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The effect of tax evasion and targeting errors across countries: the case of Greece

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1. **Introduction**

The imperfect targeting of social assistance benefits has most often been studied in the context of explaining non take up behaviour and/or quantifying its effects. However, in order fully to assess policy effectiveness one needs to address the converse phenomenon of benefits leaking to non-entitled recipients. Benefit leakage occurs when individuals withhold or distort the information on their material conditions and other characteristics, which is relevant when benefit-awarding agencies assess eligibility. Information may be manipulated in many ways but perhaps the most common method is through income under-reporting. In this sense, targeting errors and tax evasion interact.

This paper discusses how these two phenomena have been jointly studied in the context of Greece (the only country in this project where both phenomena were analysed), using the European tax-benefit model EUROMOD. The benefits considered are two income-tested benefits targeted at the elderly: the Pension Social Solidarity Benefit *ΕΚΑΣ* and the Social Pension.

The paper is organised as follows. The current section introduces the paper. Section 2 offers a brief description of the benefits considered. Section 3 presents how estimates of non-take-up have been obtained. Section 4 discusses the effects of introducing tax evasion. Section 5 is a technical summary of how our results were incorporated into EUROMOD. The final section concludes.

2. **The two benefits**

The "Pension Social Solidarity Benefit" *ΕΚΑΣ* is an income-tested supplement aimed at recipients of old age and survivor pension over 60 or of invalidity pension or orphans' pension irrespective of age. It is restricted to those receiving a contributory social insurance pension. *ΟΓΑ*[1] pensioners are excluded on the grounds that their pension is not contributory.

Beneficiaries must be over 60 if in receipt of an old age pension or a survivor pension. There

[1] *ΟΓΑ* is the social insurance fund for farmers in Greece.

is no age condition if in receipt of an invalidity pension or orphans' pension. Recipients of a farmer basic pension or a Social Pension are excluded.

Receipt of *ΕΚΑΣ* is granted to those with (a) personal net income from retirement benefits and employment earnings below €6,562 per year, (b) personal taxable income from all sources below €7,656 per year, and (c) family taxable income must be below €11,913 per year (in 2004). Claimants must satisfy all three income conditions to receive *ΕΚΑΣ*.

The Social Pension is a non-contributory, income-tested pension, reserved to people over 65 years of age, who are not in receipt of a social insurance pension – except if the relevant benefit is lower than the basic *ΟΓΑ* pension – and lack independent means of support.

Benefit is granted if family income, including all sources of gross income except for irregular lump-sum payments, does not exceed the benefit amount itself (€2,811 per annum for singles, €5,622 per annum for couples).

3. **Non take up**

Non take up estimates for 2004 were derived through a comparison of the eligible population and the recipient population, as shown below.

Table 1: **The non take up matrix**

	RECEIPT	NON- RECEIPT
ELIGIBILE	*Entitled Recipients (ER)*	*Entitled Non-Recipients (ENR)*
INELIGIBLE	*Non-Entitled Recipients (NER)*	*Non-Entitled Non-Recipients (NENR)*

The non take up rate (NTU) is then defined as

$$NTU = \frac{ENR}{ER + ENR}$$

For both benefits, the eligible population was simulated in EUROMOD. The model relies on the Household Budget Survey 2004/05, which is a survey carried out by the National Statistical Service in Greece every few years. The latest HBS covered the income year starting in February 2004 and ending in January 2005. Our best non take up estimates for ΕΚΑΣ are summarized in Table 2 below.

Table 2: ***EKAΣ* non take up and beta error** (2004)

	N (weighted)	%
(1) total number of individuals	10,900,000	100.00
(2) eligible for *EKAΣ*	422,677	3.88
(3) thereof: with *EKAΣ* receipt	317,670	0.29
(4) without *EKAΣ* receipt	105,007	0.96
(5) recipients of *EKAΣ*	378,698	3.47
(6) "beta error" cases[1]	61,028	0.56
(7) "beta error" cases due to tax evasion	508	0.00
non take up rate (4/(3+4))	24.8%	n.a.
beta error rate (6/5)	16.1%	

[1] *EKAΣ* receipt when not eligible.
Source: Flevotomou and Matsaganis (2009a).

