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Subsidies, Land Size and Agricultural Output

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In this paper we make a two-fold contribution. We first examine the impact of agricultural subsidies on Greece, using a detailed, micro-panel dataset for four years, 2008, 2010, 2012, and 2014. Our analysis is illuminating at least two aspects of subsidies: first, it suggests that an incentive scheme for promoting a larger farm size would have a probable positive effect on agricultural value-added; second, that subsidies today produce the larger impact on future value-added for the top two percentiles of the subsidy distribution. The adjacent contribution is the presentation of a new theoretical model on subsidies where we examine the impact of land size and taxes on them. We estimate the model's hyperparameters, using Greek data from the FADN database. Our new theoretical results, combined with the empirical analysis on the first part, suggest that agricultural subsidies are of dubious economic value, in magnitude and effect, and distort the incentives for returns-to-scale and increased working hours in Greek agriculture.

Keywords: agricultural subsidies, agricultural policy, farm size, fiscal policy, taxation, value-added

JEL Classifications: Q11, Q12, Q13, Q14, Q15, Q18

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Introduction

The issue of agricultural subsidies is an extremely important one (Andersen et. al. 2006), as it links directly with not just the formation of agricultural policies but a host of other economic issues at both micro and macroeconomic policies (Kirwan, 2017). Agricultural subsidies are now –for the most part– decoupled and are thus a form of direct income transfer from the rest of the economy to the farmers, and linked only to subsidy rights, farm size, and their under-operating market. Direct payments –a form of farm subsidies– are allocated based on the levels of aid per hectare within a given Member State or region (European Commission) and thus reflect farm size. As such, subsidies are capitalized on farm size and only provide income support for farmers who own or rent farmland in accordance with their entitlements.

In the case of Greece, agriculture is heavily subsidized, making agricultural subsidies one of the largest transfer programs (Kechagia and Kyriazi, 2021). Despite the huge payment amounts, concern about inequality in Greek agriculture remains strong, causing controversial results. Furthermore, as Caditi and Nitsi (2011) showed, disparities in Greek agriculture are also linked to structural factors such as size, specialization, and region . Actually, the total number of farms in Greece after 2007, has declined from about 860,150 to 685,000 farms, and at the same time, the average farm size has increased from 5 to 8 hectares in the same time period (European Commission, 2019) . It thus becomes significant, that is precisely what this paper is attempting to accomplish, to first understand the nature of these subsidies, spatially and temporally, their characteristics across prefectures and farm sizes in Greece, and also their potential economic impact; are subsidies anything to value-added in prefectural agricultural income?

Since a considerable part of the literature attempts to link various measures to farm size and productivity (Adamopoulos and Restuccia 2019, 2014), and given the European Union’s interest in economies of scale (European Commission 2013), our contribution is to build on the previous empirical studies that examined government policies, productivity, and farm structure, using for the first time an extensive and unique dataset, obtained directly from OPEKEPE, the Greek Payment and Control Authority. We begin our analysis at the micro-panel (farm) level by trying to understand what is the link, if any, between the total value of subsidies and farm size. Furthermore, we are exploring if this relationship is linear or not: our preliminary results suggest that this relationship is threshold/piecewise linear in farm size and that it differs across prefectures as well. We examine the distributional characteristics of both the farm size and subsidy value illustrating several problems and some opportunities in terms of how incentives need to play a much larger role in agricultural policy design. We then use aggregates from the farm level to the prefectural level to analyze the impact of subsidies on economic value-added. Our results confirm, that there is little evidence of a positive contribution of subsidies to economic value-added.

Furthermore, we provide certain insights concerning the design of a new agricultural policy: first, subsidies are a major disincentive for farmers inasmuch as they do not use them to upgrade their productive infrastructure or to increase farm size and economies of scale; second, subsidies decoupled from any measure of productivity are essentially a diversion of income from other productive parts of the economy to agriculture; third, if subsidies were meant to increase farmers' standards of living, that cannot be done without raising the value-added of the agricultural sector and expanding farm size and productivity. Our second stage of the analysis develops a theoretically-based structural model that connects agricultural subsidies with land size and hours worked by specifying the farmers' utility function, under the assumption that both hours worked and subsidies are essentially what generates consumption for farmers. This approach allows us to link all three variables together, i.e. hours worked, land size, and subsidies, and furthermore to link the results of our theoretical (structural) model with our earlier results provided by the regression models of the first stage of analysis.

The remainder of the paper is organized as follows. Section 2 provides the literature review. Section 3 presents the data analysis and discusses the empirical results from the estimation of the regression models based on the micro-panel data set, while Section 4 develops the structural model and discusses its empirical results under the use of the FADN data set. We conclude in Section 5.

Literature Review

A fundamental influence in farm consolidation is economies of scale. Examining the impact of farm size on subsidies has a natural and highly practical implication: if there is no discernible effect of land size on subsidies then there is no motive on behalf of the farmers to generate increasing returns to scale via increases in land size. Hallam (1991) has stated that significantly increasing returns to scale or size in the production of a particular output, or the procurement or marketing of a specific product may lead to the consolidation of firms in the associated industry with potentially harmful effects on competition and societal welfare.

Several papers have documented the existence of a strong relationship between farm structure, which is most characterized by the size of the farms, and subsidies which in turn generate government policies, Berry and Cline (1980), Barret (1996), Carletto et. al. (2016). They all examine how policies through subsidies have affected farm size. Key and Roberts (2007) estimated the effect that agricultural payments had on the likelihood of farm survival and farm size, ignoring the role of productivity, revealing that per-acre payments have a significant role in the size of the farms. Under a similar perspective Akhundjanov and Chamberlain, (2019), concluded that agricultural land that is heavily tailed plays a key role in the economy of a country and understanding the size distribution of agricultural land is fundamental to policy design.

