METHODS TO MEASURE THE UNDERGROUND ECONOMY

Underground (or black, hidden, moonlight, subterranean, unrecorded, irregular, shadow etc.) economy does not have a commonly accepted definition. A good benchmark is the definition worked out in 1993 by the SNA (1993): the u. e. is the legal production unknown by the government. Hence illegal activities (gambling, drug dealing, bootlegging etc.) are not considered underground economy[1]. Of course the borderline of what is legal or not may vary over time and space, thus what makes up u. e. is fickle. According to this framework, the main cause of the black economy is the attempt of avoiding taxes and regulations. I followed this definition both because it is an official one and because it makes the Tanzi method a proper device[2].

There are direct and indirect methods to measure the underground economy. The former use data from national accounts, surveys on household balance-sheets and fiscal micro data. The latter compare economic indicators as national expenditure and income statistics, input and relative output, actual and "theoretical" currency. In this work I used the monetary indirect method (Cagan 1958, Gutmann 1977, Feige 1979) as revised by Tanzi (1980, 1982, 1983).

Obviously there not exist an indisputable method to measure a complex and fuzzy phenomenon like the shadow economy. Each approach has pros and cons. As a matter of fact one of the results of this work is to show how difficult it is to achieve point estimates even using just one method. I preferred the Tanzi method for two main reasons. It allows us to estimate u. e. for a long span of time because it analyses aggregate time series relatively easy to obtain for many years. In this way we can study the u. e. from an historical point of view, a very difficult task to achieve using survey data. Then the Tanzi method allows us to exploit new techniques in time series analysis (Mizon 1977, Johansen 1988, Hendry 1995) not only because it uses time series, but also because it does not deal with the dynamics of the underground economy. Therefore we can exploit the so-called "let the data speak" approach suggested by Hendry (see section 5).

[1] It is worth noting that inefficiencies in collecting official data leading to under reporting are not considered underground economy because there is not the explicit will not to respect the (non penal) law. Likewise domestic and personal services produced and consumed within the same household (e.g. cleaning, the care of sick or elderly people) are legal activities unrecorded by national accounts that are not considered underground economy. Given that all these activities should not affect the currency demand, the Tanzi method is a proper device to detect the kind of u.e. depicted by the System of National Accounts definition.

[2] The Tanzi method detects the tax evasion as well, but the u.e. is larger than the tax evasion. We can conceive of an economy without taxes (hence without evasion) but with a strictly positive rate of u.e. caused by regulations.

III. THE TANZI METHOD APPLIED TO ITALY

Tanzi specifies an equation for the currency-deposits ratio as a function of the real per capita GDP, the interest rate on time deposits, the ratio of wages and salaries to national income and an income tax variable. The importance of this latter variable lies in the following fundamental hypotheses:

1) underground economy depends on the presence of taxes;
2) in the underground economy transactions are carried out in cash for the obvious reason of not leaving traces;
3) in the underground and in the regular economy the velocity of money is the same.

The estimate of currency holdings in the hypothesis of zero income tax is used to compute the “excessive” (i.e. tax induced) currency holdings due to underground economy. The size of u.e. is then calculated by multiplying the excessive currency by the velocity of money prevailing in the regular economy (see point 3). Tanzi suggests to evaluate the u.e. using a positive but minimum tax rate of a reference year as well: “As it is unrealistic to conceive of an economic without taxes (and restrictions), it does not seem very productive to attempt to measure all the underground activities but it seems preferable to concentrate on changes over relevant periods." (Tanzi 1980, p. 84). In this second case the extra currency holdings due to u.e. is estimated under the hypothesis that the income tax rate is always equal to its sample minimum.

To actually estimate the equation for the Italian economic system, I changed the ratio of wages and salaries to national income with the ratio of wages and salaries paid in the agricultural and building sectors to total because in Italy these wages and salaries are more often paid in cash than the others. Then, but in this case the adjustments have a general validity, I used the data of the household sector only because it is the main sector which demands cash to evade. Further, this is the sector whose demand for currency depends primarily upon the above explicative variables while the banks’ currency holding is, for instance, partially determined by the required reserves. Also I used the domestic per capita demand (GDP less changes in inventories and exports) and not per capita GDP because it should be a better proxy of the evolution in the domestic system of payments.