Table 2 indicates a non take up rate of *EKAΣ* of 24.8%. At the same time, it suggests that 16.1% of actual recipients in 2004 appeared not to be entitled to *EKAΣ*. This figure, usually referred to as the beta error rate, may at least in part disguise data problems and/or simulation imperfections.

In the results presented above, we have already tried to correct for potential biases in our data and simulation. First, receipt information is based on official statistics as the HBS performs rather poorly in representing *EKAΣ* recipients. Second, when simulating eligibility, income components taken into account in the income test for *EKAΣ* were adjusted to their 2002 values using applicable backrating factors. This is because the income test that claimants must pass is based on tax returns of the year before the application, for incomes earned two years before the application (that is the most recent year for which a tax return is available). As a result of these two corrections, our baseline estimate of the beta error rate was reduced to 16.1%. The final step, to be discussed in the next section, is to disentangle the part of the beta error caseload that may be genuinely attributed to system abuse and is hence unrelated to the quality of our data and/or simulation.

Results of our baseline estimation for the Social Pension are presented in Table 3, which shows that the non take up rate for Social Pension is estimated at 38.3%, while the beta error rate stands at a relatively low level of 9.7%. Note that Social Pension receipt is not reported directly in the HBS 2004/05. Instead, it is reported alongside a group of benefits targeted at the elderly, which are then all aggregated under the umbrella "old age benefits". In view of this, an inference mechanism was implemented within EUROMOD in order to simulate Social Pension receipt. The resulting recipient caseload, estimated at 57,886 persons in 2004, was deemed satisfactory against an actual number of recipients of 56,907 in the same year.

Table 3: **Social Pension non take up and beta error** (2004)

	n (observed)	N (weighted)	%
(1) total number of individuals	17,386	10,900,000	100.00
(2) eligible for Social Pension	132	84,792	0.78
(3) thereof: with Social Pension receipt	82	52,277	0.48
(4) without Social Pension receipt	50	32,515	0.30
(5) "beta error" cases[1]	8	5,609	0.05
non take up rate (4/(3+4))	37.9%	38.3%	n.a.
beta error rate (5/(3+5))	8.9%	9.7%	

[1] Social Pension receipt when not eligible.
Source: Flevotomou and Matsaganis (2009a).

4. **Tax evasion**

In order to identify to what extent income understatements may account for benefit leakage, income under-reporting for the purposes of tax evasion was incorporated in our simulation model. For subgroups defined by region and main income source, each of the four separate income components – as reported in the HBS – were adjusted using the following factors.

Table 4: **Adjustment factors for income under-reporting** (2004)

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

Source: Flevotomou and Matsaganis (2008).

The adjustment factors presented in Table 4 are the outcome of a comparison of income as reported in the HBS and income as reported in a 0.5% sample of unaudited tax returns referring to 2004 incomes.

Table 5 compares our baseline estimates for *ΕΚΑΣ* to the estimates obtained following the incorporation of tax evasion in the simulation model. It shows that accounting for income under-reporting to the tax authorities, discloses 12,297 persons who are falsely eligible for *ΕΚΑΣ*. However, very few of these would actually claim it. More specifically, out of the 61,028 beta error caseload, just 508 cases may be identified as ineligible claimants, while the remaining 60,520 cases (16.0% of all recipients) most probably represent residual data and/or

simulation imperfections.

Table 5: ***EKAΣ* non take up and beta error: introducing tax evasion** (2004)

	under no tax evasion (**1**)	under tax evasion (**2**)	difference (**3**) = (**2**) – (**1**)
eligible for *EKAΣ*	422,677	434,974	12,297
thereof: with *EKAΣ* receipt	109,016	109,524	508
without *EKAΣ* receipt	313,662	325,450	11,788
"beta error" cases [1]	61,028	60,520	-508

[1] *EKAΣ* receipt when not eligible.
Source: Flevotomou and Matsaganis (2009a).