Why is it important to identify the relationship between farm size, agricultural subsidies, and agricultural value-added, and how, if must be changed? As Lowder et al. (2019) mention, policy is not one-size-fits-all and needs to be designed based on farm size. After all, subsidies arise from government policy that supports agriculture. Furthermore, knowledge of farm structure is important when designing policies focused on agricultural development.(Sant'Anna and Katchova, 2022). For example the new CAP: 2023-2027 seeks to ensure a much stronger contribution to the goals of the European Green Deal with higher green ambitions being in line with environmental and climate legislation and not based on historical entitlements. To achieve this, farmland distribution must be considered when designing public policies. There are strong linkages between economic growth, agricultural value-added, farmland distribution, and farm size (Eastwood et al., 2010; Lowder et al., 2016). Thus, it is crucial the need for policymakers to better understand farmland distribution for effective planning and policy design as well as efficient use of government subsidies and oversight.

The successive reforms of the Common Agricultural Policy brought structural changes in the way subsidies implemented in Greece. From guaranteed prices Greece moved to the decoupling payments and the establishment of the base price (BPS). The basis of the BPS system is payment entitlements allocated to farmers. In general, each eligible hectare gave the right to one entitlement. Support under the BPS is then granted annually to farmers who have payment entitlements upon “activation" of these entitlements. Among others, farmers have to comply with certain environmental standards, namely protecting the environment, ensuring public health, animal and plant health. In this context, every year, on-the-spot inspections are carried out. The unique competent agency to export the corresponding sample is OPEKEPE. The farmers included in the sample are checked in their entirety, in terms of animals and stable facilities (cattle, sheep, goats, pigs, horses), as well as in the auxiliary areas of the farm such as warehouses, milking parlors, feed production facilities and in the agricultural equipment, especially with regard to the application of plant protection substances. The on-site inspection can be limited to a sample comprising at least 50% of each category of parcels. Even more, farmers who are entitled to subsidies have the obligation to comply with agricultural practices that are beneficial on climate and environment or equivalent practices. This mechanism is called "greening" and includes crop diversification, preservation of existing permanent pastures, existence of an agricultural ecological focus area.

Consequently, the agricultural sector in Greece constitutes an important locus in social and economic life and is expected to be a significant contributor to GDP growth. The 2008s financial crisis influenced the rural area in Greece diversely. According to Greek Statistical Authority, during the biennium 2008-2010 and against the shrinkage of the country's overall workforce labor force in agriculture had a small increase. In the same vein were the results of a study conducted by ELGO-DIMITRA (2012), the Greek Agricultural Organization, in Athens and Thessaloniki. The majority of the interviewees had thought to return to the countryside and approximately half of them (47,6%) considered working in farming. This position would easily be inverse, accounting for the peculiarities of the Greek agricultural sector, especially the enormous fragmentation of farmland. Apparently, media and government agencies put forth the return to rural areas as a creative way out of the economic crisis, (Anthopoulou et al., 2017). Undoubtedly there is a strong, positive dynamic in rural locus, and with this assertion is consistent the preliminary elements from the Greek Payment Authority of Common Agricultural Policy Aid Schemes (OPEKEPE).

The Micro-Panel Dataset

Qualitative Characteristics and Sample Formation

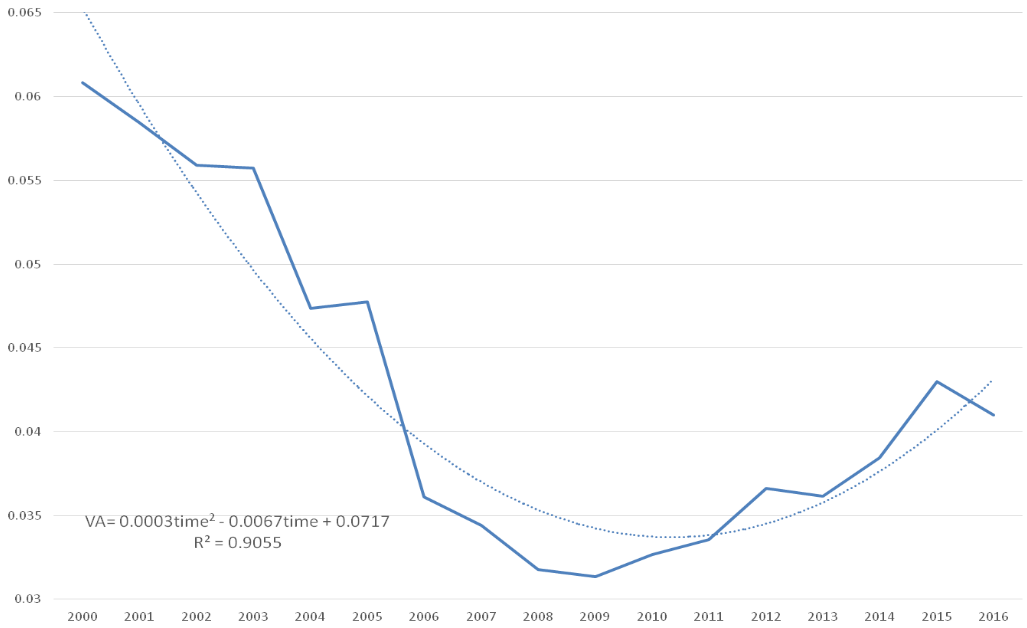
In this paper, we analyze, for the first time to the best of our knowledge, an extensive and unique dataset, obtained directly from OPEKEPE. Our data refer to four years, namely 2008, 2010, 2012, and 2014 and contains all available information on agricultural subsidies decoupled or not. The fidelity of the dataset goes to the individual/farmer level and is thus a micro-panel dataset. According to Bojnec and Latruffe, 2013, a panel data model with individual-specific effects when employed, accounts for farm heterogeneity.

