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Stress Testing the Effect of Income Tax Scale on a Full Time Agricultural Income in Greece After the New Tax Legislation

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Abstract:

The main purpose of this paper is to identify and point out changes in the tax burden on farm income given the new tax legislation of 2016 according to which the farm income has the same tax treatment as the rest of the professionals.

The paper initially presents the key determinants of tax burden through the latest tax legislation, like the new tax scales, and the relative tax rates of each scale. Furthermore, it presents a theoretical model regarding an indicative Gross Revenue and a Cost Index of a full-time farmer. By choosing to apply Monte Carlo Simulation with the Pert Distribution as analyzed below; we use @ Risk software to stress the tax parameter of Tax Scales, with intervals of ±10%, to identify how the parameter, has influenced the tax burden of farm income.

From the findings we can conclude that tax scale has an abnormal effect to the tax burden of the Farm Income as the second and not the third scale has the most significant effect.

As tax legislation evolves every one or two years it is important to point out that regarding farmers income the tax scale has a non-gradual – non-linear effect, which must be corrected to be more equal distributed along the income tax scales.

Keywords: *Farmer, Farm Income, Income Tax, Income Tax Scale, Tax Accounting Pert Distribution; Monte Carlo Simulation.*

JEL Classification: *M410; Q100; Q190.*

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1. Introduction

Given the new tax legislation of 2016 according to which the farm income has the same tax treatment with the rest of the professionals we decided to construct a model to check the effect of stressing the main tax parameters by an average of +-10%. We started by constructing a theoretical model according to which the gross revenue of the farmer is 200.000 euros and there is a gross profit margin of 30% derived from a cost index of 70% on the revenue. Given the new legislated tax-scale we stressed the cut off limits of the scales; the tax coefficients of the scale and the effective tax rate derived from the net income after tax to revenues, in order to identify which parameters, have the most significant influence on the tax burden of farmers' income.

2. Literature review

Bourdaras (2006) and Tamiolakis (2013) have researched extensively the past, the present and the future of the Common Agricultural Policy (CAP) and its implications to the income of the Greek farmer. Spanellis (2004) focus more on the export aspects of Greek agricultural products. Many other studies including Gorton *et al.* (2009), Matthews (2011), Swinnen and Johan (2009) and Zahrnt (2009) have focused on CAP and its past present and future implications to farmers' income. In general, as seen in various EU commission reports, CAP has influenced decisively the total income of European farmers. Thalassinos and Dafnos (2015) have discusssed the structural changes in EMU for a more effective Optimum Currence Area (OCA) and Rovolis *et al.* (2014) the effects of capital structure in real estate companies due to EU legislation.

3. Latest Tax Legislation

As described in Agrenda 2016 the first major change is related to the definition of a full-time farmer meaning farming as the main occupation of an individual male or female. According to the current legislation farmers are those who have at least 50% of their income deriving from an agricultural activity (article 2 par. 1 of Law 3874/2016 as amended by article 65 of Law 4389/2016) and was voted in May 2016 by the Greek Parliament.

More specifically, Article 65 provides:
1. Paragraph 1 of Article 2 of Law 3874/2010 (A 151), as in force, is amended as follows:
(a) Subparagraph (a) of paragraph 1 is replaced by the following:
A professional farmer is an adult person who has the right to be registered in the Register of Farmers by fulfilling the following conditions cumulatively:
a) He is a farmer.
b) He or she is professionally engaged in farming on his holding at least 30% of his total annual working time.

c) At least 50% of his / her total annual income (from 35% in force) comes from farming.
d) He is insured himself and his farm, where appropriate, in accordance with the applicable legislation.
e) keep accounts in accordance with the legislation in force.

The second major change concerns the income tax scale from agricultural activity as illustrated in Table 1. Pursuant to the new law, Article 112 of Law 4387/2016 (replacing paragraph 3 of Article 29 of Law 4172/2013), profits from agricultural business are now taxed on the scale of paragraph 1 of Article 15 independently without these incomes being aggregated with any income from wages, pensions and business activity.

