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Manos Matsaganis[#] and Maria Flevotomou*

ABSTRACT

The shadow economy and tax evasion are both widespread in Greece. This has adverse effects in terms of horizontal and vertical equity, as well as in terms of efficiency. We take advantage of access to a large sample of income tax returns in 2004/05, and compare tax reported incomes with those observed in the household budget survey of that year. We re-weight our two datasets to make them fully comparable, and carefully select the reference population. We then calculate ratios of income under-reporting by region and income source. The synthetic distribution of reported incomes is then fed into a tax-benefit model to provide preliminary estimates of the size and distribution of income tax evasion in Greece. Income under-reporting is estimated at 10%, resulting in a 26% shortfall in tax receipts. The paper finds that the effects of tax evasion are higher income inequality and poverty, as well as lower progressivity of the income tax system.

Keywords: tax evasion, inequality, microsimulation.

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1. Introduction

Income tax evasion raises significant issues from the point of view of efficiency. Lower tax revenues may ultimately lead to higher tax burdens on those who do pay. Moreover, to the extent that opportunities to evade differ by occupation and/or sector of the economy (Frederiksen et al., 2005), tax evasion will also distort labour supply decisions – although it is not always easy to confirm this assumption empirically (Parker, 2003).

On the other hand, tax evasion has profound implications for distributional analysis. In terms of vertical equity, "if the poor had more opportunity of evading taxes than the rich, or were better at it, then the egalitarian policy maker might have good reason to smile indulgently on evasion: up to a point anyway" (Cowell, 1987). However, tax evasion may soften rather than strengthen the redistributive impact intended by the tax schedule. Either way, ignoring tax evasion is likely to cause decision makers and policy analysts seriously to misjudge the distributive and fiscal effect of changes in social benefits and the tax system.

In terms of horizontal equity, individuals with similar income differ in terms of inclination and opportunity to under-report it. As a result, tax evasion violates

notions of fairness and equal treatment, and undermines the idea of reciprocity which lies at the heart of the social contract between taxpayers and the state.

This paper is concerned with the distributional implications of income tax evasion in Greece, where the informal economy is widely held to be very extensive. More specifically, it combines an estimation of non-compliance patterns in terms of income under-reporting, with an estimation of the distribution of gains from tax evasion in the general population using a tax-benefit model. We compare two datasets, a random sample of unaudited tax returns filed in 2005 (incomes earned in 2004), and the 2004/05 Household Budget Survey.

The structure of the paper is as follows. Section two offers a literature review. Section three explains the methodology and presents the data. Section four reports the results. Section five discusses the main findings. Section six concludes with a discussion of policy implications and issues for further research.

2. Literature review

Scholarly interest in tax evasion is growing fast, both in terms of theoretical treatment and empirical research. Comprehensive reviews of that literature are offered in Andreoni et al. (1998) and Slemrod and Yitzhaki (2002), while

Slemrod (2007) provides a recent overview of what is known about the extent and the determinants of tax evasion.

This paper draws selectively on that literature. In particular, the deterrence model of tax evasion, formulated by Allingham and Sandmo (1972) and Yitzhaki (1974), assumes that rational taxpayers decide how much to evade given their income, the marginal tax rate, as well as (crucially) the subjective probability of detection and the penalty rate. While the relation between the last two factors has been the focus of research on the optimal design of auditing policies, the starting point of our own research is the theoretical insight that the level of tax evasion is a negative function of the subjective probability of detection.

Indeed, evidence on cross-sectional variation in non-compliance rates across income sources provides compelling empirical support for the deterrence model. Specifically, there seems to be a clear positive correlation between the rate of compliance and the probability of detection in the presence of enforcement mechanisms. As Sandmo (2005) noted, since wages and salaries are typically reported to tax authorities by employers, under-reporting by employees would lead to certain detection.

In fact, the analysis of US tax audit data collected under the Taxpayer Compliance Measurement Program (TCMP) in 1988 demonstrated that the rate of under-reporting of income from dependent employment (0.5%) was much lower than for self-employment income (58.6%) (Slemrod and Yitzhaki, 2002).

Similar data from the successor to TCMP, the National Research Program (NCP), showed that an estimated 57% of self-employment income was under-reported, compared to 1% of wages and salaries (Slemrod, 2007).

These findings are supported by evidence on patterns of non-compliance by income source from other countries, or using different research designs (or both). For example, Pissarides and Weber (1989) found that the self-employed in Britain spent a higher share of their reported income on food (other things such as household characteristics being equal), and attributed this to income under-reporting rather than a higher propensity to consume food – a finding later replicated by Lyssiotou et al. (2004). Feldman and Slemrod (2007) used this insight to analyse the relationship between charitable contributions and reported income, and argued that the higher contributions of the self-employed at similar levels of reported incomes could only be explained by higher income under-reporting. In Italy, Fiorio and D'Amuri (2005) estimated the rate of under-reporting of self-employment income around the median of the distribution at 27.7%, compared to 1.9% for income from wages and salaries. In Hungary, Krekó and Kiss (2007) highlighted the opportunities for (legal) tax avoidance and (illegal) tax evasion available to the self-employed. In Greece, Tatsos (2001) found that the self-employed were more likely to participate in unregistered activities that remain invisible to the tax authorities.