The information provided pertains to the type and value of subsidies received, the cultivated farm size, the subsidy-eligible farm size, the type of cultivation, the number of animals, various topographical demographics, and other particular characteristics of each farmer receiving subsidies (type of entitlements, number and value of entitlements, types of rural development measures – organic farming, Natura 2000 and Water Framework Directive payments – payments to areas facing natural or other specific constraints). The dataset covers the whole of Greece and refers to all prefectures and municipalities. The total number of records is about 2,500,000 per year and from these about 650,000 to 850,000 are usable in our analysis. Furthermore, we use, from the Greek Statistical Authority, Gross Value-Added in Agricultural, from the years 2000 to 2016 which was available by municipality. We calculate the ratio of Agricultural in Total Value-Added and we form a time series for value-added for the years 2000-2016 per municipality. We enter our data in Stata software to calculate the percentiles for subsidy value and land size actuating thresholds.

Descriptive Statistics

This section starts by presenting a selection of our first results. In Figure 1, which illustrates the temporal evolution of value-added in agricultural, in Greece (% of total value added) we observe a progressive decline in the share of agricultural production from 2000 to 2008, the start point of the financial crisis. The important issue is that after 2008 there is a reverse of this trend, with the increase of the values of our variable.

Figure 1: Temporal Evolution of Value-Added in Agricultural in Greece:
% of total Value-Added



The potential cause of this inversion could be the fact that many people turned to the primary sector in order to ensure their livings. In Table 1A in the appendix (Figure 2) we depict the average contribution in value added in agricultural production by prefecture, except Attica and Thessaloniki, before and after 2008. It is noteworthy that several prefectures preserve a large share in the average contribution in value added, like Ilia (Peloponnese), Imathia, Serres (Central Macedonia), Karditsa, Larisa (Thessaly). A second remarkable point in this figure is that almost all prefectures have an average decline in the average contribution in value added in agricultural production.

In Table 1 (2) we present the distribution of the farm sizes for two years, 2008 and 2014, and their associated percentage change. Two things are eminent from this table: first, the massively skewed distribution of land size towards small plots of land, of considerably less than 1.5-1.8 hectares (the approximate median of the distribution) and, second, the considerable increases in small land plots at the left side of the distribution. We should be keeping in mind these numbers as they relate to our analysis that follows, on the impact of subsidies on future value-added but also on the impact of land size on subsidies themselves. In Table 2 (3) we present the distribution of subsidies for the same years as in Table 1(2), i.e. 2008 and 2014, and their associated percentage change between the years; here, however, we use land-size thresholds: we consider the distribution of subsidies on all farm sizes, on farm sizes of less that

5 hectares, on farm sizes between 5 and 15 hectares and on farm sizes of 15 to 50 hectares. The results here are also staggering in terms of their skewness, although not completely surprising: uncoupled subsidies are a direct income transfer and are hugely increased for those that declare the smallest plots of lands, smallest number of animals etc, and they progressively get a smaller increase as the farm size increases. There is an obvious two-pronged motive/work allocation problem here: on the one hand those that receive a token amount of subsidy per year (whose smaller impact in future value-added will examine later) that have the smallest farm sizes and those that receive considerably larger amounts per year (whose larger impact in future value-added we will also examine later) that have the larger farm sizes; those that take the smaller amounts cannot possibly used them for anything but as an income supplement and thus have no incentive to change their work and effort allocation and those that take the larger amounts may not be receiving enough to promote returns of scale to their production – the impact on agricultural prices, incentives, taxation is more than clear as with any income transfer scheme devoid of incentives related to productivity. We will return to these issues in the discussion of our inferential results.

Table 1(2): Quantiles of Distribution of Farm Size, 2008 and 2014 and their % change

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
2008	0.340	0.540	0.780	1.060	1.450	2.000	2.790	4.110	6.860	15.340
2014	0.490	0.760	1.050	1.410	1.870	2.470	3.360	4.800	7.690	16.260
% Change	44.12%	40.74%	34.62%	33.02%	28.97%	23.50%	20.43%	16.79%	12.10%	6.00%

Table 2(3): Quantiles of Distribution of Subsidies, 2008 and 2014 and their % change, and per farm-size group

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Farm Size
2008	133	236	363	543	807	1202	1824	2869	4827	8877	All
2014	289	428	606	838	1146	1595	2264	3349	5183	9364	
% Change	116.92%	81.46%	66.78%	54.24%	41.99%	32.69%	24.12%	16.72%	7.36%	5.48%	
2008	109.610	186	269	372	507	693	954	1341	1982	3354	0-5
2014	255.750	350	460	593	755	960	1229	1610	2204	3371	
% Change	133.33%	88.50%	71.35%	59.51%	48.90%	38.62%	28.80%	20.05%	11.20%	0.50%	
2008	124	215	323	466	668	956	1384	2050	3202	5556	0-15
2014	277	397	548	736	979	1302	1761	2449	3551	5569	
% Change	123.72%	85.08%	69.77%	57.97%	46.57%	36.17%	27.25%	19.47%	10.89%	0.24%	
2008	2868	4444	5787	7019	8263	9594	11166	13311	16879	23095	15-50
2014	3490	5301	6668	7994	9299	10755	12478	14714	18215	24484	
% Change	21.67%	19.28%	15.22%	13.88%	12.54%	12.11%	11.76%	10.54%	7.91%	6.02%	

Empirical Methodology

Our methodology is determined by the type of our dataset and the availability of variables for our analysis. Our main focus is in line with the literature and we consider the implications of subsidies vis-a-vis farm size and vis-a-vis the value-added in the agricultural sector. Furthermore, the sheer volume of available data allows us to easily consider sample splits in terms of the percentiles of the land distribution and perform the analysis in each percentile. This is a rather natural approach since the land distribution is clearly skewed to the right and the mass of farms are of smaller rather than larger size. This approach, is actually well-suited to examine, albeit in an indirect fashion, the implications of subsidies on land size before moving on to the impact of subsidies on the value-added generated in the agricultural sector.