Table 1: *Latest Income Tax Scale*

Income Tax Scale for full time farmers	
Income in €	Tax Coefficient
0-20.000,00	22%
20.000,01-30.000,00	29%
30.000,01-40.000,00	37%
Above 40.000,00	45%

The third major change concerns the reduction of income tax. In the multi-bill voted by the Parliament on 22 May, a clarification is introduced on the case where income is earned from an individual business subject to OGA insurance, together with income from agricultural activity. In this case the abovementioned tax reduction is calculated, but only on the income earned from the agricultural activity. At the same time, it is stated that if income from paid employment or pensions is earned together with the income of the previous paragraph, the tax reduction will be that which corresponds to the part of the income derived from paid employment and pensions as well as agricultural activity.

More specifically, if income from wages and pensions is earned together with income from an individual agricultural enterprise, the tax reduction is calculated once for the total income. In the case of income from paid employment and pensions and / or from an individual agricultural enterprise together with income from other categories, the tax reduction will be that which corresponds only to part of the income derived exclusively from paid employment and pensions or even from an individual agricultural business.

Also, in paragraph 2 of Article 112 of Law 4387/2016, Article 16 of Law 4172/2013 was replaced, and a different tax credit related to the number of children is now applicable. The tax reduction under the new Article 16 except for employees and pensioners is also calculated for those who have income from an individual agricultural enterprise.

In addition to the provisions of paragraph (b) of paragraph 3 of Article 44 of Law 4389/2016, which added a new paragraph at the end of Article 29 (3) of Law 4172/2013, it is clarified that the reduction of the tax for the trainees agricultural business is reduced by the amount of one thousand nine hundred (1.900) euro for the taxpayer without dependent children as defined in Article 11 when the taxable income from salaried services and pensions does not exceed the amount of twenty thousand (20.000) euro.

The tax deduction amounts to one thousand nine hundred and fifty (1.950) euros for the taxpayer with one (1) dependent child, two thousand (2.000) euros for two (2) dependent children and two thousand one hundred (2.100) euro for three (3) dependent children and above. If the amount of the tax is less than these amounts, the tax reduction is limited to the amount of tax payable.

For taxable income exceeding the amount of twenty thousand (20.000) euro, the amount of the reduction is reduced by ten (10) euro per thousand (1.000) euro of the taxable income. Note that as of 01.01.2016 income from agricultural activity is subject to a 100% tax advance and a solidarity levy for income of more than twelve thousand (12.000) euro as follows (Table 2):

Table 2: *Income Solidarity Contribution Scale*

Income Solidarity Contribution Scale for full time farmers	
Income in €	rate
0 - 12.000	0%
12.000 - 20.000	2,2%
20.000 - 30.000	5,0%
30.000 - 40.000	6,5%
40.000 - 65.000	7,5%
65.000 - 220.000	9,0%
Above 220.000	10,0%

4. Construction of the model

The model has been constructed according to the following assumptions and restrictions:

a) The Agricultural Income Gross Profit Margin is set to 30%.
b) Accordingly, the Cost Index is set to 70%.
c) The Gross Income for our reference farmer is 200.000 euros because after the application of the Cost Index there is a 60.000 of taxable income which is an amount that covers all the range of current tax scale, which gives the opportunity to test all tax scales.
d) For simplicity of the model Solidarity Contribution and tax deduction amounts are excluded.

According to paragraph 6 of article 112 of Law 4387/2016 the tax scale with the relative tax rates that are applied also to income of full time farmers is as follows (Table 3):

Table 3: *Income tax scale according to paragraph 6 of article 112 of Law 4387/2016*

Income Tax Scale for full time farmers	
Income in €	TaxCoefficient
0-20.000,00	22%
20.000,01-30.000,00	29%
30.000,01-40.000,00	37%
Above 40.000,00	45%

The model was chosen to stress the Income Tax Scale with the following parameters. To keep the model simple, all the expenses plus depreciation, Social Security expenses (EFKA) and other taxes like land tax (ENFIA) etc. are treated all as expenses and are included inside the 70% Cost Index. The Total Tax Burden is described below in Table 5 as it derived from the implementation of the Income Tax Scale in Table 3 to the Model Basic Data in Table 4.