As tax rate I chose the ratio of total direct revenues collected by the public sector to national value added at factor costs. This variable is not the only option and suffers from some pitfall. Other things equal, an increase (decrease) in direct revenues collected by the public sector implies a reduction of (a raise in) u. e., but the model shows the opposite. In addition, the decision not to declare (or under declare) income is more likely based on the marginal than on the average rate. Anyway this direct effective tax rate has some advantage as well. First of all it is easily available for many years. Then it can take into account the u. e. caused by the VAT. When taxpayers (self-employed persons) under declare the value added, the direct effective tax rate increases because of the reduction in its denominator. That way the method rightly detects an increase in the underground economy.

IV. CRITIQUES TO THE TANZI METHOD

In the previous section I showed some of the problems and some of the possible interventions in the choice of the variables suggested by Tanzi. It is worthless to say that we can obtain as many different estimates as (equally plausible) sets of variables we choose. But other critical and more specific points have been emphasised by the literature. The most recurrent are the following (Schneider and Enste 2000, Feige 1986, Pozo 1996). Not all transactions in the u. e. are paid in cash, thus estimates are likely to be under-valued. Second, it is obvious that the shadow economy is not caused only by taxes. Given the tax rate, government regulations, the complexity of the fiscal system and its efficiency in detecting and in prosecuting the tax evader can modify the size of the underground economy. To the extent these variables are positively correlated with the tax rate, their omission can lead to an over-estimation of the hidden economy. In a recent work, Schneider (1998) tried to tackle these problems. Third, it is unrealistic to conceive both an economy without taxes, and the total absence of underground economy in the year(s) of the minimum tax rate. Anyway, given that these hypotheses seem to be opposite extremes, it could be useful to match their results. The hypothesis of a unique velocity of money is another critical point mentioned by Tanzi as well (1980). However it is reasonable to think that when the "underground" money (i. e. the excessive currency caused by taxes) is used in regular markets, it should behave exactly in the same way as "regular" money in order not to appear suspicious. If this is true, the distinction between the source (from underground incomes) and the destination (towards consumption) links the Tanzi method to approaches based on the hypothesis that people tend to (or can) hide much more income than consumption. In addition, we can say that the method is less microfounded than, for instance, the pioneeristic work by Allingham and Sandmo[3] (Allingham and Sandmo 1972). This is a well-known issue because the dichotomy between micro and macro approaches to u. e. is very common in the literature (Thomas 1988).

Other critiques can be raised. In the method no mention is made about the dynamics of the underground economy. However it should be clear that the decision to go (or to remain) underground, just like any other human decision, is subject to adjustment costs, information lags, etc. that obliges to work out the Tanzi's steady state equation (see the next section). Then it is possible that illegal economy uses cash as well, and that criminal activity is positively correlated to underground economy (Schneider and Enste 2000). Hence the parameter of the income-tax variable, and consequently the u.e., could be over-estimated. Lastly, we may think about different currency demand equations.

All these remarks make the Tanzi method debatable and its point estimates untrustworthy. But the procedure is not useless, and not only because it still remains one of the most commonly used approach. By making adjustments, by applying new econometric techniques, and by focusing only on the principal features of the estimates, we can reach interesting results (see concluding remarks).

[3] This study deal only with the tax evasion, but the underground economy is strictly correlated with the tax evasion (see note 2).