To this end, let Y_{it} denote the subsidy value (in euro) of the i^{th} farm with associated size X_{it} (in hectares), where t denotes one of the four available years. For each year t we estimate the cross-sectional threshold regression:

$$Y_{it}I\big(X_{it} \in A_j\big) = \big(\alpha_{jt} + \beta_{jt}X_{it} + \epsilon_{it}\big)I\big(X_{it} \in A_j\big) \tag{1}$$

where A_j is a particular land-size interval (the intervals were chosen in accordance to the land distribution as discussed in the previous section). Examining the impact of land size on subsidies has a natural and highly practical implication: if there is no discernible effect of land size on subsidies then there is no motive on behalf of the farmers to generate increasing returns to scale via increases in land size; since decoupled subsidies are only income transfers there is no a priori reason to consider increases in land size, ceteris paribus. We are saying this with full understanding that farmland may not be available for purchase or that farmers may not have the funds to purchase available land – however, the implications for distribution or buy-outs of unused public land cannot be overstated.

Now, with the above approach, we can examine the differences on the impact of farm size both across years and across farm size. Note, importantly, that the constant term in the model of equation (1) has a meaningful interpretation as the fixed (minimum) subsidy amount that is available to eligible farmers, on average, per farm-size interval. Thus, we can perform the following useful calculation: let $j = 1,2,\dots,M$ where M corresponds to the largest land-size interval; we can find the estimated average land size $X_{t,M}$ that will give us the corresponding fixed subsidy that is attributed on average to farms on interval M (the fixed-subsidy hectare equivalent) as follows:

$$X_{t,M} = \big(\alpha_{Mt} - \alpha_{jt}\big)/\beta_{jt} \tag{2}$$

which obtained by re-arranging the parameters of the j^{th} interval with respect to the fixed subsidy of the largest M^{th} interval. This land size can be thought of as a “saturation" threshold in terms of increasing land size: once this land size is reached a farmer receives the largest average fixed subsidy possible and one has to examine the estimate of β_{Mt} to see if it is worthwhile (from a subsidy perspective) to add more hectares or not. The implications of this simple analysis will be made clear later on our discussion of the results.

We next turn to data aggregation at the prefectural level, as we have no access to other farmer-level data to be able to perform a deeper analysis at the micro-level of our dataset. At the prefectural level, we do have access to the value-added of the agricultural sector in each prefecture and we are interested in examining the impact of subsidies on value-added. We do so as follows: First, let Y_{pt} denote the total subsidy value in prefecture p at year t and let $y_{pt} = Y_{pt}/\sum_{j=1}^{P} Y_{jt}$ denote the % participation of the p^{th} prefecture to total subsidies (this also serves as a potential deflator of the value-added); then, let v_{pt} denote the % contribution of the agricultural sector to the total value-added of all output in the p^{th} prefecture.

Using these aggregations we compute the quantiles of the distribution of Y_{pt}, say $Y_{pt}(q)$ and then we compute the cross-correlation between each $Y_{pt}(q)$ and future value-added $v_{p,t+h}$ for the appropriate h and all q. In this stage of the analysis, we use the nominal value-added Y_{pt} because it corresponds directly to income received by the farmers at the p^{th} prefecture and examine whether this has any linkage with future value-added in the agricultural sector of the prefecture. Formally, we compute the following for each quantile of the distribution of Y_{pt}:

$$\rho_{t,t+h}(q) = \frac{\mathrm{Cov}[Y_{pt}(q), v_{p,t+h}]}{\sqrt{\mathrm{Var}[Y_{pt}]\mathrm{Var}[v_{p,t+h}]}} \tag{3}$$

and it should be clear that we can examine on which side of the subsidy distribution we can find a larger impact on future value-added. Now, the results from these quantile-based cross-correlations are linked quite well with the results on the impact of farm size on subsidies: if, as naturally expected, larger farms receive proportionately larger subsidies and larger farms contribute more to future value-added, we have a strong argument in favor of generating returns to scale via the subsidies and not just using them as supplementary income. For robustness, we repeat our analysis by computing the same cross-correlations by using y_{pt} instead of Y_{pt}, which has a slightly different interpretation because the subsidies are relative to the total subsidies.

Finally, we compute (with all associated caveats) a simple panel model on the relationship between y_{pt} and $v_{p,t+h}$ (constrained only to the next available year of $v_{p,t+1}$) to examine the impact of subsidies on value-added on the agricultural sector. The caveats here are that, of course, subsidies cannot be the sole determinant of value-added in agriculture but then again they might be a significant one. What is crucial here is the magnitude of the slope estimate of this model: a slope estimate at or greater than one implies a 1:1 or $1 > 1$ relationship of agricultural value-added and subsidies and essentially suggests that subsidies give a considerable drive to future agricultural production. The model has the following standard form:

$$v_{p,t+h} = \alpha_p + \beta y_{pt} + \epsilon_{pt} \tag{4}$$

which we estimate with three different approaches (pooled OLS, panel WLS, and random effects – the estimation methods are determined by the shape of our dataset, with way more cross-sections to time periods) to examine the relative contribution of the prefectural participation of subsidies into the participation of future agricultural value-added to total value-added.

Discussion of Results based on the micro-data

Our results are concentrated in Tables 1 through 4 and they tell a brief but rather concentrated story. We begin with the first and possibly most fundamental question: does it pay to become a farmer that enjoys increasing returns to scale in agricultural production by increasing farm size? To our opinion, our answer is a resounding yes. Furthermore, adding land progressively up to about 10 hectares “exhausts" the marginal impact of subsidies. On the other hand, perhaps more significantly from a policy perspective, subsidies given to the bulk of those possessing the smallest land sizes are neither good for sustenance nor for increasing productivity: if one couples this with the exorbitant tax evasion that plagues (and) the agricultural sector it is easy to understand that the structure of subsidies for Greece is a way off its useful target.