Table 4: *Model Basic Data*

Model Basic Data	
Sales of Agricultural Products	200.000,00
Agricultural Income Gross Profit Margin	30%
Cost Index = (1-Agricultural Income GP Margin)	70%
Cost of Goods Sold = (Sales*Cost Index)	140.000,00
Taxable Income	60.000,00
Total Tax Burden	19.999,99

Net Income	40.000,01

__Table 5:__ Calculation of Tax Burden according to paragraph 6 of article 112 of Law 4387/2016

Calculation of Tax Burden				
0	20.000,00	20.000,00	22%	4.400,00
20.000,01	30.000,00	9.999,99	29%	2.900,00
30.000,01	40.000,00	9.999,99	37%	3.700,00
40.000,01	60.000,00	19.999,99	45%	9.000,00
Total Tax Burden				20.000,00
Effective Tax Rate				33%

5. Estimations and findings

By choosing to apply Monte Carlo Simulation with the Pert Distribution as analyzed below; we use @ Risk software to stress the tax parameter of Tax Scales, with intervals of ±10%, to identify how the parameter, has influenced the tax burden of farm income. As precisely described by Liapis *et al.* (2013), Tsamis and Liapis (2014), Hertz (1964), a method which applied Monte Carlo simulation (due to the gambling aspect of the process) to business decisions under uncertainty is the most appropriate methodology. Since then, this method has been popularized by the rapid development in information technology. Nowadays, many practical and theoretical problems involving risk and uncertainty in the area of economics and management are solved using approaches which follow the same principles originating from these works.

According to Bennett and Ormerod (1984), Monte Carlo technique or stochastic simulation (due to the presence of random processes) typically generates estimates by randomly calculating a feasible value for each variable from a statistical probability distribution function which represents the range and pattern of possible outcomes. To ensure that the chosen values are representative of the pattern of possible outcomes, a quite large number of repetitive deterministic calculations (known as iterations) are made.

Vose (1996) Lorance and Robert (1999), as cited in Loizou and French (2012), list the various steps of carrying out a Monte Carlo simulation: the first step is to define the capital resources by developing the deterministic model of the estimate. The second step is to identify the uncertainty in the estimate by specifying the possible values of the variables in the estimate with probability ranges (distributions). The third step is to analyze the estimate with simulation – the model is run (iterated) repeatedly to determine the range and probabilities of all possible outcomes of the model. Prior to running the simulation, the model produces a single-point value (result) for the estimate. This value is known as the deterministic result, and generally is referred to as the base estimate before adding contingency. There are a few software tool environments in which Monte Carlo simulations can be run with add-ins to spreadsheets being the most popular (such as Crystal Ball, @risk and ModelRisk commercial software packages).

Again, as precisely described by Liapis *et al.* (2013), Tsamis and Liapis (2014) the PERT probability distribution function gets its name because it uses the same assumption about the mean as PERT (Program Evaluation and Review Technique) networks used in project planning. Technically, it is a version of the Beta distribution and is widely employed in risk analysis for modelling expert opinion of a variable's uncertainty. It is based on the assumption that the mean (μ) = (minimum + 4 * most likely + maximum) / 6, therefore, the mean for the PERT distribution is four times more sensitive to the most likely value than to the minimum and maximum values. It requires the same three parameters as the Triangular distribution (minimum-a, most likely-b, maximum-c) without suffering to the same extent the Potential systematic bias problems of the Triangular distribution, that is in producing too great a value for the mean of the risk analysis results where the maximum for the distribution is very large.