In the light of the above, Table 2 may be updated to provide a more informative picture of our results. Whereas our best estimate of non take up of ΕΚΑΣ remains at 24.8% and that of the beta error rate at 16.1%, we may disentangle the latter into the part related to benefit leakage (0.1%) and the part absorbing simulation imperfections of data quality problems (16.0%). This is shown in Table 6.

Table 6: ***EKAΣ* non take up and beta error updated** (2004)

	N (weighted)	%
(1) total number of individuals	10,900,000	100.00
(2) eligible for ΕΚΑΣ	422,677	3.88
(3) thereof: with ΕΚΑΣ receipt	317,670	0.29
(4) without ΕΚΑΣ receipt	105,007	0.96
(5) recipients of ΕΚΑΣ	378,698	3.47
(6) "beta error" cases[1]	61,028	0.56
(7) "beta error" cases due to tax evasion	508	0.00
non take up rate (4/(3+4))	24.8%	n.a.
beta error rate (6/5)	16.1%	
beta error rate due to simulation imperfections (6–7)/(5)	16.0%	
beta error rate due to tax evasion (7/5)	0.1%	

[1] *EKAΣ* receipt when not eligible.
Source: Flevotomou and Matsaganis (2009a).

Table 7 shows that income under-reporting to the tax authorities makes 2,542 individuals (87,333 minus 84,792) falsely eligible for Social Pension. However, the recipient population remains unchanged as the additional potential claimants do not take up their Social Pension "entitlement". In other words, our best estimate of the rate of non take up of Social Pension remains at 38.3%, while that of the rate of beta error at 9.7%. Further, in contrast with *EKAΣ*,

it is impossible to draw any conclusions upon the relative weights of benefit leakage and simulation limitations in the resulting beta error caseload.

Table 7: **Social Pension non take up and beta error updated** (2004)

	no tax evasion	tax evasion	difference
eligible for Social Pension	84,792	87,333	2,541
thereof: with Social Pension receipt	52,277	52,277	0
without Social Pension receipt	32,515	35,056	2,541
"beta error" cases [1]	5,609	5,609	0

[1] Social Pension receipt when not eligible.
Source: Flevotomou and Matsaganis (2009a).

5. **Technical issues**

This section offers a summary of how non take up and tax evasion were practically incorporated in EUROMOD. It is inevitably technical and therefore aimed at modellers wishing to implement a similar analysis in a tax-benefit model.

Three approaches were considered as to how to identify eligible non-recipients in EUROMOD. In order of decreasing complexity, they were:

(a) identify eligible non-recipients on the basis of individual characteristics,

(b) identify eligible non-recipients on the basis of expected entitlement,

(c) identify eligible non-recipients randomly.

The three approaches are discussed in detail in a separate paper (Matsaganis et al, 2009). For the purposes of this paper, we give a brief description of the final approach, which was our preferred choice. Approach (c) essentially assigns a random number drawn from the uniform distribution to each potential beneficiary and determines who claims the benefit or not by comparing this to the threshold (with respect to random numbers) which ensures the desired take-up rate in the baseline. This procedure is carried out externally as the current random number generator facility in EUROMOD cannot be used for a subset of the population (here the eligible population). Results are thereafter 'internalized' in EUROMOD, where switches enable users to choose between a full or less than full take-up scenario. The end product is a set of new variables indicating receipt of the benefit(s) considered, and income from that benefit. Alternative assumptions of non-take-up cannot, however, be parameterised within EUROMOD.