We start evaluating the above claims from Table 4(1). There we present the estimates from equations (1) and (2) of the previous section. There are several interesting things to notice. First, our estimates in this table are based on the micro-data and are thus highly accurate and representative of the average impact of farm size on these coupled subsidies. Second, we see the progression of the marginal impact of one additional hectare to subsidies received and the progression of the (here physically meaningful) intercept of the model – the fixed amount that each eligible farmer is getting on average for each farm size group. Third, we can clearly see that the results on the whole of the farm sizes are essentially similar to explanatory power with those on the 0-15 hectares group but with two significant differences, in terms of the associated intercept and slope numbers. Becoming a bit more particular on the above we can see that the average constant subsidy for all farm sizes has grown from about 1,800 euros to 2,200 euros from 2008 to 2014, a change of 22%. The absolute amount might be seen small but the percentage change is huge: during the financial crisis Greece has lost about 25% of its real GDP and here we have an uncoupled income transfer to a particular professional group of about the same amount. Furthermore, we see that about 35% to 45% of the subsidy variation rests on land size – a reasonably large proportion given that subsidies are tied to subsidy rights but still considerably small if one considers that subsidies are almost unrelated to production or productivity. Then, we note that the marginal impact of each additional hectare (again for the group of all farm sizes) has mildly increased up to 2012 and then dropped in 2014 compared to 2008 – and it's still trivially low to make it meaningful for real-world applications.

Table 4(1): Impact of Farm Size on Subsidies, all years and per farm-size group

Year	Land Size Group	Equivalent Hectare	Constant (Euro)	Slope (Euro per Hct)	R^2
2008	Aggregate	29	1835,85	176,58	35,62%
	0-15	10	297,37	619,7	35.50%
	15-50		6916,64	158,73	2,92%
2010	Aggregate	24	1953,68	188,23	42,42%
	0-15	10	327,43	585,81	43,40%
	15-50		6534,7	183,23	4,35%
2012	Aggregate	22	2057,87	195,62	43,83%
	0-15	10	356,16	599,6	44,60%
	15-50		6463,46	198,55	4,70%
2014	Aggregate	22	2238,89	158,57	36,82%
	0-15	9,3	308,63	589,49	44,72%
	15-50		5778,66	243,45	6,51%

Now, one might argue that the results on the group of all farm sizes are biased by the presence of the ultra-large farms. We thus next split to farms that are less than 15 hectares and that are greater than 15 hectares: the results are again staggering and now more useful. For the group of 0-15 hectares, the intercept estimate of about 300 euros remains essentially the same across years but the marginal impact per additional hectare actually drops from 620 euros in 2008 to 590 euros in 2014, a drop of -4.8% while the explanatory power of farm sizes on subsidy variation increases sharply within the crisis years after 2008 from 35% to almost 45%. Here, and in contrast to the group with all farm sizes, it appears that it pays to build up on farm size within this group, as the average marginal impact of each additional hectare is larger in magnitude than the average fixed subsidy one would receive. This essentially suggests our experiment of hectare equivalent farm size that we described in the previous section – but to fully understand this we have to discuss the results on the ultra-large farms next. For this group of farm sizes greater than 15 hectares we observe that the average fixed subsidy has dropped from about 6900 euros to 5780 euros, a drop of -16.2% (keep this in mind for later, as these farm sizes have the greater impact on future value-added); the average marginal impact per hectare, on the other hand, has consistently increased from 158 euro in 2008 to 243 euro in

2014, a rise of almost 54%. This is not a completely surprising result and is crucially useful: this is the only group in that we observe this kind of reversal between the fixed and marginal impact of farm size on subsidies. Furthermore, the explanatory power in terms of subsidy variation due to land size increased from 2.92% in 2008 to 6.51% in 2014 – a small number by itself but a 100% increase compared to the other groups!

Putting things together, in support of the argument in favor of creating returns to scale via an increase in land size, we see that the experiment of the hectare equivalent in terms of the average fixed subsidy gives us a clear direction: go for 10-hectare minimum or double that to about 20-22 hectares. Based on our numbers, farms that progressively go towards this farm size not only exhaust the (based on current calculations) average fixed subsidy, but they enjoy the full benefits of higher marginal impact per additional hectare as they grow.

One of the comments that we have received, and well so, about the analysis of subsidies is that they are indeed uncoupled from any measure of economic performance – by regulation and desire to redistribute income and support farming. However, and especially for crisis-stricken Greece, one cannot and should not avoid the obvious question to those that call for a refactoring of the Greek economy with greater emphasis on the primary sector: Are subsidies any good for a sector whose contribution to value-added is extremely small in comparison to the overall economy? The answer is conditional on sound economic principles: let increasing returns to scale in agriculture take over and then we'll see greater contributions to agricultural value-added. Tables 1(2) and 2(3) tell this story very succinctly. Using equation (3) to compute the correlation between the distribution of subsidies and future value-added with the base year of 2008 and the results could not be clearer: the higher the quantile that we look at for the subsidies distribution, the higher the future value-added. Therefore, the higher the farm size the higher the contribution to the future value-added – use the subsidies to enhance returns to scale; one has to go up to the 8th quantile of the distribution to consider that a plateau of about 40% correlation has been reached (compared to the 20% correlation for the 1st quantile). This result is entirely consistent with everything that we have seen before and is not just natural from an economic perspective, but also from a policy perspective. It has significant implications for the way the subsidies are allocated. If land transfers from buying and selling are either too expensive or not feasible within particular agricultural regions, then the only way of creating returns to scale via subsidies is from such a market. This is not the first best choice, since farmland that is used productively is more useful than an income supplement, but it will do as a first response to a clearly outdated system of billions of euros on income transfers of dubious use.

We end the discussion of our results with Table 3(4). Here we take the percent participation of each prefecture in total subsidies and use it as an explanatory variable in a panel regression. The dependent variable is the percent participation of agriculture in each prefecture. The estimates have an interpretation as elasticities and can provide information on returns to scale.

As values are statistically higher that means that raising the percent participation of that prefecture by 1% in total subsidies (at the expense of another prefecture of course) will create more than 1% additional participation of agriculture in that prefecture. Our results, from three methods of estimation, are very clear: as things stand now subsidies *are* value-added, and agriculture has a problem with its productive structure–the estimates are statistically identical to 1 (results on testing available on request). Increasing the total amount of subsidies and re-distributing to all prefectures will possibly raise the participation of agriculture in total value-added. In this case, this is not a sensible policy argument, either domestically or in the European Union: subsidies are tax money and have to be used to generate growth and growth comes from returns to scale. Therefore, it is only by linking subsidies to farm size that one might, at least in the case of Greece, find some justification for continuing the most expensive experiment of direct income transfers attempted in Europe in the context of the CAP.

