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Estimation of the size of tax evasion in Greece

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Abstract

The purpose of this paper is to estimate the extent of tax evasion in Greece for the period 1980-2018. For this estimation we have chosen to apply an indirect method of approach to the issue, as developed by Tanzi, based on the assumption that estimating the size of the shadow economy can lead us to a safe measurement of the extent of tax evasion. More precisely, through the Currency Demand approach which is based on the basic assumption that activities under the shadow economy constitute a direct response of taxpayers to the increased tax burden and also that cash is mainly used to conduct such transactions and of the wealth derived from them, the size of the shadow economy was determined using the method of the University of Leicester research team and then the level of tax evasion was assessed by imposing an annual tax rate on it as a ratio of total tax revenue to Gross Domestic Product. The results showed a significant increase of the size of tax evasion during the period considered, while the model estimation showed that most of the tax evasion came from direct taxation.

JEL classification numbers: H21, H26, H30, H23
Keywords: Macroeconomics, public economics, applied economics, tax evasion, Greece

1 Introduction

Undoubtedly, limited tax compliance is a longstanding issue for national economies (Richardson 2006). Tax evasion is one of the biggest problems faced by both developing and developed economies, as it results in significant economic costs because it slows economic growth, distributes productivity factors inefficiently to unproductive activities, motivates businesses to stay small creating conditions of unequal competition between tax evaders and those who are consistent in their tax obligations (Stiglitz 1988, Rice 1992, Mills1998). For these reasons, the extent of tax evasion is a major source of concern for fiscal policy makers and those responsible for implementing fiscal policy. According to Manesiotis (1990), tax evasion is the most massive and most tolerant manifestation of antisocial behavior and violation of the relevant tax provisions.

For this reason, the phenomenon of tax evasion has been the subject of scientific research in many developed economies for quite a long time (Andreoni Erard & Feinstein 1998, Cuccia 1994, Jackson & Milliron 1986, Kinsey 1986, Long & Swingen 1991, Richardson & Sawyer 2001, Richardson 2006). Following the theoretical framework introduced by the model of Allingham & Sandmo (1972) and its theoretical extensions, as formulated subsequently, the empirical investigation of the phenomenon of tax

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evasion and its determinants began to bear fruit. The research to date on this issue, although it could be described as limited (Torgler 2011), has provided us with significant empirical results on both traditional and non-traditional determinants of tax evasion (Jackson & Milliron 1986, Andreoni 1998).

However, it is not only the existence of tax evasion that is of concern to fiscal policy makers, but mainly the extent of it. At this stage estimating the size of tax evasion is the main objective of the research activity observed in this field because by measuring the degree of tax evasion, people exercising an economy's tax policy can form a safe estimation of the credibility of the policy applied but also the effectiveness of fiscal management measures. However, measuring tax evasion by direct approximation methods (Schneider & Enste 2002, Richupan 1986 & Cashin 2008) is inherently difficult, mainly due to the legal restrictions imposed by tax law on tax secrecy provisions and on the other hand due to conceptual problems that make it difficult to clearly identify the concept of tax evasion and its components (Thomas 1999, Schneider & Enste 2000, Pedersen 2003, Feld & Larsen 2005, Patenlar et al. 2011). Besides all that, the traces that left behind by activities that are characterized as predominantly tax evasion elements can be analyzed and lead to useful conclusions (Tanzi, 1971). Bearing in mind that economists and fiscal policy makers in a country have long been concerned with the link between the tax evasion-driven economy, the demand for cash and the theoretical approach that estimating the size of the shadow economy can lead us to a safe measurement of the extent of tax evasion, we inevitably lead to the conclusion that the approach of tax evasion through the gray economy is a safe, scientific way of approaching the size of the non-tax compliance phenomenon (Petanlar et al., 2011).

As mentioned above, the purpose of this paper is to estimate the extent of tax evasion in Greece for the period 1980-2018. Specifically, the main research questions of the study consist in: a) estimating the size of tax evasion in Greece for the period 1980-2018, as a percentage of GDP and the detailed presentation of this evolution over time, b) revealing the relationship of tax evasion with significant macroeconomic factors, such as the average tax burden and per capita income and c) the assessment of the part of tax evasion resulting from direct taxation and the detailed presentation of the evolution of this relationship, as a tool for assessing the effectiveness of the tax administration in Greece.