The standard deviation of the PERT distribution is also less sensitive to the estimate of the extremes and systematically lower than the Triangular distribution, particularly where the distribution is highly skewed. As for the Triangular distribution, the PERT distribution is bounded on both sides, hence, may not be adequate for some modelling purposes when it is desired to capture tail or extreme events. The equation of the PERT distribution is related to the Beta distribution as follows:

PERT (a,b,c) = Beta (a1,a2) * (c – a) + a

Where:
a1 = [(μ– a) * (2b – a – c)] / [(b – μ) * (c – a)]
a2 = [a1 * (c – μ)] / (μ– a)
And the mean is:
μ= (a + 4 * b + c) / 6.

The variance of the PERT distribution derives from the equation:

$$\sigma^2 = \frac{(\mu - \alpha) * (c - \mu)}{7}$$

The probability density function of the PERT distribution is:

$$f(x) = \frac{(x-a)^{a1-1} * (c-x)^{a2-1}}{\mathrm{Beta}(a1, a2) * (c-a)^{a1+a2-1}}$$

By applying the above methodology, we get the results as illustrated below:

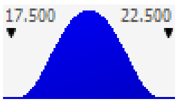
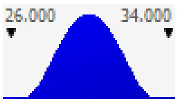
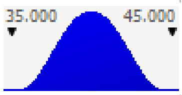
In order to find the impact on tax burden we are stressing the limits of tax scale for an interval of 10% in Table 6 and Table 7.

Table 6: *Income Tax Scale of ±10%*

Name	Cell	Function	Min	Mean	Max
1 SCALE	L52	RiskPert(18000;20000;22000;RiskStatic(20000);RiskName("1 SCALE"))	18.000	20.000	22.000
2 SCALE	L53	RiskPert(27000;30000;33000;RiskStatic(30000);RiskName("2 SCALE"))	27.000	30.000	33.000
3 SCALE	L54	RiskPert(36000;40000;44000;RiskStatic(40000);RiskName("3 SCALE"))	36.000	40.000	44.000

Table 7: *Income Tax Scale Inputs @Risk*

@RISK Model Inputs

Name	Cell	Graph	Function	Min	Mean	Max
1 SCALE	L52		RiskPert(18000;20000;22000;RiskStatic(20000);RiskName("1 SCALE"))	18.000,00	20.000,00	22.000,00
2 SCALE	L53		RiskPert(27000;30000;33000;RiskStatic(30000);RiskName("2 SCALE"))	27.000,00	30.000,00	33.000,00
3 SCALE	L54		RiskPert(36000;40000;44000;RiskStatic(40000);RiskName("3 SCALE"))	36.000,00	40.000,00	44.000,00

As we can see below in Table 8 after 100.000 iterations the results of stressing by ±10% intervals of income tax scale the impact to the tax burden is not as we would expect. As illustrated in Figure 1 and Figure 2, 2nd SCALE has the most significant effect on Tax Burden with High Input above the baseline which lead us to the conclusion that the Income Tax Scale has an abnormal effect to the tax burden of the Farm Income. Also, it is noteworthy the fact that the 3rd SCALE has the least significant effect on Tax Burden with Low Input above the baseline, the opposite of the second and first scale.

According to Table 9 as illustrated in Figure 3 and Figure 4, 2nd SCALE has also the most significant effect on Net Income, which means the direct analog relation between Tax Burden and Net Income is been confirmed, with the same abnormal effect. The deference here is the exactly opposite position regarding the Low Input above the baseline of 2nd and 1st SCALE and the High Input above the baseline of 3rd SCALE.