V. ECONOMETRIC ANALYSIS

Apart from the aforementioned interventions to adapt the variables to the Italian situation, the Tanzi's original equation looks like the following[4] (the prefix L stands for natural logs):

$$(LC\text{-}LM2)_t = \beta_0 + \beta_1 LTDIR_t + \beta_2 LWSNI_t + \beta_3 LR_t + \beta_4 LYX_t + \Xi_t \qquad (1)$$

where:

C = stock of currency held by the household sector;

M2 = stock of M2 held by household the sector (currency and deposits);

β_i = parameters ($\beta_i > 0$, if i = 1,2; $\beta_i < 0$, if i = 3,4);

TDIR = one plus effective tax rate (ratio of total direct revenues collected by the public sector to national value added at factor costs);

WSNI = ratio of wages and salaries paid in the agricultural and building sectors to total wages and salaries;

R = net interest rate on time deposits;

YX = real domestic per capita demand (GDP less changes in inventories and exports);

Ξ = residual.

I estimated equation (1) following two alternative routes. The Wickens-Breusch approach (Wickens and Breusch 1988) and the Johansen procedure (Johansen 1988). The former[5] suggests to start from an over-parameterised-ECM version of the steady state equation worked out by theory:

$$\Delta(LC\text{-}LM2)_t = a_1\Delta(LTDIR)_t + a_2\Delta(LWSNI)_t + a_3\Delta(LR)_t + a_4\Delta(LYX)_t + \\ +(b_5\text{-}1)[(LC\text{-}LM2)_{t-1}+\beta_0+\beta_1 LTDIR_{t-1}+\beta_2 LWSNI_{t-1}+\beta_3 LR_{t-1}+\beta_4 LYX_{t-1}]+E_t \qquad (2)$$

where:

a, b = parameters; $(b_5\text{-}1)<0$;

$\Delta(X)_t$ = first difference of variable $X = X_t - X_{t-1}$;

E = residual.

There are economic and statistical reasons to apply the so-called "general-to-specific" approach to equation (1) (Hendry 1995). The former depends on the presence of adjustment costs, information lags, etc., in the decision to go (or to remain) underground. That is to say, equation (1) could be valid in the long run, but surely is not valid in each period. Granger's words can shed some light on the relationships between the short run and the long run (p. 213, 1986): "at the least sophisticated level of economic theory lies the belief that certain pairs of economic variables should not diverge from each other by too great an extent, at least in the long run. Thus, such variables may drift apart in the short-run (…),

[4] Actually I tried to plug into the equation (1) the male labour force participation rate as a measure of the degree of regulation in the economy. Results show that the findings here obtained are robust.

[5] There is some evidence that the estimators of the long run parameters have a smaller sample bias than that of two-step procedure worked out by Engle and Granger (Engle and Granger, 1987).

but if they continue to be too far in the long-run, the economic forces, such as a market mechanism or government intervention, will begin to bring them together again".

The statistical reasons are pointed out by recent developments in time series analysis (Banerjee et al. 1993), which showed that the standard regression techniques are invalid when applied to non-stationary variables. This is the case for the variables here used, which become stationary after first differencing (see next section). The long run solution (1) is still visible in equation (2), but the latter is a better starting point to estimate because its disturbances are more likely innovations[6] for the relevant information set. In other words, the over-parameterisation is a clear case of "measurement without theory" (Thomas 1999), but the "let the data speak" approach (Hendry 1995) could be a working answer.

While the Wickens-Breusch approach suggests to estimate the single equation (2), the Johansen procedure is a system (maximum-likelihood) estimation. Shortly, Johansen's method is to test the restrictions imposed by cointegration on the unrestricted VAR involving the series. This means that the "general" is no more equation (2), but a reparametrised VAR:

$$\Delta \mathbf{Z}_t = \Gamma \Delta \mathbf{Z}_{t-1} + \Pi \mathbf{Z}_{t-1} + \psi \mathbf{D}_t + \mathbf{R}_t \qquad (3)$$

where:

Z = vector made up by 5 variables of the system suggested by Tanzi [(LC-LM2), LTDIR, LWSNI, LR, LYX],

D = vector of the deterministic components of the system,

Γ, Π, ψ = 5x5 matrices of the system coefficients,

R = vector of the system residuals.