2 The Currency Demand Approach as a method of estimating the magnitude of tax evasion

The Currency Demand Approach is one of the key theoretical approaches for estimating the degree of tax evasion. This method is a macroeconomic approach that uses various economic and other indicators that contain information on the development of activities that are part of the shadow economy (over time) and leave some traces that intimate such illegal behavior (Cagan 1958, Gutt 1977, Tanzi 1980, 1983).

The currency demand approach is based on the basic assumption that activities within the shadow economy are the direct response of taxpayers to the increased tax burden and that cash is mainly used to carry out such transactions and to accumulate the wealth derived from them. The basic idea behind this approach is to determine the demand for cash in such a way that it can measure the effects of changes in tax policy on such demand.

Then, once the size of the shadow economy is determined, the level of tax evasion is calculated by assuming that the income included in the shadow economy would have been taxed at the same average tax rate as the income of the official economy. At this point lies the weakness of this method as it assumes that the relative income elasticity not differ between the two economies, i.e. official and shadow economy (Tanzi 1983).

Further, the currency demand approach can be applied through: (a) the Tanzi method (1980), (b) the method of the University of Leicester research team (Vavoura, Karavitis and Zouhlou, (1990), Vavouras and Koutris, (1991), Bhattacharyya, Karavitis and Tsouhlou, (1986) and Bhattacharyya (1990)), and the University of Zurich method (Weck-Hanneman & Frey, (1985)). Another theoretical model of estimating the economy in New Zealand, was also widely applied (Giles 1999), which, like the model of the University of Leicester research team, is based on an estimation of a money demand function.

In essence, the currency demand approach examines the extent of tax evasion from the point of view of the black economy. More specifically, if the whole of the Greek hidden economy is not taxed, estimating the level of the gray economy as a percentage of GDP using one of the above econometric models and imposing an annual tax rate on it, as a ratio of total tax revenue to Gross Domestic Product, we could get a reliable estimate of the level of tax evasion. The disadvantage of this method, which will be used in this study, is that it is based on the assumption that all the incomes in the hidden economy are not taxed, even though its common for many activities in the shadow economy, that their income is taxed directly or indirectly.

In addition, empirical results on the impact of the level of tax burden on the size of the shadow economy are provided by several studies such as Schneider (1994, 2000, 2004, 2005) and Johnson, Kaufmann & Zoido-Lobaton (1998), which revealed the existence of a statistically significant effect of taxation on the shadow economy.

This significant impact of direct and indirect taxation on the level of shadow economy is further demonstrated by the systematic overview of the research activity carried out on this subject in the case of Austria and the Scandinavian countries (Denmark, Norway and Sweden). In particular for Austria, the driving force behind the development of shadow economy activities is the direct tax burden (including social security payments) which appears to have the greatest influence, followed by the intensity of enforcement of the law and the complexity of the tax system. Similar results were presented by Schneider's (1986) study of the Scandinavian countries, which revealed that various tax variables, such as average direct tax rate, average total tax rate (direct and indirect tax rates) and the limit tax rates, have a positive and statistically significant effect on the level of currency demand. These results are supported by the studies of Kirchgaessner (1983, 1984) on Germany and of Klovland (1984) on Norway and Sweden. Further, Kemal (2007) concluded that the impact of the shadow economy on the changes in the formal economy is significant in contrast to movements in the black economy which appear to be unable to be interpreted, based on the level of the formal economy. Yasmin & Rauf (2003) also argued that shadow economy and tax evasion negatively affect the level of the official GDP of Pakistan. Finally, a significant number of researchers such as Shabsigh (1995), Ahmad and Ahmad (1995), Iqbal, Qureshi & Mahmood (1998), Aslam (1998), Khalid (2002), Kemal (2003) and Yasmin & Rauf (2003), have attempted to assess the extent of tax evasion by using the monetary approach.