Note that what the theory predicts is that the propensity to evade taxes will vary by income source, not by employment status. The distinction is clear in the case

of employees “moonlighting” (Slemrod and Yitzhaki, 2002). Since the probability of detection is lower for self-employment income earned in their spare time than it is for wages or salaries from their main job, the expected rate of under-reporting will be higher for the former than for the latter.

While the evidence on patterns of non-compliance by income source seems robust, and is supported by unambiguous theoretical predictions, the same cannot be said with respect to non-compliance by income class. Even though theoretical models generate no clear prediction on the relative strength of income and substitution effects of tax rates on compliance, they all indicate that tax evasion should generally rise with income (Andreoni et al., 1998). Nevertheless, the empirical evidence is mixed.

For example, Christian (1994) used data from the 1988 TCMP study to show that, relative to the size of their true income, higher-income taxpayers evaded *less* than those on lower incomes. However, his study was seen as inconclusive on methodological grounds: it classified as low incomes taxpayers with high permanent income reporting business losses, while it failed to account for illegal tax shelters and for non-compliance in partnership and corporate tax returns (Slemrod, 2007). Fiorio and D’Amuri (2005) also found that the share of unreported income in Italy fell with income. In contrast, Pashardes and Polycarpou (2008) showed that, once corrected for tax evasion, the income distribution in Cyprus was less equal than the distribution of reported incomes,

while Tatsos (2001) argued that high earners in Greece were more inclined to non-compliance.

On the whole, little is known about the level of non-compliance by income class, and the available evidence does not always support the hypothesis of a regressive bias of tax evasion.

The trouble with the deterrence model is that it seems to predict more tax evasion than is actually observed. While several studies within this intellectual tradition (Sandmo, 1981; Andreoni et al., 1998; Pestieau et al., 2004; Sandmo, 2005; Slemrod, 2007) attempted to resolve this puzzle, others have looked for explanations elsewhere. The emphasis on intrinsic motivations, such as civic virtue, is the main contribution of behavioural theories to the understanding of tax evasion. Frey (1997), for instance, argued that there is more to tax compliance than simple fear of punishment, and that excessive reliance on extrinsic motivations (such as increased penalties) may ultimately crowd out intrinsic ones.

One implication of the theory, the proposition that the propensity to evade taxes will inversely correlate with trust in institutions, appears to have intuitive appeal and has in fact found support in the literature. Some have attempted to test behavioural models drawing on the results of the World Values Survey (WVS), the European Values Survey (EVS) or similar surveys. For example, Torgler (2003) and Slemrod (2003) established that professed trust in government correlates quite closely with survey-based attitudes towards tax

evasion, both across countries and across individuals within countries. Furthermore, Hanousek and Palda (2004) analysed opinion poll evidence from the Czech Republic relating attitudes towards tax evasion to perceived quality of public services, and found that a 20% increase in the former could lead to a 13% reduction in the latter. Still, as Slemrod (2007) has pointed out, "survey responses may also reflect after-the-fact rationalization of noncompliant behaviour".

Empirical approaches to estimating the size of informal activities and/or tax evasion often rely on relationships between macroeconomic indicators. The most common are the demand-for-currency method (Cagan, 1958; Tanzi, 1983; Bhattacharyya, 1990), the transactions method (Feige, 1979), the electricity consumption method (Lackò, 2000), and the Multiple Indicators Multiple Causes (MIMIC) method (Frey and Weck-Hannemann, 1984; Schneider, 1997; Giles 1997; Dell'Anno et al., 2007). These methods, reviewed by Schneider and Ernste (2000) and Schneider and Klinglmair (2004), have been extensively criticized on the grounds that their estimates are sensitive to changes in key parameters and are not firmly based on theory (Thomas, 1999; Caridi and Passerini, 2001; Breusch, 2006; Hanousek and Palda, 2006).

Another strand of research using *microeconomic* data relies on the expenditure-based method (Pissarides and Weber, 1989; Lyssiotou et al., 2004, Feldman and Slemrod, 2007). The method assumes that family expenditure surveys are

more reliable on the expenditure side rather than on the income side, and use information on the former to estimate under-reporting of the latter.

Direct methods include voluntary questionnaire-based sample surveys, trying to elicit information on respondents' non-compliance (Mogensen et al., 1995; Pedersen, 2003), and the discrepancy method. The latter focuses on the difference between two alternative and independent measurements of the same variable, e.g. comparing income declared for tax purposes to that measured by selective checks such as audits. Most of the TCMP/NCP studies in the US belong to that category. The analysis of tax returns alongside a general-purpose income survey may be thought of as an extension of the discrepancy method. (Note that the term "discrepancy method" is also used to describe macro studies looking at the difference between expenditure and income statistics in national accounts, between the official and the actual labour force etc.)