A Structural Model and Estimation using the FADN dataset

The Theoretical Model

We next present a novel theoretical model that attempts to connect agricultural subsidies, as they are decoupled now, with land size and hours worked. Our approach follows some of the related literature (see for example Adamopoulos and Restuccia, 2014, 2020), which considers land size an important component of agricultural output. We model subsidies in the farmer's utility function along with hours worked, under the assumption that both hours worked and (particularly) subsidies are essentially what generates consumption for farmers: the higher the hours worked and the higher the subsidies per hour worked, the higher their marginal contribution to the farmer's utility. This approach allows us to model directly the impact of the subsidies' characteristics in the utility function but also to link all three variables neatly together, i.e., hours worked, land size, and subsidies, and furthermore to link our theoretical model with our earlier results. In this subsection, we present the structural model and its implications from simple comparative statistics, while in the next subsection, we discuss the estimation of the hyper-parameters.

Consider thus $i = 1,2,\dots,N$ farmers producing output using the CRS production function $y_i = (Ah_i)^{1-\gamma}\ell_i^{\gamma}$ where A is productivity in agriculture, h_i are the hours worked and ℓ_i is the farm size. Each farmer is entitled to a decoupled subsidy of s_i units valued at a common price Q. As subsidies are decoupled from production they can only possibly depend on farm size, which is supported by our previous empirical results and the nature of the subsidies themselves, in the sense that a farmer with larger farm size can potentially buy more subsidy units. In this case we write $s_i = \sigma_0 + \sigma_1\ell_i$ and for convenience we normalize $\sigma_0 = 0$. The total amount of subsidy units is $\sum_{i=1}^{N} s_i = S$. Farmers get utility from agricultural consumption only and their consumption can depend only on their hours worked and the subsidies received – as subsidies are a linear function of land size we will establish that the choice variables for output will also be the choice variables for the farmer's utility optimization problem. The total income of each farmer is $I_i = py_i(1-\tau_i) + Qs_i$ that defines the budget constraint – here τ_i is the corresponding tax rate on agricultural income. Farmers cannot influence factor prices and subsidy prices so that (p, Q), and also the parameters (σ_1, τ_i), are taken as given.[1]

As subsidies are decoupled they are a direct infusion of income for consumption and, therefore, each farmer faces a trade-off between income that comes from productive hours worked and subsidies received. Thus, we define the utility function as a linear combination of the consumption drivers as in:

$$\begin{aligned} U_i(h_i, s_i\omega_i) \equiv U_i &= \omega_i \log(h_i) + (1-\omega_i)\log(s_i/h_i) \\ &= (2\omega_i - 1)\log(h_i) + (1-\omega_i)\log(s_i) \end{aligned} \tag{5}$$

that is, a farmer "weights" the utility of hours worked and the utility of the subsidies received per hour worked. This implies that the farmer has to devote more than $\omega_i \geq 0.5$ to the weight of the utility function to hours worked to have the benefit of any utility from hours worked. Note that the closer ω_i gets to one-half the heavier is the dependence of the farmer exclusively on subsidies. Substituting the linear form of subsidies to land size we end up with the final form of the utility function:

$$U_i = \gamma(\omega_i, \sigma_1) + (2\omega_i - 1)\log(h_i) + (1-\omega_i)\log(\ell_i) \tag{6}$$

where $\gamma(\omega_i, \sigma_1) = (1-\omega_i)\log(\sigma_1)$ is the fixed utility the farmer receives for being entitled to subsidies. Defining as $\beta_i = \ell_i/h_i$ the ratio of land size per hour worked, and after some algebra, we can re-write the utility function as in:

$$U_i = \gamma(\omega_i, \sigma_1) + \omega_i \log(h_i) + (1-\omega_i)\log(\beta_i) \tag{7}$$

which is a useful representation in terms of the land size-to hours worked ratio.

Each individual farmer's allocation problem is to select $\{h_i^*, \ell_i^*\}$ so as to maximize utility subject to income and production function constraints. Setting up the corresponding Lagrangian function with multiplier μ_i we have:

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[1] One referee asked why our model is a utility-of-work rather than a profit maximizing model. The results of section 3.3 before might be used to explain this. As farm size increases, up to a threshold, so does the subsidy payment. Thus, farmers do have an incentive to receive additional, guaranteed, income without additional considerations. As the majority of farm holdings are smaller than the threshold we find in the previous analysis, one could argue that our model is highly suitable for these kinds of smaller farms where work vs. subsidy considerations and not profits and factor prices are the ones that affect decision making.

$$\max_{h_i,\ell_i} \Lambda_i = U_i + \mu_i(I_i - py_i(1-\tau_i) - Qs_i) \tag{8}$$

We obtain the first order conditions as in:

$$\frac{(2\omega_i - 1)}{h_i} = \mu_i p \frac{\partial y_i}{\partial h_i}(1-\tau_i) \tag{9}$$

for the hours worked and then as in:

$$\frac{(1-\omega_i)}{\ell_i} = \mu_i p \frac{\partial y_i}{\partial \ell_i}(1-\tau_i) + \mu_i Q\sigma_1 \tag{10}$$

for the land size. To proceed we need the marginal products of hours worked and land size obtained from the production function as in:

$$\begin{aligned} \partial y_i / \partial h_i &= (1-\gamma)A^{1-\gamma}\beta_i^{\gamma} \\ \partial y_i / \partial \ell_i &= \gamma A^{1-\gamma}\beta_i^{1-\gamma} \end{aligned} \tag{11}$$