In this research effort, in order to empirically assess the size of the Greek black economy, we will use the monetary model of the University of Leicester research team as a basis for estimating the results that appear to be satisfactory for the Greek economy (Vavouris, Karavitis and Tsouhlou, 1990 and Bhattacharyya, Karavitis and Tsouhlou, 1986), in comparison with other models of currency demand. This model will refer to the time period 1980-2018 and will be estimated using the exact maximum likelihood approach method.

3 Theoretical and mathematical specialization of the model to be evaluated

The model developed by the University of Leicester research team (1990, 1986) on the shadow economy is expressed by the money demand function of the form:

$$\frac{M_t}{P_t} = cY_t^{c1}H_t^{c2}\pi_t^{c3}(i_t - \pi_t)^{c4} \quad (1)$$

where $\frac{M_t}{P_t}$: the demand for cash in real terms, Y_t : real income at fixed prices, H_t: the income of black economy at constant values, i_t: nominal deposit rate, P_t: the Consumer Price Index and π_t: the level of inflation.

Since the income of the shadow economy is an unobservable variable, we assume that it can be defined by the following semi-logarithmic function:

$$\ln H_t = \alpha_1 \, lnY_t + a_2 \ln Z_t + \alpha_3 \, lnT_t + \, a_4 U_t \quad (2)$$

where: Z_t : divergence between real and expected income, T_t : the average tax burden on the economy as a percentage of real income tax and U_t : the unemployment rate.

According to the University of Leicester research team, the variable Z_t is defined as follows $Z_t = \frac{Y_{dt}^*}{Yd_t}$

where Y_{dt} : is the per capita disposable income and Y_{dt}^* : is the expected per capita disposable income.

Because the expected per capita disposable income is not "observable" and therefore cannot be used in estimates, we use the Hodrick and Prescott (1980) filter, which allows us to find virtual data using the variables and the correlation of two variables.

The filter of Hodrick and Prescott is a mathematical tool used in macroeconomic theory, especially the theory of economic cycles. It is applied to obtain a smooth non-linear time series, which is more sensitive to long-term than short-term fluctuations. Adjusting the strain sensitivity to short-term fluctuations is achieved by changing the multiplier λ.

The reason why it is necessary to use the Hodrick-Prescott filter in contrast to ARIMA, which was used by I. Vavoura, N. Karavitis and A. Tsoichlou (1990), as well as I. Vavoura and A. Koutris (1991), for estimating per capita expected disposable income, is the separation of the cyclical behavior of a variable over its long run. Using the H-P filter allows us to interpret the behavior of real and virtual data using criteria such as volatility, autocorrelation, bivariate correlation, etc. (Palaiologos, 2003).

Then by expressing the function (1) in logarithmic form and substituting the function (2) in (1), we get:

$$\ln\left(\frac{M_t}{P_t}\right) = c_0 + c_1 \ln Y_t + c_2 \ln H_t + c_3 \ln \pi_t + c_4 \ln(i_t - \pi_t) \quad (3)$$

where $c_0 = \ln c$

By doing the appropriate calculations and transformations, function (3) is written:

$$\ln\left(\frac{M_t}{P_t}\right) = c_0 + c_1 \ln Y_t + c_2[a_1 \ln Y_t + a_2 \ln Z_t + a_3 \ln T_t + a_4 U_t] + c_3 \ln \pi_t + \, c_4 \ln(i_t - \pi_t) \quad (4)$$

As can be seen, function (4) expresses a hyperparametric model and therefore cannot be estimated. However, as stated above, the research team at the University of Leicester assumes that income elasticity is the same for the formal economy and the shadow economy, and therefore, c1 = c2. The broader the definition of money, the more equation (4) is written as follows:

$$\ln\left(\frac{M_t}{P_t}\right) = c_0 + c_1(1 + a_1)\ln Y_t + (c_1 a_2)\ln Z_t + (c_1 a_3)\ln T_t\,(c_1 a_4)U_t + c_3 \ln \pi_t + c_4 \ln(i_t - \pi_t) \quad (5)$$

Then by estimating the function (5) we find the coefficients α_t, replace them with the function (2) and calculate the size of the shadow economy.