Studies attempting to estimate the size of the informal economy and tax evasion in Greece (Pavlopoulos, 1987; Vavouras et al., 1990; Negreponti, 1991; Kanellopoulos et al., 1995; Tatsos, 2001), sometimes in a comparative context (Schneider and Enste, 2000; Schneider and Klinglmair, 2004; Lackò, 2000; Dell'Anno et al., 2007), have all used macro data. Some of the resulting estimates put the size of the informal economy at as much as 37% of GDP, though mostly at about 30%, and the size of tax evasion at 15% of GDP.

3. Methodology and data

This paper departs from previous studies of tax evasion in Greece in that it uses micro data. In particular, it builds on the discrepancy method applied in Fiorio and D'Amuri (2005), albeit with important differences.

We begin with the similarities. Both papers compare data from an income survey to a sample of tax returns. Both papers assume that taxpayers concealing part of their income from tax authorities might consider declaring a higher figure to an anonymous interviewer.

Nevertheless, our approaches differ in significant ways. Fiorio and D'Amuri (2005) had no direct access to their sample of tax data, analysed on their behalf by the Ministry of Finance. In order to correct for non-response bias in the income survey, and hence ensure that the two datasets are representative of the Italian population, they apply a post-stratification procedure. Thereafter, income by source is ranked by centile, and all (positive) differences between observed income in the survey and reported income in the sample of tax returns are attributed to non-compliance for the purpose of tax evasion. As Mantovani and Nienadowska (2007) have shown, that approach implicitly amounts to assuming away re-ranking effects, which in turn leads to an under-estimation of the regressive impact of tax evasion.

In contrast, we had full access to a random sample of unaudited income tax returns (at a sampling fraction of approximately 0.53%), supplied by the Ministry of Finance to our institution in anonymised form. We make an effort

to define the reference population in such a way as to minimise measurement and simulation errors, in particular the unreliability of income surveys at the bottom of the income distribution, and the impossibility to model tax rules in all their complexity (e.g. with respect to presumptive taxation, or the treatment of luxury goods as proxies for high income). We then compare across the two datasets by category, as defined by income source and region, rather than by income level (centile), and from that comparison we derive adjustment rates in order to correct for tax evasion. We focus on income source rather than employment status to allow for individuals earning income from multiple sources ("moonlighting"). We explicitly assume that all income from a certain source earned by residents of a certain region is under-reported at the same rate, regardless of its level. While this is a strong assumption, it seems to us preferable to alternatives in the light of theoretical ambiguity and methodological complications arising from re-ranking effects. We do present estimates of under-reporting by level of income, but these are due to a pure composition effect, i.e. result from our application of adjustment rates by income source and region to the entire income distribution.

The main contribution of our paper to the literature, beyond the above refinements, is that it links an estimation of non-compliance patterns to an analysis of how gains from tax evasion are distributed in the general population.

Our estimates refer to the year 2004. Personal income tax is individual. Spouses file a joint income tax return, but their income is separately recorded and individually taxed – except for some tax allowances and/or tax credits, which are jointly assessed. The tax unit for the assessment of tax allowances or credits includes spouse and dependent child(ren). The tax schedule is shown in Table 1.

Table 1. Income tax brackets and marginal tax rates (2004).

income brackets (€ p.a.)		tax rate
From	to	
0	8,400	0%
8,400	13,400	15%
13,400	23,400	30%
23,400		40%

Notes: The zero-tax threshold was set at €10,000 for employees or pensioners, and was raised for taxpayers with dependent children (by €1,000 for one child, by €2,000 for two children, by €10,000 for three children, and by an extra €1,000 for each subsequent child).

In a bid to combat tax evasion, the system provides for presumptive taxation. More specifically, a rather detailed set of rules applies to a number of activities (e.g. shopkeeping, personal private services, and all other types of self-employment, including the medical and other professions), specifying a minimum taxable income which varies by type of activity, seniority, location etc. If a taxpayer declares a level of earnings below the minimum taxable income, tax due is assessed at the minimum. Also, luxury assets such as swimming pools, helicopters, yachting boats and the like may lead to an upwards revision of taxable income by the tax authorities. Even though presumptive taxation may correct some tax evasion at the margin, the correction and corresponding recovery of tax receipts is more effective at lower

rather than higher levels of income. Presumptive taxation rules are impossible to simulate because the detailed information they rest on is largely unavailable.

Our estimation of the size and incidence of tax evasion draws on two sets of data: (a) the microdata from a household budget survey, and (b) a large sample of unaudited income tax returns randomly drawn for the purposes of this study.

The 2004/05 Household Budget Survey was carried out by the National Statistical Service of Greece over the 12-month period starting February 2004 and ending January 2005. The survey contains detailed information on the personal incomes, expenditure patterns and demographic characteristics of 17,386 individuals in 6,555 households. All household members aged over 14 were interviewed separately.

The sample of unaudited tax returns contains information on the demographic and other characteristics of tax units, as well as on incomes earned in 2004 (reported in tax year 2005). Our sample covers 41,283 taxpayers and 12,203 children and other dependents in 27,414 tax units (0.53% of all tax returns).

We compare the distribution of income as observed in the survey with a synthetic distribution of reported income as revealed to tax authorities, which we have corrected for income under-reporting in the light of information derived from the sample of tax returns.