Figure 1: *Tax Burden output after stressed for ±10% scale intervals*

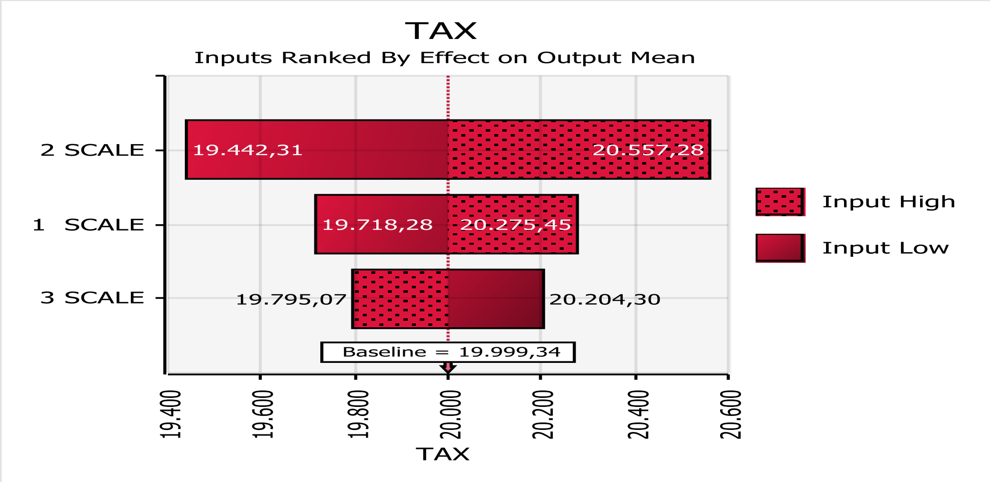


Figure 2: *Graph of summary statistic on tax stressed for ±10% scale intervals*

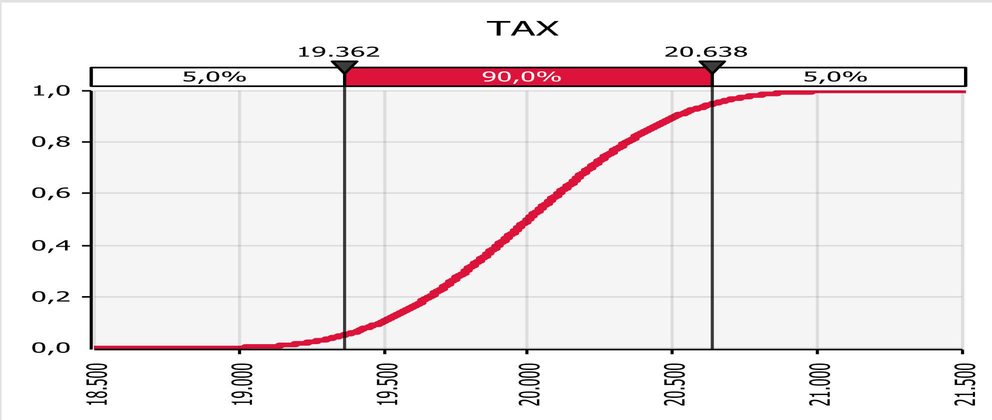


Table 8: *Summary statistic on tax*

Summary Statistics for TAX			
Statistics		Percentile	
Minimum	18.726,33	1,0%	19.144,42
Maximum	21.344,19	2,5%	19.257,76
Mean	19.999,34	5,0%	19.361,75
StdDev	387,55	10,0%	19.490,73
Variance	150194,5857	20,0%	19.659,39
Skewness	0,00098516	25,0%	19.724,78

Kurtosis	2,626702624	50,0%	19.998,80
Median	19.998,80	75,0%	20.273,42
Mode	19.973,18	80,0%	20.341,08
Left X	19.361,75	90,0%	20.507,27
Left P	5%	95,0%	20.638,42
Right X	20.638,42	97,5%	20.741,25
Right P	95%	99,0%	20.853,61
#Errors	0		