Variables are cointegrated if and only if the rank of **Π** is neither full nor zero. If the rank is equal to r (r is the number of cointegrating relations, that is to say the cointegrating rank, in the present case: $0<r<5$), then we may write $\Pi=\alpha\beta'$, α and β being two 5xr matrices. In the previous single equation case, β was the vector of parameters β_i, while α was equal to (b_5-1). In the hypothesis of cointegration we may write:

$$\Delta \mathbf{Z}_t = \Gamma \Delta \mathbf{Z}_{t-1} + \alpha\beta' \mathbf{Z}_{t-1} + \psi \mathbf{D}_t + \mathbf{R}_t \qquad (4)$$

To determine the number of cointegrating relations r, we can proceed sequentially from r = 0 to r = 5-1 until we fail to reject. Summing up, the Johansen test strategy is the multivariate analogue of DF test. The point is that both over and under estimation of the number of cointegrating vectors have potentially serious consequences for estimation and inference. But the number of cointegrating vectors is unknown and must first be determined from the data. Hence the Johansen procedure has several advantages in comparison with the single equation approach. Anyway the philosophy behind these two procedures is different and is not useless to match their results.

[6] The (testable) hypothesis is that, lagging once, residuals become innovations.

VI. RESULTS

In this section I report the estimates of the u.e. in Italy in the period 1970-1997 using the ECM version of the Tanzi equation as outlined in the preceding discussion. The testing down procedure applied to the equation (2) led to the following empirical version:

Table 1

The Wickens-Breusch approach

Regressor	OLS Coeff.	S.E[7].	t-stat.	Prob.
C	2.278597	0.933837	2.440037	0.0247
$\Delta(LWSNI)_t$	0.995172	0.335966	2.962123	0.0080
$\Delta(LR)_t$	-0.094072	0.036975	-2.544238	0.0198
$\Delta(LYX)_t$	-1.585690	0.564665	-2.808195	0.0112
$LTDIR_{t-1}$	0.274714	0.125079	2.196323	0.0407
LR_{t-1}	-0.128493	0.044867	-2.863882	0.0099
LYX_{t-1}	-1.515609	0.558514	-2.713645	0.0138
$(LC-LM2)_{t-1}$	-0.629098	0.209041	-3.009456	0.0072

R-squared	0.622461	Mean dependent var	-0.018518
Adjusted R-squared	0.483367	S.D. dependent var	0.055056
S.E. of regression	0.039573	Akaike info criter	-3.380158
Sum squared resid	0.029754	Schwarz criterion	-2.996206
Log likelihood	53.63213	F-statistic	4.475128
Durbin-Watson stat	1.829437	Prob(F-statistic)	0.004304

Dependent variable: $\Delta(LC-LM2)_t$

Legend: see text.

Data suggest that the influence of the variable LWSNI is limited to the short term. Conversely, the dynamics of LTDIR are statistically not significant. Residuals satisfy the most commonly used diagnostic tests (Jarque-Bera, Breusch-Godfrey, Ramsey RESET, ARCH, CUSUM, CUSUMSQ) so the model is a satisfactory one[8].

A careful treatment of data is very important especially when we are interested in estimating a shadow. Hence I looked for a confirmation of previous findings by applying the Johansen procedure. Since it is valid only for non-stationary series, I performed some usual unit root tests[9] (ADF and Phillips-Perron). Results strongly demonstrate the I(1) nature of all the five series [(LC-LM2), LTDIR, LWSNI, LR, LYX].

After having confirmed that LWSNI does not enter the long run solution, I performed the Johansen cointegration test on the vector made up by the four left out variables. The so-called “trace test” indicates one cointegrating equation at 1% significance level and two cointegrating equations at 5% significance level, the maximal-eigenvalue statistic indicates one cointegrating equation at 5% significance level. Hence the hypothesis that there are two unit roots can reasonably be rejected in favour of only one cointegrating vector. This findings is very important for inference because if the ECM

[7] White Heteroskedasticity-Consistent Standard Errors (White, 1980).

[8] I tested for weak exogeneity as well. In particular the marginal processes of the RHS variables seems does not have the same ECM. Anyway this is only a necessary condition for the use of single-equation methods (Banerjee et al. 1993).