A crucial assumption is that respondents reveal their income to survey interviewers more truthfully than they do when filling their tax return. While

this assumption has intuitive appeal, and is consistent with incentives, all income is known to be measured with error. Atkinson et al. (1995) conceptually defined five levels of measuring income ("true income", administrative record income, tax reported income, edited survey income, reported survey income), with involuntary measurement error potentially increasing as we move from one level to the next. Dhami and Al-Nowaihi (2006) discussed measurement error in the context of tax evasion. Rendtel et al. (2004) carefully analysed factors leading to misreporting of incomes in surveys. Respondents tend to forget small or irregular incomes such as tips and bonuses, and to estimate uncertain incomes (e.g. from self employment) conservatively – to which one might add recall error, possibly rising with age. Over-reporting of incomes in surveys relative to tax registers can also happen: respondents may confuse net and gross earnings, or ignore tax deductions, while self-employed workers will report positive incomes in the survey (or negative incomes will be edited out of the survey) even when for tax purposes they report negative incomes. Moreover, taxable incomes may be under-reported relative to survey incomes for the purpose of tax evasion, i.e. voluntarily. Jäntti (2004) found that interview incomes tend on average to be lower than register incomes, while non-respondents tend to have lower incomes than respondents. On the whole, Rendtel et al. (2004) concluded that "all trends will be present to some extent and it is not clear how these trends balance at the end".

In this paper, we accept that involuntary measurement error can go either way, but rely on the working hypothesis that the various causal factors offset each other, and that residual discrepancies between survey incomes and tax reported incomes can be attributed to tax evasion alone. Furthermore, we attempt to minimise measurement (and simulation) error by defining the reference population narrowly. This is explained below.

We begin by adjusting income components in the survey in such a way as to mirror income as reported to the tax authorities. Here, the main objectives are: (i) ensuring that variables are consistently defined in the two datasets, (ii) identifying the reference population, and (iii) obtaining adjustment factors to correct reported incomes for under-reporting with a view to evading tax.

With respect to defining variables consistently, in tax returns incomes are obviously reported gross of income tax. Moreover, self-employment and farming incomes are gross of social contributions, while wages, salaries and pensions are net of social contributions. As regards the household budget survey, all income is reported net of social contributions and income tax. To ensure comparability, we used a tax-benefit model to compute income taxes (and, in the case of the self-employed, social contributions as well), then added these to net incomes in order to have gross incomes in both datasets.

On a minor point, self-employment income (originally defined in the data as income from a liberal profession or from business not in agriculture) was made

to include property income (i.e. income from rents) and maintenance income in both datasets for the sake of consistency.

With respect to defining the reference population, we re-weighted the sample of tax returns to be representative of the entire population of individuals filing a tax return, then we reconciled the re-weighted sample of tax returns with the survey sample to ensure that it is similar in both datasets. More specifically, we re-weighted the tax returns sample to reflect the distribution of population and the distribution of average household (tax unit) income. Subsequently, we reconciled the re-weighted sample of tax returns experimenting with two alternative reference populations: those liable to file a tax return (excluding non-zero incomes), and those liable to pay non-zero tax.

In the first scenario we identified tax filers according to tax legislation mandating that only (i) wage/salary earners with annual income below €6,000 and (ii) farmers and others earning less than €3,000 a year are exempt from the obligation to submit a tax return (except if they are self-employed, own a car or boat, or have gross annual property income over €600). We estimate the coverage of the income tax system in 2004 at 93.4% of the population. Note that as the necessary information to identify tax filers is not always available, the relevant population cannot be perfectly simulated. In the second scenario we applied the zero-tax threshold of €8,400 or €10,000 a year as a cut-off point to identify those liable to pay non-zero tax.

The number of tax filers identified in the survey was 9,736, of which 9,622 reported non-zero incomes (4,964 incomes above the zero-tax threshold). By definition, the sample of tax returns comprises tax filers only, of which 34,213 reported positive incomes (14,444 reported incomes above the zero-tax threshold).

Faced with a choice between the two alternative reference populations, those with non-zero income and those with non-zero tax, we opted for the second option. The rationale was that the obligation to file a tax return could not be perfectly simulated, as a result of which the population of tax filers in the survey was too dissimilar to that in the sample of tax returns. In fact, compared to the household budget survey, the proportion of tax filers below the zero-tax threshold in the sample of tax returns was significantly higher (58% vs. 48%), and their average income significantly lower (€10,993 vs. €15,158). We think that focusing on tax filers above the zero-tax threshold tax limits the scope for errors in the measurement of income at the bottom of the distribution.

With respect to obtaining adjustment factors (needed to correct incomes for tax evasion), we allocated the reference population of tax filers above the zero-tax threshold into 16 categories defined as combinations of region and source of income. Our decision not to pursue a finer categorisation rested mainly on considerations of sample size: since 8 of our 16 categories contained less than 200 observations, splitting them further into, say, another 4 each was bound to produce too many categories with too few observations.

Specifically, the four regions were Greater Athens, Northern (Thrace, Macedonia and Thessaly), Southern (Central, Western and Peloponnese), and the Islands (Aegean, Ionian and Crete); the four sources of income were wages and salaries, pensions, farming and self employment.