Under the chosen, random, approach of identifying eligible non-recipients one would ideally repeat random draws n times (1000, for instance) in order to point out any robust effects. Further, given that the two benefits considered interact with each other in the greek tax benefit system (and in fact affect pensioners' social insurance contributions and income tax), two implementation options within EUROMOD would be left open. First, produce two EUROMOD outputs – the baseline and another where nobody claims the benefit. Non take up would be assigned externally to the eligible population but information from the two outputs would be combined to attain relevant disposable incomes. The second option would be to add random numbers to the input dataset and re-run the whole tax-benefit system for everybody. However, this would be computationally extremely time-consuming.

Because of the above-mentioned practical considerations, it was decided to rely, for the time being, on one random draw only and examine efficient ways to model larger number replications at a later point. For each benefit of interest ***x*** (***x*** = 01, 02 referring to *EKAΣ* and Social Pension respectively) two markers were externally defined: *grpsaenx* and *grpsaefx*. The former, grpsaen*x*, indicates entitlement to benefit ***x***. The latter (*grpsaefx*) indicates receipt of benefit ***x***. Having ranked the population of interest in ascending order of the uniform random number drawn, grpsaef*x* for individual ***i*** was defined as shown below:

$$grpsaefX_i = \begin{cases} 1, \left| \sum_{j=1}^{i} w_j\, j - TU \right| \leq \min_j \left(\left| \sum_{j=1}^{i} w_j\, j - TU \right| \right) \\ 0, otherwise \end{cases}$$

where

$\sum_{j=1}^{i} w_j\, j$ is the (weighted) cumulative sum of the population of interest up to individual *i*

TU is the required number of people receiving the benefit.

In other words, an individual was assumed to take up the benefit if the sum of potential recipients up to herself/himself was as close as possible to the required number of people actually receiving the benefit. Note that in the case of *EKAΣ*, the population of interest was extended beyond the eligible population to include that part of the non-eligible population who is receiving the benefit due to income under-reporting to the tax authorities. This was an

effort to capture benefit leakage in addition to benefit non take up, at least for *EKAΣ* where accounting for tax evasion gave us some limited insight on the relevant population sub-group.

The markers defined above are used in two new policies ("*poltakeup_ekas*" and "*poltakeup_socpen*") which have been introduced in the greek policy file of EUROMOD to account for non take up of *EKAΣ* and of Social Pension respectively. Each policy attributes to individuals who have been randomly selected as eligible non-recipients the simulated amount of the appropriate benefit (*gr_sben_socsolidarity* or *gr_sben_socpen*), which is to be treated as a reduction that needs to be made from disposable income (output variable *gr_psardx).* Figure 1 shows how this is done for *EKAΣ*. The specification for the Social Pension is similar and therefore omitted.

Figure 1

param_name	GR_2004	system			
first_module	**EKAS Social Solidarity Benefit Non-Take-Up and Leakage**				
co_SBEN_Elig	Eligibility Module				
first_cond	**0**				
eq_var1	2				
eq_var2	2				
end_cond	**0**	*eligible persons MUST NOT …*			
eq_var1_name	grpsaef01	*… receive EKAS*			
eq_var1_lt	0				
eq_var2_name	grpsaen01	*… although they are eligible for EKAS*			
eq_var2_lt	1				
SBEN_elig_type	2				
TAX_UNIT	individual_gr				
SWITCH	1				
co_set_var					
must_be_elig	1				
nvars	1				
def_var1	gr_sben_socsolidarity				
var1	gr_psard01				
TAX_UNIT	individual_gr				
SWITCH	1				

Figure 1 shows that for those individuals who have been randomly selected not to receive *EKAΣ* (*grpsaef01*=0), while they are eligible for it (*grpsaen01*=1), the reduction that needs to be made from their disposable incomes (gr_*psard01*) is equal to the simulated amount of *EKAΣ* (*gr_sben_socsolidarity*).

As already mentioned, in the case of *EKAΣ*, beta error was also incorporated in the model. This is shown in Figure 2. In this case, for individuals who have been randomly selected to receive the benefit (*grpsaef01*=1), but are not eligible for it (*grpsaen01*=0), an amount (*gr_psaxp01*) equal to the amount of *EKAΣ* received (*grbcm*) is calculated as an income component that should be added to disposable incomes.