[9] As well known it is hard to understand if a variable is stationary in small samples. Anyway given that in this case the aim is to estimate and not to forecast, it suffices to verify if the variables are stationary in the available sample.

terms enter more than one equation this would violate the weak exogeneity requisite (Engle et al. 1983). The presence of only one cointegrating vector makes the single-equation approach valid.
We are now in a position to compare the long run solution of the two approaches.

WICKENS- BREUSCH:

$(LC\text{-}LM2)_t = 3.61 + 0.44 * LTDIR_t - 0.20 * LR_t - 2.41 * LYX_t$

JOHANSEN:

$(LC\text{-}LM2)_t = 5.73 + 0.92 * LTDIR_t - 0.28 * LR_t - 3.58 * LYX_t$

In spite of different methods and samples (and dynamics[10], see equations (2) and (4)), results seems to be relatively similar with the notable exemption of the parameter of LTDIR. In other words the "underground parameter" is the most difficult to catch. Applying both extreme versions of the Tanzi method (zero income taxes and minimum tax rate, see section 3) to these two equations we may calculate four estimates of underground economy for Italy in the period 1970-1997.

[10] Having eliminated LWSNI from the system, I excluded $\Delta(LWSNI)_{-1}$ as well.

Table 2.

Underground Economy in Italy as % of domestic demand

obs	(1)	(2)	(3)	(4)
1970	21.41189	33.60610	00000000	00000000
1971	21.49041	33.37255	0.402860	0.816457
1972	21.86945	34.69754	1.469466	3.032876
1973	17.75225	24.96656	0.667459	1.266099
1974	15.23189	19.59763	0.250276	0.443749
1975	22.01293	31.21585	1.112427	2.102993
1976	20.74897	28.79458	2.495710	4.653861
1977	19.11558	25.66700	3.380059	6.139794
1978	20.18752	27.96684	4.792558	8.902220
1979	17.08060	21.80455	3.874599	6.730917
1980	15.74918	19.65959	4.448475	7.539176
1981	15.62205	20.08450	5.180940	8.962265
1982	16.11328	21.15542	5.780765	10.15230
1983	16.69879	21.84205	6.244216	10.90264
1984	16.79152	22.08995	6.387610	11.20040
1985	18.43070	25.24064	7.132873	12.95100
1986	16.20076	20.92441	6.284988	10.82583
1987	16.54918	21.47381	6.632537	11.44844
1988	15.67366	19.46893	6.372151	10.55561
1989	15.65557	19.44403	6.709896	11.06812
1990	16.81968	20.75906	7.221036	11.84138
1991	15.48260	18.70546	6.738790	10.81894
1992	15.94124	19.34226	6.982636	11.24983
1993	18.45846	24.25272	8.522114	14.71557
1994	18.94867	25.08859	8.332863	14.54949
1995	18.11733	23.64067	7.920494	13.65303
1996	17.28410	22.37733	7.775617	13.27561
1997	16.99550	23.64730	7.906215	14.38743

(1) Wickens-Breusch single equation method with Tanzi “zero income taxes” hypothesis (see section 3)

(2) Johansen system estimation method with Tanzi “zero income taxes” hypothesis (see section 3)

(3) Wickens-Breusch single equation method with Tanzi “minimum tax rate” hypothesis (see section 3)

(4) Johansen system estimation method with Tanzi “minimum tax rate” hypothesis (see section 3)

VII. CONCLUDING REMARKS

In this paper I made some adjustments on the variables and on the econometric technique of the Tanzi method. It is worth noting that these adjustments have a general validity. Here I applied them to Italy to verify the presence of underground economy in the period 1970-1997. Not surprisingly, and as already reported by other works (Saba 1980, Schneider and Enste 2000 and, regarding non monetary methods, Frey and Weck 1983, Deaglio 1985, Italian National Statistical Institute 1993), data confirm the existence of the phenomenon.