Adjustment factors are ratios of reported to survey income. Let $\bar{y}_{ij}^{R}$ denote the average income from source *j* of individuals resident in region *i* as reported to tax authorities and $\bar{y}_{ij}^{T}$ the corresponding average income as observed in the survey. Further, let $\bar{y}_{j}^{R}$ denote the average reported income and $\bar{y}_{j}^{T}$ the average survey income from source *j* irrespective of region. Each adjustment factor α_{ij} is defined as $\alpha_{ij} = \bar{y}_{ij}^{R} / \bar{y}_{ij}^{T}$

where $i = A$ (Athens), N (Northern), S (Southern), I (Islands);

and $j = w$ (wages, salaries), p (pensions), f (farm income), s (self-employment income).

Even though we originally found the ratio of reported to survey incomes to be 102.2 (implying over-reporting by 2.2%), we set adjustment factors for pension incomes equal to one (i.e. $\alpha_{ip} = 1, \forall i$). Since tax returns are cross-checked against the records of benefit-paying agencies, and since taxpayers use these agencies' statements to fill in their tax return, it is impossible to under-report (or, for that matter, over-report) one's pension incomes in tax returns – except due to measurement (e.g. recall) error.

We also observed small rates of over-reporting for wages and salaries in Athens and in the Islands (4.1% and 4.7% respectively). Again, the corresponding adjustment factors were set equal to one (i.e. $\alpha_{Aw} = \alpha_{Iw} = 1$), on the grounds that no-one knowingly reports higher incomes in a tax return than in an income survey ($\bar{y}_{ij}^{T} \geq \bar{y}_{ij}^{R}, \forall ij$).

Finally, since the relevant category was critically small in the survey (n=8) , we set the adjustment factor for income from farming in Athens equal to 1 minus the "national" rate of under-reporting (53.2%) for that type of income (i.e. $\alpha_{Af} = \bar{y}_{f}^{R} / \bar{y}_{f}^{T} = 0.468$).

The resulting adjustment factors by income source and region are shown in Table 2.

Table 2. Adjustment factors.

	Athens	Northern	Southern	Islands
wages / salaries	1.000	0.978	0.992	1.000
pensions	1.000	1.000	1.000	1.000
farming	0.468	0.412	0.530	0.519
self employment	0.770	0.860	0.640	0.712

Notes: The adjustment factors are multiplied by survey incomes in order to derive a distribution of tax reported incomes.

In order to draw out the implications of income under-reporting for the resulting distribution of post-tax disposable incomes and in terms of tax evaded, we use the Greek component of the European tax-benefit model EUROMOD (see: http://www.iser.essex.ac.uk/msu/emod/).

4. Results

Our results are summarized in Tables 3-6. Table 3 shows rates of under-reporting alongside three dimensions: income source, region and family size.

Table 3. Under-reporting by income source, region and family type.

	population share	survey income	tax reported income	difference
wages / salaries	41.5%	13,085	13,007	-0.6%
pensions	37.1%	7,960	7,960	0.0%
farming	6.3%	12,353	5,819	-52.9%
self employment	15.1%	19,327	14,616	-24.4%
Greater Athens	39.2%	14,555	13,733	-5.6%
Northern	27.4%	11,152	9,859	-11.6%
Southern	22.7%	10,839	9,110	-16.0%
Islands	10.8%	11,534	9,991	-13.4%
single	35.5%	9,970	9,252	-7.2%
women	*20.4%*	*8,753*	*8,414*	*-3.9%*
men	*15.1%*	*11,611*	*10,383*	*-10.6%*
married no children	34.5%	11,310	10,136	-10.4%
married 1 child	12.5%	16,250	14,446	-11.1%
married 2 children	13.7%	17,034	15,133	-11.2%
married 3 children	3.1%	17,042	14,818	-13.1%
married 4+ children	0.6%	17,225	14,348	-16.7%

Notes: Mean income by category is non-equivalised annual personal income in euros. Population shares refer to positive (non-zero) income earners only. Survey income is observed in HBS 2004/05. Tax reported income is adjusted for under-reporting using the adjustment factors by region and income source shown in Table 2. Income from self employment includes property.

Predictably, in terms of income source, farming or self-employment incomes are more likely to be under-reported in tax returns: average under-reporting rates for these two sources are 53% and 24% respectively, while reported incomes from wages and salaries or pensions are nearly identical to survey incomes. In terms of region, under-reporting appears to be most pronounced in Southern Greece (16%) and least so in Greater Athens (less than 6%). Also, income under-reporting seems to increase with family size: singles under-report least, while married people with four children under-report most. Also, in the

singles category, we found that men under-report significantly more than women (10.6% vs. 3.9%).

Table 4 shows how under-reporting varies by income group. The extent of income under-reporting seems to be greatest at the two ends of the income distribution, especially in the highest income decile (about 15%), followed by the bottom three deciles (10-11%). The average rate of under-reporting for the entire population is almost 10%.