Figure 2

	co_SBEN_Elig		Eligibility Module					
	first_cond		**0**					
	eq_var1		2					
	eq_var2		2					
	end_cond		**0**		*eligible persons MUST ...*			
	eq_var1_name		grpsaef01		*... receive EKAS*			
	eq_var1_lt		1					
	eq_var2_name		grpsaen01		*... although they are NOT eligible for EKAS*			
	eq_var2_lt		0					
	SBEN_elig_type		2					
	TAX_UNIT		individual_gr					
	SWITCH		1					
	co_set_var							
	must_be_elig		1					
	nvars		1					
	def_var1		grbcm					
	var1		gr_psaxp01					
	TAX_UNIT		individual_gr					
	SWITCH		1					

With respect to tax evasion, at the core of our methodology lays the imputation of the 'reported' income distribution or, in other words, the adjustment of incomes contained in the HBS so as to replicate as closely as possible the income distribution underlying the tax returns data. For that purpose, the adjustment factors presented in Table 4 were estimated . The first issue we had to address as modellers was whether to adjust income components externally and then run the tax benefit model on the updated income survey data or introduce adjustment factors in EUROMOD as separate parameters that may be revised or updated. In the latter case, new modules in the model would then simulate the synthetic (imputed) income distribution as well as that part of income which is not reported to the tax authorities. The desire for flexibility in the future use of the model makes, to our opinion, this last option superior and was the preferred one for Greece. Estimated parameters were incorporated into EUROMOD through two new 'policies'. The first policy estimates adjusted income

components; an illustration of how individuals' incomes were adjusted in Northern Greece is provided in Figure A.1 in the Appendix. Table A.1 presents the underlying calculations. The second policy estimates that part of income which remains unreported to the tax authorities but should be added onto households' disposable income if a distributional analysis is to be undertaken. Figure A.2 and Table A.2 in the Appendix present the parameterisation in the tax benefit model and the underlying calculations respectively.

The second issue that needs to be tackled by the tax-benefit model concerns income definitions. In practical terms, the modeller may need to implement changes in the income lists used in the tax evasion simulation. To avoid confusion with baseline results, it is advisable that a new income list set is created. The modeller should investigate which income lists are affected by the imputation of the various income components. For example, in Greece EUROMOD simulates total 'reported' self-employment income (*coSLFEMY*) based upon survey information on self-employment income from agriculture (*grYSEAGTX*) and other self-employment income (*grYSETX*). However, the non-agricultural part of self-employment income (*grYSETX*) is defined so as to contain property income and maintenance payments, which are not included in the baseline definition of *coSLFEMY*. Table 8 below shows the mapping between variable definitions in the baseline and tax evasion simulations.

Table 8: **Variable definitions**

baseline	**tax evasion**
coSLFEMY coPROPY coMAINTY	coSLFEMY

The immediate implication for the tax-benefit modeller is to check which income lists contain the above variables and in the new income list set replace the presence of all three components in a specific income list with just coSLFEMY. In Greece, this affected eight income lists.

The income list which will inevitably have to be changed is that of standard disposable income. This is because in the baseline specification income components are assumed to be truly revealed, whereas in the tax evasion scenario income components are as 'reported' to the tax authorities. Clearly, the unreported part of incomes needs to be added onto disposable

incomes for an informative distributional analysis to take place. Figure A.3 in the Appendix compares the standard disposable income list in Greece across the two scenarios.