For the estimation of the variables of the model were used annual data for the period 1980-2018. In particular, to measure the amount of money M_t in the economy, the definition of the amount of money M_3 was adopted (at constant prices). This definition includes currency in circulation, sight deposits, savings and time deposits by individuals, including bond placements at various banks and other credit institutions and agencies.

Also, as a recorded Y_t product, official GDP was used at constant prices and as for the general price level P_t, the Consumer Price Index at constant prices. Furthermore, the savings rate was used to measure the interest rate and the share of total taxes (T) on gross domestic product was estimated as follows:

T= [(direct taxes + indirect taxes + social security contributions)/ GDP]

Further, real per capita disposable income equals the quotient of disposable income through the labor force. The expected per capita disposable income came from using the Hodrick-Prescott (H-P) filter (Hodrick and Prescott, 1980), as opposed to researches used the ARIMA method.

Also in the model, predefined values for the coefficient ci, with a step change of 0.001, were used to determine the accuracy of the three decimal places. The models for the various values of c1 were estimated using the Exact Maximum Likelihood method, and the one that was the best fit was chosen. Application of the model was judged by appropriate diagnostic tests (Akaike criterion) and a value of c1 was set at 0.8.

Then, after estimating the level of the Greek hidden economy in Greece as a percentage of GDP (H/Y), we can assume that the size of tax evasion could be expressed by the following relation:

Tax Evasion (TE): Underground Economy (H) * (Total Taxes/GDP)

According to the above approach (Petanlar et al. (2011), Aslam (1998), Khalid (2002), Kemal (2003), we could examine the extent of the tax evasion from the point of view of the black economy and assume that for the whole of the Greek black economy, as estimated by the model of the Leicester University team, no tax is levied and therefore by imposing this tax on total income, based on the ratio of total tax revenue to Gross Domestic Product, we will obtain an estimate of the level of tax evasion in Greece for the period 1980-2018.

4 Estimation of the model-Results

From the estimation of the function (5) using the maximum likelihood method for $c_1 = 0.8$, we obtain the following parameter values of model (5):

Table 1: Estimation of model coefficients

Variable	Coefficient	Coefficient	Prob	Coefficient	estimation
		Estimation			
constant	c_0	-10.619 *	0.001		
$\ln Y_t$	$c_1(1+a_1)$	1.5793*	0.000	α_1	0,9741
$\ln Z_t$	$(c_1 a_2)$	0,392*	0.044	α_2	0,49
$\ln T_t$	$(c_1 a_3)$	0,059*	0.007	α_3	0,07375
U_t	$(c_1 a_4)$	0,245*	0.027	α_4	0,3062
$\ln \pi_t$	c_3	0.02543*	0.011		
$\ln(i_t - \pi_t)$	c_4	0.01215	0.678		

Durbin-Watson statistic: 0,87

Adjusted R-squared: 0,945139

** indicates statistical significance at 95% confidence level*

Therefore, the estimated cash demand function takes the following form:

$$ln\left(\frac{M_t}{P_t}\right) = -10{,}619 + 1{,}5793 \ln Y_t + 0{,}392 \ln Z_t + 0{,}059 \ln T_t + 0{,}245 U_t + 0{,}02543 \ln \pi_t$$

The estimation of the model using the maximum likelihood method resulted in the estimation of the currency demand function of the above form, as well as the statistical significance check of the model coefficients showed that the c4 coefficient for the variable $\ln(i_t - \pi_t)$ is not statistically significant, indicating the inability of this factor to influence the currency demand level of the Greek economy.

A basic condition for estimating the model coefficients is that the residuals follow a normal distribution. For this purpose we used the Bera & Jarque test which showed that the residuals follow the normal distribution. The value of the Bera & Jarque statistic was determined to be 0.3340838 and therefore assuming a standard error equal to α = 0.05, we assume that the residuals follow a normal distribution.

Further, using the LM method in order to determine the existence of any heteroskedasticity problems, we estimated using the least of squared method, the model $e_i{}^2 = a_0 + a_1 y + u_i$ and calculated the coefficient of determination R^2 through the residuals u_i. We then formulated the test to determine whether or not heteroskedasticity was present and also, given that $n * R^2 < X^2$, the assumption of homoskedasticity was accepted.