Table 4. Under-reporting by level of income.

	survey income	tax reported income	Difference
decile 1 (poorest)	1,963	1,769	-9.9%
decile 2	3,540	3,174	-10.4%
decile 3	5,667	5,031	-11.2%
decile 4	7,079	6,715	-5.1%
decile 5	8,191	7,723	-5.7%
decile 6	9,867	9,172	-7.0%
decile 7	12,298	11,322	-7.9%
decile 8	15,447	14,314	-7.3%
decile 9	19,869	18,525	-6.8%
decile 10 (richest)	39,650	33,839	-14.7%
top 1%	96,526	73,732	-23.6%
top 0.1%	156,859	126,523	-19.3%
Total	12,455	11,220	-9.9%

Notes: Mean income by income group is non-equivalised annual personal income in euros. Income deciles constructed excluding those earning zero or negative incomes. Survey income is observed in HBS 2004/05. Tax reported income is adjusted for under-reporting using the adjustment factors by region and income source shown in Table 2.

Table 5 presents our estimate of taxable income and the resulting tax liability under the competing assumptions of full compliance and tax evasion respectively. The findings worth highlighting are that under-reporting lowers taxable income by slightly more than reported income; that tax allowances and reductions are broadly similar in the two datasets; that tax evasion raises average disposable income by 2.7%; and that it reduces the tax yield by 26.1%.

The latter figure can be decomposed to 11.1% fewer persons paying on average 16.7% less tax.

Table 5: Income tax variables under full compliance and tax evasion.

	full compliance	tax evasion	difference
reported income	12,455	11,220	-9.9%
taxable income	11,957	10,724	-10.3%
tax allowances	499	499	0.0%
tax reductions	182	181	-0.6%
tax due (all)	1,175	868	-26.1%
tax due (non-zero)	3,263	2,716	-16.7%
disposable income	11,280	11,587	2.7%

Notes: Mean income is non-equivalised annual personal income in euros. Full compliance provides estimates of income tax variables assuming incomes are reported to tax authorities as observed in the survey. Tax evasion provides estimates of the same variables assuming incomes are under-reported to tax authorities as implied by the adjustment factors shown in Table 2. The share of positive non-zero income earners paying non-zero tax is 36.0% and 32.0% under full compliance and tax evasion respectively.

Table 6 presents the fiscal and distributional implications of tax evasion in terms of poverty and inequality, tax progressivity, and tax receipts. Since household disposable income is higher under tax evasion than would have been under full compliance, the relative poverty line is also higher (by 1%). Nonetheless, our two poverty indices rise, suggesting that tax evasion causes relative poverty to rise. All five inequality indicators (S80/S20, Gini, Atkinson for e=0.5 and e=2, and Theil) have higher values for tax reported than for survey income, implying that tax evasion results in a more unequal income distribution. Finally, the tax progressivity and redistribution indices (Kakwani, Reynolds-Smolensky, Suits) indicate that income under-reporting renders the tax system more regressive.

Table 6: Fiscal and distributional implications of tax evasion.

	full compliance	tax evasion	difference
tax receipts (€ million)	7,890	5,830	-26.1%
poverty line (€ p.a.)	5,578	5,636	1.0%
poverty rate (FGT α=0)	18.9	19.3	2.3%
poverty gap (FGT α=1)	6.0	6.1	1.6%
Gini	0.320	0.331	3.5%
S80/S20	5.424	5.705	5.2%
Atkinson e=0.5	0.088	0.094	7.2%
Atkinson e=2	0.422	0.434	2.7%
Theil	0.177	0.194	9.2%
Kakwani	0.116	0.104	-10.0%
Reynolds-Smolensky	0.028	0.022	-23.5%
Suits	0.207	0.173	-16.2%

Notes: Full compliance provides estimates of income tax variables assuming incomes are reported to tax authorities as observed in the survey. Tax evasion provides estimates of the same variables assuming incomes are under-reported to tax authorities as implied by the adjustment factors shown in Table 2. Fiscal effects (i.e. tax receipts) are in terms of non-equivalised euros. Distributional indices are computed on the basis of equivalised household disposable incomes. The poverty line is set at 60% of median equivalised household disposable income, and is calculated separately under full compliance and tax evasion. FGT is the Foster Greer Thorbecke family of poverty indices.

5. Discussion

As shown above, the estimated aggregate rate of income under-reporting for the purpose of tax evasion is around 10%. With respect to income source, under-reporting is close to zero with respect to earnings from dependent employment and pensions, but reaches 53% and 24% with respect to income from farming and from self-employment respectively. This is strictly consistent with the literature, as well as with prior notions as to the different opportunities for tax evasion presented to different occupations.

Nevertheless, it seems unlikely that under-reporting of wages and salaries in Greece is nearly zero. The standard assumption that it must be negligible because of withholding and information provided by employers cannot hold in the case of collusion – i.e. when employers and employees agree to conceal all

or part of wages paid in order to reduce both employers' labour costs and workers' take-home pay.

In fact, empirical evidence suggests the existence of a large shadow economy centred on precarious, unregistered, informal jobs (*petits boulots*). The Inspectorate Service of the Social Insurance Foundation IKA estimated that employers in 10% of all firms inspected in 2008 failed to pay social contributions, while 27% of all workers remained unregistered (press release, 25 January 2009). Such practices are particularly widespread in retail trade, construction, tourism, contracted-out services such as cleaning and catering and so on.