6. **Conclusion**

This paper tried to highlight the main issues arising when a joint analysis of non take up and tax evasion is undertaken within the framework of a tax-benefit model. The aim was twofold. On the one hand, introducing tax evasion in the analysis of imperfect targeting of benefits could be enlightening in explaining, at least part of, benefit leakage. This goal was pursued by focusing on two social assistance benefits targeting the elderly in Greece. Unfortunately, the introduction of tax evasion did not confirm our prior expectations about its influence on benefit leakage for neither benefit: some small effect was found for *ΕΚΑΣ*, where about 0.8% of the so-called beta error caseload (508 out of 61,028 cases) was identified as abusing the system through income under-reporting to the tax authorities. For social pension, tax evasion had no effect whatsoever on the composition of the beta error caseload.

Results could be country-specific or driven by the limitations of the current study. The analysis presented in this paper may be extended along many dimensions, all of which are implementable in the framework of a tax-benefit model. With regard to tax evasion, an obvious improvement would be to relax the somehow crude assumption that all members of a given category under-report their incomes by the same ratio through the introduction of stochastic variation in the adjustment factors used to simulate the 'reported' income distribution. Another extension would be to extend the scope of analysis by incorporating not only tax evasion but also evasion of social insurance contributions into the tax-benefit model[2]. Further, albeit not crucial when looking at old-age benefits, the study of the interaction of non take up and tax evasion in a more general setting may be informed by examining the dynamic effects of taxation through its impact on decisions concerning labour supply and demand, the allocation of disposable income between consumption and savings, the allocation of consumption between different goods and services and so on. Such behavioural responses may be accounted for in a tax-benefit model through its linkage to an externally estimated labour supply function. Finally, a limitation of our non take up analysis is that we have relied on a single random draw in order to identify eligible non-recipients. In order to point out any

[2] Note that part of contribution evasion has already been implicitly captured insofar as social insurance contributions have been simulated in EUROMOD upon lower than true incomes. However, a full treatment of the issue would also include cases that fully abstain from social insurance contribution payments.

robust effects, larger number replications should be modelled.

On the other hand, the work presented in this paper, aimed primarily to provide guidance to modellers as to how tax evasion and non take up can be jointly studied and practically implemented in a tax-benefit model. The key issues have been highlighted in this paper in the form of recipes; a more extensive presentation can be found in the quoted thematic papers covering non take up and tax evasion separately.

Appendix

Figure A.1: **Adjusting income components for under-reporting to the tax authorities**

Name	Period	GR_2004	end_system								
first_module		Adjusting Income Sources for Tax Evasion									
co_SBEN_Elig											
first_cond		0									
eq_var1		1									
end_cond		0									
eq_var1_name		coregion									
eq_var1_lt		1	*region is Northern Greece*								
SBEN_elig_type		1									
TAX_UNIT		individual_gr									
SWITCH		1									
co_formula											
must_be_elig		1									
namounts		1									
nvars		1									
formula		var1 * amt1									
amt1		0,978	*adjustment factor for wages and salaries in Northern Greece*								
var1		coEMPY	*gross earnings from employment*								
output_var		coEMPY	*adjusted earnings from employment*								
TAX_UNIT		individual_gr									
SWITCH		1									
co_formula											
must_be_elig		1									
namounts		2									
nvars		2									
formula		var1*amt1 + var2*amt2									
amt1		0,860	*adjustment factor for other self-employment income in Northern Greece*								
amt2		0,412	*adjustment factor for self-employment income from agriculture in Northern Greece*								
var1		grYSETX	*gross other self-employment income*								
var2		grYSEAGTX	*gross self-employment income from agriculture*								
output_var		coSLFEMY	*adjusted self-employment income*								
TAX_UNIT		individual_gr									
SWITCH		1									
co_formula											
must_be_elig		1									
namounts		1									
nvars		1									
formula		var1 * amt1									
amt1		1	*adjustment factor for pension income in Northern Greece*								
var1		grben_OA	*gross old-age pensions*								
output_var		grben_OA	*adjusted old-age pensions*								
TAX_UNIT		individual_gr									
SWITCH		1									