Looking at the wide range of the estimates obtained (see table 2), one remains puzzled. Anyway this is simply one of the results of this work: it is not possible to achieve fully accepted point estimates of the underground economy and the "face values" are rather misleading even using the same method. Tanzi's two alternatives – the complete absence of u.e. in a given year or the complete absence of taxes - are extreme cases that could include, but that can not catch the precise size of the shadow economy.

Nevertheless from the estimates we can draw some interesting results. As a matter of fact, the reported estimates include common elements that, being based on different hypotheses, are robust and reliable. Among these elements the more apparent is the absence of a clear growing trend in the series of the underground economy. This finding is quite astonishing because it goes counter to the mainstream of the literature, which often reports growing trends (Schneider and Enste, 2000). The absence of a growing trend may be indirectly confirmed by looking at the level of regulations. There should be a positive correlation between the level of regulations and black economy and in Italy results that the former was higher in the eighties than in the following decade (OECD 1999). Further, data from the Italian national statistical institute (ISTAT) show that in the period 1980-1997 the ratio of irregular to total workers increased only slightly from 21.2% to 22.6%.

Another common feature of the series reported in table 2 is the minimum reached in 1974. One explanation can deal with the starting of the tax reform that deeply changed the Italian fiscal system. The *ratio* is that in the earlier years evading was easier, while in the following ones the u.e. regressed to "pre-reform" level because of the reaction of economic agents to the new economic environment. *Mutatis mutandis*, similar reasoning can explain the common peak realised in the 1993. Since this year Italian policy makers began to exercise an overwhelming fiscal discipline to match the European commitments. This pushed up the level of the underground economy, but data suggest that economic agents reacted once again to the shock lowering the level under the previous maximum. In other words, the Italian u.e. tend to revert to the pre-shock values. On the other hand all the reported estimates show that during the eighties, a period of relatively smooth (or less shocking) fiscal policies, the shadow economy quietly oscillated around a stable mean.

Summing up not even two large shocks, like the tax reform and the European commitments, were able to permanently modify the level of the u.e. in Italy. It could demonstrate the presence of a sort of "natural rate" of black economy (Castellucci and Bovi 1999). This rate could be seen as the rate imposed to the economic system by structural (market and/or institutional) forces that prevent the ratio of irregular to regular economy to maintain, in the medium-long term, values too far from the natural one. We can also see the natural rate of shadow economy as the economic counterpart of the statistical ECM(s) here found. Obviously to say more about the natural rate of the u.e. a deeper theoretical analysis would be necessary. Given that the goals of this paper are eminently empirical, very little remains to be said but to follow the advice to close the gap between the statistical approach to the cointegration and the steady state solutions derived from the economic theory (Pesaran 1997).

References

Allingham, M.G. and Sandmo, A. (1972). Income tax evasion: a theoretical analysis, *Journal of public economics*. 1: 323-338.

Banerjee, A., Dolado, J.J., Galbraith J.W. and Hendry, D.F. (1993). *Co-integration, Error Correction, and the Econometric Analysis of Non-Stationary Data.* Oxford: Oxford University Press.

Bovi, M. (1999). Un miglioramento del metodo di Tanzi per la stima dell'economia sommersa in Italia, *Rivista di Statistica Ufficiale (Istat).* 2: 5-51.

Cagan, P. (1958). The Demand for Currency Relative to the Total Money Supply, *Journal of political economy.* 66: 302-328.

Castellucci, L. and Bovi M. (1999). What Do We Know About the Size of the Underground Economy in Italy Beyond the "Common Wisdom"? Some Empirically tested Propositions, Paper presented at the Far Eastern Meeting of the Econometric Society 1999, 1-3 July Singapore and *Quaderni CEIS*. Università di Roma Tor Vergata. 120: 1-53.

Deaglio, M. (1985). *Economia sommersa e analisi economica.* Torino: Giappichelli.

Engle, R.F. and Granger C.W.J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing, *Econometrica.* 55: 251-276.

Engle, R.F., Hendry, D.F. and Richard, J.F. (1983). Exogeneity, *Econometrica.* 51: 277-304.