Dividing the first order conditions to eliminate the Lagrange multiplier and solving for β_i^*, the optimal ratio of land size per hour worked, we end up with:

$$\beta_i^* = \left\{\frac{pA^{1-\gamma}(1-\tau_i)[1-\omega_i(1+\gamma)]}{(2\omega_i-1)Q\sigma_1}\right\}^{1/(1-\gamma)} \tag{12}$$

which shows directly the impact of both taxes and subsidies in the optimal choice of land size per hour worked. It is straightforward to do a simple comparative static analysis on the optimal ratio of land size per hours worked. Taking the corresponding derivatives we find that:

$$\partial\beta_i^* / \partial\tau_i = -(1-\gamma)^{-1}(1-\tau_i)^{\gamma/(1+\gamma)}\left\{\frac{pA^{1-\gamma}[1-\omega_i(1+\gamma)]}{(2\omega_i-1)Q\sigma_1}\right\}^{1/(1-\gamma)} \tag{13}$$

for the marginal impact of taxation and as in:

$$\partial\beta_i^* / \partial\sigma_1 = -\sigma_1(1-\gamma)^{-1}\left\{\frac{pA^{1-\gamma}(1-\tau_i)[1-\omega_i(1+\gamma)]}{(2\omega_i-1)Q\sigma_1}\right\}^{1/(1-\gamma)} \tag{14}$$

for the marginal impact of the rate of increase of subsidy units with respect to land size. Both these derivatives are consistent according to the following observations:

1. Higher taxes and/or a linear schedule of subsidy increases, with respect to land size, are both detrimental to the optimal land size per hours worked; this implies a

thresholding effect on land size and thus agricultural output (a result broadly consistent with our previous findings in section 3.3). Note that this effect is not directly on land size (which would contradict both the subsidies practice and earlier empirical results but to the ratio of land size to hours worked).

2. The land size intensity γ affects the magnitude of the marginal impacts above; the closer production depends on land size intensity the higher the marginal impact becomes, ceteris paribus.
3. Increases in agricultural productivity are positively related to higher land size, ceteris paribus.
4. High taxes and high rates of increase in subsidy units imply a double negative effect on land size per hours worked.

These theoretical predictions are consistent with observations on land size and hours worked: the negative impact of higher taxes and a linear schedule of subsidy increases indicate that there is a motivation on the part of the farmers to maintain relatively smaller land plots with respect to hours worked, and, as we saw in our previous discussion, this compresses the agricultural value added. Note that the ω parameter is crucial in the above discussion, for as ω gets closer to one-half, the negative impacts just discussed are magnified.

Estimation Methodology of the Structural Parameters

The main structural hyper-parameters that we need are $(A, \gamma, \sigma_0, \sigma_1, p, Q, \omega)$ - we will treat the τ_i as an observable variable as there are data available for it. Ideally, we would need to estimate a system that includes the production function, the income, and the utility function or some of its first-order conditions. As some identification issues arise due to the nature of the data (we have values not quantities, i.e. we have py and Qs instead of y and s) we will proceed in two different ways: a system of first order conditions or a sequential estimation. We describe these in turn. In this discussion, and out of necessity, we normalize the price parameters as $p = Q = 1$ so that quantity and value coincide.

In the system approach, we must impose a separable vector of parameters in the sense that (σ_0, σ_1) do not enter directly into the decision-making of the farmer. These parameters can be estimated in two ways: (a) by regression of subsidies on land size (with and without the σ_0 parameter) and (b) by averaging the ratio of $\sigma_1 = \mathsf{E}[s_i/\ell_i]$; we experimented with both these approaches. The remainder of the parameters are thus three and let us put them into the vector $\theta = (A, \gamma, \omega)$. We, therefore, need three equations to estimate them as follows (written in estimable form):

$$\begin{aligned} \partial y_i / \partial h_i = (1-\gamma)A^{1-\gamma}\beta_i^{\gamma} &= 0 \\ \partial y_i / \partial \ell_i = \gamma A^{1-\gamma}\beta_i^{1-\gamma} &= 0 \\ \beta_i - \left\{\frac{A^{1-\gamma}(1-\tau_i)[1-\omega(1+\gamma)]}{(2\omega_i-1)\sigma_1}\right\}^{1/(1-\gamma)} &= 0 \end{aligned} \tag{15}$$

These equations can be estimated by GMM if we choose suitable instruments – and this is to be discussed in the next section of our FADN dataset.

In the step-by-step approach, we work from the production function down to the estimation for ω. Here we proceed as follows. First, we impose the CRS on the production function:

$$\begin{aligned} \log(y_i) &= (1-\gamma)[\log(A) + \log(h_i)] + \gamma\log(\ell_i) \\ [\log(y_i) - \log(h_i)] &= (1-\gamma)\log(A) + \gamma[\log(\ell_i) - \log(h_i)] \end{aligned} \tag{16}$$

which implies (a) a direct estimation of γ and then a solution for A as follows: let c denote the composite term of the constant $c = (1-\gamma)\log(A)$ and then solve for A as in $A = \exp[c/(1-\gamma)]$, so with by estimating c and γ we can obtain A as well. Standard errors of the A parameter are easily obtainable via the delta method.

Once we have (A, γ) available then we can either optimize by GMM the last of the equations in the system in (11) or simply solve for ω using the mean of β_i and of τ_i. The last approach yields the following solution for ω:

$$\omega = \frac{2\beta^{1-\gamma}\sigma_1 + (1+\gamma)A^{1-\gamma}(1-\tau_i)}{A^{1-\gamma}(1-\tau_i) + \sigma_1\beta^{1-\gamma}} \tag{17}$$

where $(\beta = \mathsf{E}[\beta_i], \tau = \mathsf{E}[\tau_i])$ are the means of the (β_i, τ_i) observable variables. The theory requires that $1 > \omega \geq 0.5$ to obtain utility from subsidies. It is immediate, however, that the condition that $\omega < 1$ does not hold in the above solution - thus an unconstrained solution is not a feasible one and therefore we have to estimate ω under the bounded constraint of $1 > \omega \geq 0.5$ or at least of $\omega < 1$ via GMM. This is what we end-up doing and the results are very robust as we discuss below.