We think there are three reasons we failed to detect much under-reporting of wages and salaries earned by the informally employed. To start with, a large proportion of those concerned belong to disadvantaged groups such as foreign workers, who tend to be under-represented in household budget surveys. On the other hand, tax records are truncated, either in the sense that unregistered workers are by definition invisible to tax authorities, or because those earning below a certain level (€3,000 a year) are legally exempt from the obligation to fill in a tax return. Thirdly, given that the household budget survey and our sample of tax returns were drawn from different populations, as a consequence of which a fair amount of re-weighting had to be done, it is possible that some variation was smoothed out in the process.

With respect to region, the extent of income under-reporting by region appears to be smaller in Greater Athens than in the North, in the Islands and, especially, the South. This may be attributed to the concentration of public employment and government-sponsored economic activity in and around Athens, and to the significance of farming, tourism and the construction sector in other regional economies.

As explained before, all other results are due to composition effect, driven by our estimates of under-reporting and resulting adjustment rates by income source and region. This is clearly true for the pattern of non-compliance by household type: under-reporting seems to be lowest for single persons, and to rise with family size. This seems consistent with most of the empirical literature (Clotfelter, 1983; Feinstein, 1991), but in our case is simply the effect of the higher incidence of farming and self-employment in larger families.

Similarly derived is our result by income class, which suggests something between a U- and a J-shape. It appears that income under-reporting for the purpose of tax evasion is higher in low-income groups than middle-to-high income groups, and even higher in top incomes. Specifically, the rate of income under-reporting is 10-11% in the bottom 3 deciles, falls to 5-6% in deciles 4 and 5, rises slightly to 7-8% in deciles 6 to 9, and then sharply to almost 15% in the top decile (24% in the top centile).

Since, by design, under-reporting was not allowed to vary by income class, this U- or J-pattern is entirely due to the concentration of pensioners and wage or

salary earners in the middle of the distribution, combined with the high incidence of small shopkeepers and farmers at low incomes, and the strong presence of self-employed professionals at the top.

As discussed earlier, the available evidence on the relation between tax evasion and income class is mixed. In particular, beyond the literature reviewed in the relevant section, our finding that tax evasion is more prevalent at high incomes finds some extra support in the results of the 1999 values survey jointly conducted by WVS and EVS – at least insofar as survey-based attitudes towards tax evasion reflect actual behaviour. In that survey, the share of respondents agreeing with the statement "cheating on tax if you have the chance is never justified" was greater at low- than at high-income levels in Greece (43% vs. 30%). Incidentally, the same was true in several other countries including Germany, Italy, Hungary and the US, although variation by income class was not significant in Britain. The survey also shows that variation in attitudes towards tax evasion across countries is wide indeed (http://www.worldvaluessurvey.org).

Clearly, the implications of a given rate of under-reporting at low levels of income are very different from those of the same rate further up the income distribution – and not just because of the difference between relative and absolute terms. At the bottom, because of significant tax-free allowances, especially for families with children, the fiscal effect of income under-reporting is pretty minimal. At the top, because of progressive taxation, extensive non-

compliance (as practised, for example, by the medical profession and other groups) translates into sizeable losses in terms of tax receipts, and has considerable effects in terms of income inequality and the progressivity of the tax system in the real world.

Using a tax-benefit model enabled us to compute the distributional and fiscal effects of tax evasion, by simulating tax due under full compliance and under tax evasion, and by comparing the outputs. This produced a series of interesting results. To start with, we found that 10% income under-reporting results in 26% shortfall in tax receipts, which is obviously a function of the progressive structure of income taxation in Greece.

Distributional effects may be seen as rather predictable, given the pattern of under-reporting by level of income discussed above. However, this is less true than it may appear. The results shown in Table 6 were computed on the basis of the distribution of equivalised household disposable income, while the results shown in Table 4 relied on the distribution of non-equivalised personal pre-tax incomes instead.

In spite of this important difference, we find that tax evasion is associated with more inequality, by between 2.7% (Atkinson e=2) and 9.2% (Theil). What this seems to suggest is that the effect of tax evasion on inequality is highest for indices that are more sensitive to changes at high levels of income, which is not unexpected, given the distribution of income under-reporting and the operation of a progressive income tax schedule. Rather less obviously, tax evasion also

seems to cause the poverty rate and the poverty gap to rise above what would have been under full tax compliance, in spite of the fact that the poverty line was allowed to rise to reflect higher disposable incomes with tax evasion.

Finally, the effect of tax evasion on tax progressivity appears to be substantial: the decline in the Kakwani index was estimated at 10%; that of the Suits index at 16.2%; furthermore, the reduction in the Reynolds-Smolensky index was estimated at 23.5%. All three suggest that tax evasion renders the tax system more regressive.