Finally, Durbin - Watson statistics were used in order to test for the existence of autocorrelation. However, in accordance with the model data and the value of the Durbin - Watson statistic = 0.87 , the hypothesis of lack of autocorrelation is not accepted. This confirms that the data we are looking at comes from time series, where their values are created in a specific rather than random way. We re-evaluated the model using the Cochrane-Orcutt iterative procedure assuming first degree autocorrelation in the error terms. However, the results did not differ significantly from the initial results, thus concluding that autocorrelation is not a significant problem in the model.

According to the above, through our estimation of the level of the Greek hidden economy as a percentage of GDP for the period 1980-2018, we can assume that the degree of tax evasion could be expressed by the following function:

Tax Evasion(TE): Underground Economy (H)*(Total Taxes/GDP)

The results from the development of the above method on the level of the shadow economy in Greece during the period 1980-2018, as a percentage of GDP, presented in the following Table 2. In particular, the table below presents aggregated results on the relationship between the hidden economy and tax evasion in Greece and data on the share of tax evasion in direct taxes (TED).

Note that in Table 2 below, the column H / GDP % represents the level of shadow economy in Greece as a percentage of GDP, the column TE / GDP % the level of tax evasion in Greece as a percentage of GDP, the column T / GDP % the total taxes as a percentage of GDP, the column TD / GDP % the direct taxes as a percentage of GDP and finally the column TED / TE % the percentage of tax evasion derived from direct taxes.

Table 2: Hidden economy (H) and Tax Evasion (TE) in Greece

Year	H/GDP %	TE/GDP %	T/GDP %	TD/GDP %	TED/TE %
1980	14.73%	**3.74%**	25.40%	6.10%	41.14%
1981	15.87%	**4.08%**	25.40%	6.00%	39.52%
1982	17.02%	**4.76%**	27.70%	6.8%	39.25%
1983	18.71%	**5.35%**	28.40%	6.50%	36.48%
1984	18.56%	**5.57%**	29.90%	7.00%	39.18%
1985	18.80%	**5.38%**	28.60%	6.60%	37.84%
1986	19.91%	**6.14%**	31.00%	7.00%	38.46%
1987	20.50%	**6.51%**	31.90%	7.00%	36.93%
1988	19.73%	**5.08%**	25.90%	5.70%	34.75%
1989	19.19%	**4.67%**	24.50%	5.30%	34.59%
1990	18.88%	**5.05%**	26.90%	6.30%	37.45%
1991	19.15%	**5.21%**	27.40%	6.30%	38.48%
1992	19.96%	**5.63%**	28.40%	6.40%	38.09%
1993	20.93%	**5.79%**	27.90%	6.40%	36.80%
1994	21.27%	**5.95%**	28.20%	7.40%	43.05%
1995	21.57%	**6.05%**	28.30%	7.80%	44.73%
1996	21.94%	**6.19%**	28.50%	7.80%	37.38%
1997	21.49%	**6.30%**	29.60%	8.40%	49,81%
1998	22.90%	**6.99%**	30.80%	10.00%	57.96%
1999	23.41%	**7.38%**	31.80%	10.50%	61.29%
2000	23.45%	**7.78%**	33.40%	10.00%	57.28%
2001	22.90%	**7.28%**	31.90%	9.30%	57.40%
2002	22.46%	**7.43%**	33.10%	9.50%	60.11%
2003	21.51%	**6.80%**	31.50%	8.90%	62.48%
2004	21.60%	**6.64%**	30.50%	8.90%	67.71%
2005	21.43%	**6.92%**	31.90%	8.40%	61.81%
2006	20.10%	**6.32%**	31.00%	8.90%	71.25%
2007	19.38%	**6.25%**	31.80%	8.70%	69.97%
2008	18.70%	**6.04%**	31.80%	8.30%	66.99%
2009	20.13%	**6.28%**	30.80%	9.10%	70.62%
2010	22.57%	**7.29%**	32.00%	8.90%	62.78%
2011	26.33%	**8.89%**	33.60%	9.40%	57.57%
2012	29.48%	**10.46%**	35.50%	10.80%	59.98%