Figure A.1 (cont'd): **Adjusting income components for under-reporting to the tax authorities**

co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1 * amt1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_inv	*gross invalidity pensions*	
output_var	grben_inv	*adjusted invalidity pensions*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1 * amt1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_surv	*gross survivors' pension*	
output_var	grben_surv	*adjusted survivors' pension*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1 * amt1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_or	*gross orphans' pension*	
output_var	grben_or	*adjusted orphans' pension*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1 * amt1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grogapns	*gross oga pension*	
output_var	grogapns	*adjusted oga pension*	
TAX_UNIT	individual_gr		
SWITCH	1		

Table A.1: **Underlying calculations I**

income component	**input variable (read-off data)**	**adjustment factor**	**output variable (simulated)**
wages and salaries	coEMPY	0.978	coEMPY = coEMPY×0.978
self-employment income from agriculture	grYSEAGTX	0.412	coSLFEMY = 0.412×grYSEAGTX +0.860×grYSETX
other self-employment income	grYSETX	0.860	
pensions (old-age benefits)	grben_oa	1.000	grben_oa = 1.000×grben_oa
pensions (invalidity pension)	grben_inv	1.000	grben_inv = 1.000×grben_inv
pensions (survivors' pension)	grben_surv	1.000	grben_surv = 1.000×grben_surv
pensions (orphans' pension)	grben_or	1.000	grben_or = 1.000×grben_or
pensions (farmers' pension)	grogapns	1.000	grogapns = 1.000×grogapns

Figure A.2: **Calculating unreported income**

Name	Period	firs	GR_2004	end_system
first_module			**Calculating part of income not reported**	
co_formula				
nvars			3	*same for all regions*
formula			var1 + var2-var3	
var1			grYSETX	
var2			grYSEAGTX	
var3			coslfemy	
output_var			co_temp2	
TAX_UNIT			individual_gr	
SWITCH			1	
co_SBEN_Elig			**region condition**	
first_cond			0	
eq_var1			1	
end_cond			0	
eq_var1_name			coregion	
eq_var1_lt			1	*region is Northern Greece*
SBEN_elig_type			1	
TAX_UNIT			individual_gr	
SWITCH			1	
co_formula				
must_be_elig			1	
namounts			1	
nvars			1	
formula			var1/amt1-var1	
amt1			0,978	*adjustment factor for wages and salaries in Northern Greece*
var1			coEMPY	*adjusted employment income*
output_var			co_temp1	*employment income not reported*
TAX_UNIT			individual_gr	
SWITCH			1	
co_formula				
must_be_elig			1	
namounts			1	
nvars			1	
formula			var1/amt1-var1	
amt1			1	*adjustment factor for pension income in Northern Greece*
var1			grben_OA	*adjusted old-age pension income*
output_var			co_temporary_var1	*old-age pension income not reported*
TAX_UNIT			individual_gr	
SWITCH			1	

Figure A.2 (cont'd): **Calculating unreported income**

co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1/amt1-var1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_inv	*adjusted invalidity pension income*	
output_var	co_temporary_var10	*invalidity pension income not reported*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1/amt1-var1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_surv	*adjusted survivors' pension income*	
output_var	co_temporary_var2	*survivors' pension income not reported*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1/amt1-var1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grben_or	*adjusted orphans' pension income*	
output_var	co_temporary_var3	*orphans' pension income not reported*	
TAX_UNIT	individual_gr		
SWITCH	1		
co_formula			
must_be_elig	1		
namounts	1		
nvars	1		
formula	var1/amt1-var1		
amt1	1	*adjustment factor for pension income in Northern Greece*	
var1	grogapns	*adjusted oga pension*	
output_var	co_temporary_var4	*oga pension not reported*	
TAX_UNIT	individual_gr		
SWITCH	1		