Overall, our analysis seems to underestimate the magnitude of income tax receipts under tax evasion (€5.83 billion) compared with official figures (€6.66 billion). We assume this is because we have been unable to simulate the Greek tax system in its full complexity. For instance, as explained earlier, presumptive taxation and the presence of luxury assets may lead tax auditors to revise taxable income upwards. Both sets of rules defy simulation.

6. Conclusion

Tax evasion in Greece was shown to increase inequality and poverty, and to reduce tax progressivity, as well as implying a considerable loss of tax receipts. This is a strong finding – but is it to be trusted?

A cause for caution regards the distinction between static and dynamic effects of tax evasion. It is important to remember that taxation (and, by implication,

tax evasion) does not simply reduce disposable incomes; it also affects decisions concerning supply of, and demand, for labour, the allocation of disposable income between consumption and savings, the allocation of consumption between different goods and services and so on (Slemrod and Yitzhaki 2002, Sandmo 2005). Although the analysis of such dynamic effects lies well beyond the scope of this paper, we need to recognise that the implications of tax evasion exceed what we can show with a static arithmetical recalculation of the income distribution.

On a related point, while our approach focuses on the effects of income tax evasion, the distributional impact of evading other taxes (e.g. company tax, capital tax, value added tax) is likely to reinforce these effects. The case of social contributions, often evaded at the same time as income taxes, deserves a comment. Two effects operate here. On the one hand, social contributions are paid at a flat rate in the case of employer and employee contributions, or as a lump sum in the case of self-employed contributions, and they are payable from the first €1 earned (i.e. no lower earnings threshold typically applies). As a result of that, the distributional impact of evasion may be less regressive for social contributions than it is for income tax. On the other hand, employer social contributions in Greece are formally twice as high as employee contributions, as a result of which (and given labour market realities) unregistered work and incomplete reporting of wages may reduce employers' labour costs far more than it may raise take-home workers' incomes. Recall also that, as recognised by Slemrod (2007), the presence of tax evasion calls

into question the standard result that the incidence of taxes does not in the long run depend on which side of the labour market payroll taxes are levied. On balance, taking both effects into account, we think that evasion of social contributions is more likely to reinforce than mitigate the regressive impact of tax evasion.

Our approach relies on matching data from tax returns with survey data. While we have made an effort to make the two sources comparable, our adjustment techniques offer at best good approximations. In particular, the truncated nature of tax records (i.e. low-income families pay no taxes) and the limited reliability of income statistics at either end of the income scale leave our estimates vulnerable to measurement error. Therefore, our results should be seen as tentative estimates under an experimental research design. Clearly, the design itself can be improved further, e.g. by trying other approaches to matching the two databases, by repeating the analysis with a larger sample of tax returns, or by collecting more information, enabling us to create smaller, more homogeneous categories.

A possible refinement concerns the introduction of stochastic variation. Specifically, there is no reason to think that all members of a given category under-report their incomes by the same ratio: some will report less, some more, some others may even faithfully reveal their incomes to the tax authorities. This would be consistent with the literature: a TCMP study found that among taxpayers with reported income between $50,000 and $100,000 in 1988, 60%

understated tax, 14% overstated it, and 26% reported tax correctly (Christian, 1994). Stochastic variation involves introducing a random term around an average rate of under-reporting by category. Again, this exceeds the scope of the current paper.

Our key assumption is to treat incomes observed in the household budget survey as closer approximations of "true income", on the grounds that people have no incentive to conceal their income from survey interviewers, since their disposable income would not be affected by their response. The intuition – reflected in similar approaches taken in other studies (Fiorio and D'Amuri, 2005) – is reasonable, but not necessarily correct. The role of measurement error, introducing indeterminacy and calling for a healthy dose of scepticism, was discussed above. Quite apart from that, there are at least two reasons to suspect that the actual but unknown level of tax evasion may be considerably higher than that implied by our estimates.

On the one hand, while our approach attempts to capture income under-reporting, in the sense of individuals reporting a lower figure in their tax return, some tax evasion is also caused by individuals who decline to file a tax return altogether. On the other hand, there is evidence (Elffers et al., 1987) that the very same factors causing tax evasion (low trust, low tax morale and so on), combined with the wish of tax-evading individuals to be somehow "consistent", may cause under-reporting of incomes in surveys as well, albeit at a lower level. To the extent that these factors are at work here, our estimates of

tax evasion will be biased downwards. That would be consistent with the reflection of Schneider and Enste (2000), that "it is unlikely that [direct methods] capture all shadow activities, so they can be seen as lower-bound estimates".

A final word concerns the nature of our research. Even though the design of our work was experimental, the assumptions we have had to rely upon were sometimes crude, and several issues (some of which discussed here) remain unresolved, we believe our results capture essential aspects of the problem we set out to explore. Our core finding, that tax evasion in Greece has a regressive impact, seems reasonably robust. While we have not addressed the question of the optimal design of tax auditing policies, our results suggest that the payoff of efforts to reduce tax evasion could be very substantial indeed: higher tax receipts, lower poverty, reduced inequality, and a more progressive tax system.

After all, it may be that the "egalitarian policy maker" invoked by Cowell (1987) has little reason to "smile indulgently on evasion", and every reason actively to engage in a sustained effort to reduce it.

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