2013	31.09%	**10.96%**	35.50%	11.11%	59.71%
2014	30.98%	**10.99%**	36.00%	11.60%	58.56%
2015	30.35%	**10.56%**	35.50%	10.90%	52.68%
2016	29.45%	**11.36%**	38.60%	10.00%	45.72%
2017	28.14%	**10.89%**	38.70%	9.00%	41.45%
2018	26.66%	**10.32%**	38.70%	10.10%	47.77%

5 Conclusions

As arising from the data on table 2 above, it can be concluded that:

1. The average level of tax evasion in Greece, as a percentage of GDP in the period 1980-2018, is 6.96%. The highest was recorded in 2016 (11.36%) and the lowest in 1980 (3.74%).

2. Overall, during the period 1980-2018, the size of tax evasion increased by 275.94%. While in 1980, the tax evasion rate in the Greek economy was 3.74%, in 2018 it stood at 10.32%.

3. According to the model estimates we can observe how the increase in the average tax burden, that is, the increase in the share of total tax revenues (as a percentage of GDP), leads to an increase in tax evasion in Greece. Specifically, increasing the tax burden on the economy after 2010, increases the size of tax evasion.

4. The decrease in per capita income after 2010, over the period of economic crisis in Greece, results in an increase in the level of tax evasion.

5. Also, arising from the data in the table above, we can observe that most of the tax evasion comes from direct taxes as their share in estimating the overall level of tax evasion in Greece ranges from 34.59% to 71.25%, as opposed to indirect taxes where the possibilities of avoiding such payments are limited. However, in the last years there has been a reduction in tax evasion in direct taxes, which should be attributed to the mobilization of tax collection mechanisms, the introduction of new legislative initiatives to tax the income of natural and legal persons, the conduct of targeted audits using appropriate criteria based on risk analysis and the adoption of electronic cross-checking instruments.

The above estimates are consistent with economic theory and the results of previous studies, confirming the view that the increase in the tax burden, especially in periods of reduced income, increases the level of tax evasion. Regarding to the estimates of the level of tax evasion, they are considered compatible with the findings of previous studies (Mylonas P., Magginas N. & Pateli E. (2010), Leventi C., Matsagannis M. & Flevotomou M. (2013), Schneinder (2015), European Commission (2015)) of which it is estimated that tax evasion in Greece range from 2.5% to 10% of GDP. The differences are due to the indirect nature of the method and its application to the whole economy, in contrast to previous surveys that are limited to certain areas of economic activity or specific taxes.

Taking into account all the above findings, it is necessary for the Greek government and tax authorities to take initiatives aimed at:

1. Improving tax policy, by reducing tax rates (direct and indirect) and abolishing extraordinary taxes on already taxed income.

2. Creating a stable and simplified tax system, by reducing the complexity and ambiguity of tax legislation, which will help attract investment and create a favorable climate for new innovative businesses. The establishment of the Independent Authority for Public Revenue (IAPR) of the Hellenic Republic, as an autonomous revenue agency, will also contribute in this direction. However, to achieve

this, requires reforms in almost all public administration, with an emphasis on business structure, by encouraging the creation of larger economic units and reducing bureaucracy.

3. Reducing of compliance costs, in terms of time and financial burden, mainly through expanding the range of electronic tax services, digitization of the tax administration, introduction of electronic invoicing and extensive use of electronic methods of payment.

4. Improving the level of tax compliance, by creating a climate of trust of taxpayers in the tax administration, which will encourage voluntary compliance and by cultivating tax awareness, through information on the necessity of taxes and the negative economic and social consequences of tax evasion.

5. Increasing the level of productivity and reducing the operating costs of the tax administration, by adopting modern and effective tax collection approaches.

6. Formulating a clear and stable organizational framework for the operation of tax authorities, which will undoubtedly define the responsibilities of the tax administration, will effectively resolve tax disputes and will provide support to citizens and businesses to facilitate transactions, reduce bureaucracy and simplification of procedures, by operating in a system oriented towards treating the taxpayer as a "customer". In addition, continuous investment in staff and new technologies will contribute to an organizational renewal in order to create an efficient and rapidly adapted tax administration.

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