Table A.2: **Underlying calculations II**

income component	**input variable (simulated)**	**adjustment factor**	**output variable (simulated)**
wages and salaries	coEMPY	0.978	co_temp1 = coEMPY/0.978 – coEMPY
self-employment income from agriculture	grYSEAGTX*****	n.a.	co_temp2 = grYSEAGTX + grYSETX – coSLFEMY
other self-employment income	grYSETX*****		
all self-employment income	coSLFEMY		
pensions (old-age benefits)	grben_oa	1.000	co_temporary_var1 = grben_oa/1.000 – grben_oa
pensions (invalidity pension)	grben_inv	1.000	co_temporary_var10 = grben_inv/1.000 – grben_inv
pensions (survivors' pension)	grben_surv	1.000	co_temporary_var2 = grben_surv/1.000 – grben_surv
pensions (orphans' pension)	grben_or	1.000	co_temporary_var3 = grben_or/1.000 – grben_or
pensions (farmers' pension)	grogapns	1.000	co_temporary_var4 = grogapns/1.000 – grogapns

***** These two variables are read off the data.

Figure A.3: **Standard disposable income list in baseline and under tax evasion**

Standard Disposable Income Lists			
Income Component	**Income Variable**	Baseline	Tax Evasion
tax : income tax	co_nat_inctax	-1	-1
unreported income: wages and salaries	co_temp1	1	0
unreported income: self-employment income	co_temp2	1	0
unreported income: old-age benefits	co_temporary_var1	1	0
unreported income: invalidity pension	co_temporary_var10	1	0
unreported income: survivors pension	co_temporary_var2	1	0
unreported income: orphans pension	co_temporary_var3	1	0
unreported income: farmers pension	co_temporary_var4	1	0
benefits : education	coEDY	1	1
income : employment	coEMPY	1	1
benefits : housing	coHB	1	1
income : investment	coINVY	1	1
income : private transfers : maintenance payment	coMAINTY	0	1
benefits : maternity	coMATERY	1	1
income : Other	coOTHERY	1	1
income : property	coPROPY	0	1
income : private pension	coPRVPEN	1	1
income : private transfers : Other	coPRVTRN	1	1
benefits : Other : regular, periodic	coREGY	1	1
income : self employment	coSLFEMY	1	1
GR: banking employees' social insurance contributions (ETE)	gr_banksic	-1	-1
Civil Servants Social Contribution	gr_cssic	-1	-1
ika employee contributions	gr_eesic	-1	-1
Gr: Farmer's SIC	gr_frmsic	-1	-1
GR: Unemployment Assistance for Old Workers	gr_iben_ua_old_workers	1	1
GR: social insurance agencies' solidarity account	gr_lafka	-1	-1
GR: other self-employed social insurance contributions (TAE)	gr_osesic	-1	-1
ika pensioner contributions	gr_pesic	-1	-1
GR: liberal professions' social insurance contributions on employment income (ΤΣΑΥ)	gr_profeesic	-1	-1
GR: liberal professions' social insurance contributions on self-employment income (ΤΣΑΥ)	gr_profsesic	-1	-1
GR: public enterprise workers' social insurance contributions (ΤΑΠ-ΟΤΕ)	gr_pubsic	-1	-1
Gr: Third Child Benefit	gr_sben_cb_third	1	1
Gr: Social Pension	gr_sben_socpen	1	1
Gr: EKAS Social Solidarity Benefit	gr_sben_socsolidarity	1	1
GR:Scheme TEBE(selfempl.)	gr_sesic	-1	-1
GR: disability benefit (non-contributory)	GRBEN_DI	1	1
GR: invalidity pension	grBEN_INV	1	1
GR: old age pension	GRBEN_OA	1	1
GR: orphans' pension	grBEN_OR	1	1
GR: sickness benefits	grBEN_SICK	1	1
GR: widows' benefits	grBEN_SURV	1	1
GR: Unemployment Benefit	GRBEN_UN	1	1
GR: child benefit	grCB	1	1
GR: large family child benefit	grCBLARGEFAM	1	1
GR: many-children child benefit	grCBMANY	1	1
GR: other family benefits	grFAMBEN	1	1
GR: OGA Old Age Pension	grOGAPNS	1	1

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