Feige, E.L. (1979). How big is the Irregular Economy?, *Challenge.* 22: 5-13.

Feige, E.L. (1986). A Re-examination of the 'Underground Economy' in the United States, *IMF Staff Papers*. 33: 768-781.

Frey, B.S. and Weck H. (1983). Estimating The Shadow Economy: a 'Naive' Approach, *Oxford Economic Papers*. 35: 23-44.

Granger, C.W.J. (1986). Developments in the Study of Co-integrated Economic Variables, *Oxford Bulletin of Economics and Statistics*. 48: 213-228.

Gutmann, P.M. (1977). Subterranean Economy, *Financial Analysts Journal*. 34: 24-27.

Hendry, D.F. (1995). *Dynamic Econometrics.* Oxford: Oxford University Press.

Italian National Statistical Institute (Istat), (1993). *Annali di statistica.* Roma: Istat.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control*. 12: 321-254.

Mizon, G.E. (1977). Model selection procedure, in M.J. Artis and A.R. Nobay (eds), *Studies in modern economic analysis*. Oxford: Basil Blackwell.

OECD, (1999). *Employment Outlook.* Paris: OECD.

Pesaran, M.H. (1997). The Role of Economic Theory in Modelling the Long Run, *Economic Journal*. 107: 178-191.

Pozo, S. (ed.) (1996). *Exploring the Underground Economy: Studies of illegal and Unreported Activity*. Michigan: W.E. Upjohn Institute for Employment Research.

Saba, A. (1980). *L'industria sommersa ed il modello di sviluppo*. Venezia: Marsilio.

Schneider, F. (1998). Further Empirical Results of the Size of the Shadow Economy of 17 OECD Countries Over Time, *Discussion Paper*. University of Linz.

Schneider, F. and Enste D.H. (2000). Shadow Economies: Size, Causes and Consequences, *Journal of Economic Literature*. 38: 77-114.

SNA (1993). *System of National Accounts.* Commission of European Communities-INF-OECD-UN-WB.

Tanzi, V. (1980). Underground economy and tax evasion in the United States: estimates and implications, *Banca nazionale del lavoro Quarterly Review*. 32: 427-453.

Tanzi, V. (1982). *The Underground Economy in the United States and Abroad.* Lexington (Mass): Lexington Books.

Tanzi, V. (1983). The underground economy in the United States: annual estimates, 1930-1980, *IMF Staff Papers*. 30: 283-305.

Tanzi, V. (1999). Uses and Abuses of Estimates of the Underground Economy, *The Economic Journal*. 109: F338-F347.

Thomas, J.J. (1988). The politics of the black economy, *Work, Employment and Society*. 2: 169-190.

Thomas, J.J. (1999). Quantifying the Black Economy, *The Economic Journal*, 109: F381-F389.

White H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica*, 48: 817-838.

Wickens, M.R. and Breusch, T.S. (1988). Dynamic specification, the long run and the estimation of transformed regression models, *Economic Journal*. 98: 189-205.

SUMMARY

Estimation of Italian underground economy based on the Tanzi monetary method maybe improved taking into account both the peculiarities of the Italian economic system and the recent time series econometric techniques. Despite the difficulty to obtain point estimates, interpretations of the results are nevertheless possible and interesting.

ZUSAMMENFASSUNG

Die Schätzung der unoffiziellen Italienischen Wirtschaft, basierend auf der Tanzi währungs Kontroll Methode, könnte verbessert werden durch Berücksichtigung der Carakteristik des Italienischen Wirtschaftssystems und der kürzlich eingeführten wirtschaftlichen Techniken. Trotz der Schwierigkeit genaue Prognosen zu erstellen, sind Interpretationen der Ergebnisse möglich und interessant.

RESUME'

L'estimation de l'économie souterraine italienne, basée sur la méthode monetaire à la Tanzi peut être ameliorée en considerant les caractéristiques du système économique italien aussi bien que les nouvelles techniques econometriques. Malgré la difficulté à obtenir des estimations ponctuelles, l'interpretation des résultats est néamoins possible et interessante.