Figure 3: *Net Income output after stressed for ±10% scale intervals*

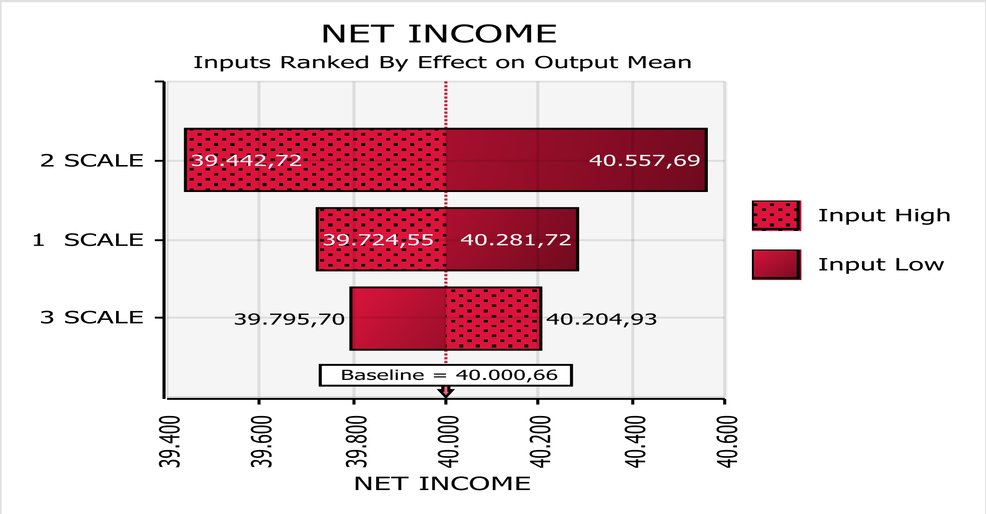


Figure 4: *Graph of summary statistic on Net Income stressed for ±10% scale intervals*

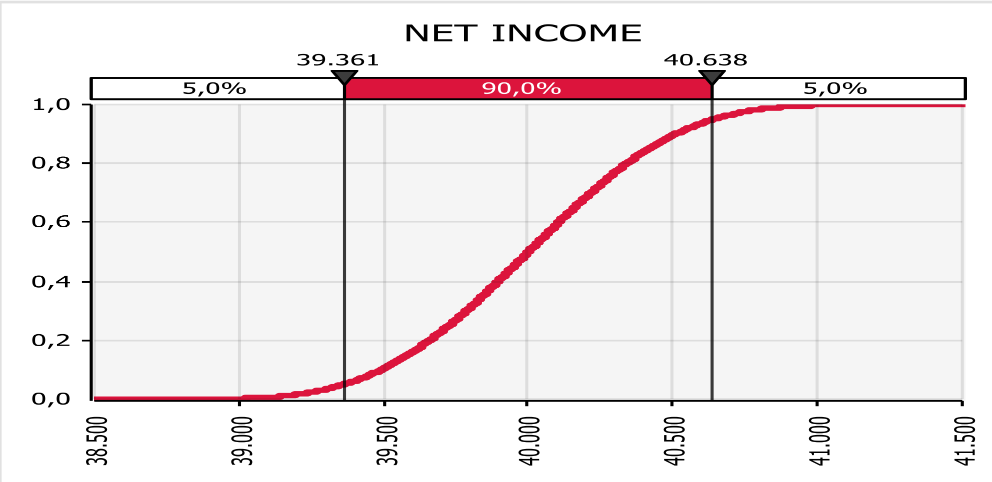


Table 9: *Summary statistic on net income*

Summary Statistics for NET INCOME			
Statistics		Percentile	
Minimum	38.655,81	1,0%	39.146,38
Maximum	41.273,67	2,5%	39.258,70
Mean	40.000,66	5,0%	39.361,49
StdDev	387,55	10,0%	39.492,72
Variance	150194,5857	20,0%	39.658,91
Skewness	-0,00098516	25,0%	39.726,57
Kurtosis	2,626702624	50,0%	40.001,17
Median	40.001,17	75,0%	40.275,17
Mode	40.026,82	80,0%	40.340,60
Left X	39.361,49	90,0%	40.509,25
Left P	5%	95,0%	40.638,22
Right X	40.638,22	97,5%	40.742,15
Right P	95%	99,0%	40.855,55
#Errors	0		

6. Conclusion

From the findings we can conclude that tax scale has an abnormal effect to the tax burden of the Farm Income as the second and not the third scale has the most significant effect. As tax legislation evolves every one or two years it is important to point out that regarding farmers income the tax scale has a non-gradual – non-linear effect, which must be corrected to be more equal distributed along the income tax scales.

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