Data, Estimation Results and Discussion

We consider a rather reliable data set stemming from the Farm Accountancy Data Network (FADN). The time series span the period from 2004 to the end of 2017. Our data set is linked with four major prefectures in Greece: Makedonia-Thraki, Ipiros-Peloponnese-Nisia Ioniou, Thessalia, and Sterea Ellada-Nisia Aigaiou-Kriti. The variables from this data set, and the exact definitions of what we have used in estimation, are available on request from the authors.

In our analysis, we had to make choices for variables to be associated with the theoretical model and instruments to be used in the estimation of the ω parameter. Since our dataset is a panel one, we proceeded as follows. We take as our measure of output the total value of agricultural output, expressed in euros, as hours worked the total labor input expressed in hours, and as land size the total value of land for permanent cultivation expressed in hectares. From these variables and after imposing the CRS condition we can estimate the γ parameter by fixed effects (this is the appropriate model since the cross-sectional dimension is by construction fixed and only the time dimension can vary). Then, we estimate – using again fixed effects – the impact of land size on subsidies (the σ_1 parameter) using as subsidies the decoupled component of subsidies expressed in euro and the land size as before. Finally, we take as our tax variable τ_i the implicit tax rate as the ratio of total taxes due over the farm's total net income. Using the tax variable and the land size to hours worked variable we then estimate the ω parameter by GMM applied to the third equation in (15), using different combinations of the weighting matrix and instruments. Our results are robust in both the just identified and the overidentified case and are the same whether the weight matrix is the identity matrix or an instrument-based matrix. Details on the scaling of variables and parameters that ensure convergence of the GMM approach are available on request.

Given all of the above, our estimation results are given in Table 5 and tally well with the theoretical model's assessment. The estimate of the land size intensity in the CRS production function comes out to 0.50 and is significant while the A parameter is not estimated as significant (although the composite constant term is). The insignificant A might be considered a problem but we have to proceed on that constraint. The estimation of the marginal impact of an additional hectare in subsidies comes out significant at around 485 euros which falls within the range of values presented in Table 4(1) and based on the same regression idea. With all these estimates we go on to estimate the value of the ω parameter at 0.66 which satisfies the theoretical constraints. This is a relatively balanced value for hours worked and the land size to hours worked ratio: away from the lower bound of one-half and towards a rule of "two-thirds utility from hours worked and one-third utility from the land size to hours worked ratio" – this can easily be seen in equation (7). However, if we revert to the original equation (5) the rule will become "one-third utility from hours worked and one-third utility from subsidies" or the same weight in front of both hours worked and subsidies (if we are to look at the second equation of (5)). In terms of a very plain practical interpretation these results do make sense: from the perspective of using land size and hours worked (equation (7)) the weight shifts more to hours worked naturally, for you cannot extract anything out of the land if you do not work on it; from the perspective of getting subsidies however, the results indicate that the association of hours worked and subsidies go hand-in-hand, for you get equal weight for hours worked and subsidies received. This last result can possibly (and we are stretching the interpretation here) be linked with the results of Table 3(4), where we showed that the impact of subsidies on value-added is almost 1:1. It appears that the motivation to work the land is tied to the subsidies received and this affects the final agricultural outcome.

Table 4: Correlation of Subsidies Distribution in 2008 with future value-added, quantiles 1-5

Year	Q1	Q2	Q3	Q4	Q5
2009	19,68%	20,04%	23,14%	26,91%	29,86%
2010	19,29%	19,50%	22,57%	26,36%	29,36%
2011	22,93%	23,59%	26,82%	30,78%	33,68%
2012	20,17%	20,82%	23,67%	26,95%	29,44%
2013	24,81%	25,71%	28,78%	32,21%	34,47%
2014	21,27%	22,28%	25,03%	28,09%	30,36%
2015	21,23%	20,98%	23,38%	26,18%	28,33%
2016	23,64%	23,74%	26,52%	29,64%	31,79%

Table 5: Correlation of Subsidies Distribution in 2008 with future value-added, quantiles 6-10

Year	Q6	Q7	Q8	Q9	Q10
2009	32,51%	35,84%	38,58%	40,62%	43,28%
2010	32,04%	35,47%	38,29%	40,36%	43,17%
2011	35,98%	39,00%	41,49%	43,19%	45,90%
2012	31,57%	34,51%	36,96%	38,74%	41,72%
2013	36,51%	39,40%	41,82%	43,52%	46,23%
2014	32,41%	35,39%	37,93%	39,66%	42,29%
2015	30,28%	33,14%	35,58%	37,19%	39,28%
2016	33,72%	36,50%	38,84%	40,16%	42,00%

Table 6: Impact of Subsidies on Value-Added, all years panel, % contribution in both variables

Model	Constant	Subsidy	AIC
Pooled OLS	0,0530	1,0247	-781,07
Panel WLS	0,0504	1,0974	-1014,75
Random Effects	0,056	0,8759	-780,19

Table 7: Estimation results of hyper-parameters of theoretical model

Variable	Estimation	Std. Error	P-Value
γ	0.502	0.055	0.000
A	2.226	3.910	> 0.1
σ_1	485	207	0.023
ω	0.664	0.000	0.000

Concluding Remarks and Policy Implications

Subsidies: what are they good for? What has begun as a post-WWII project to protect agricultural income and to promote food security now appears (at least on the data of this case study) not just outdated but outright unfair and unjustified. Income transfers are well known to fail and, although subsidies have been –almost–decoupled from both output and productivity, it is just bad economics to ignore the effects and prospects of subsidies for the future of the agricultural sector. In this paper, we use a unique database on agricultural subsidies given to Greece in four years, 2008, 2010, 2012, and 2014. The database is a micro-panel dataset and we have provided a small set of results that mainly have to do with the distributional characteristics of the subsidies and their relationship to the value-added that is being produced by the agricultural sector in Greece.

Greece is a very important case study to consider because of the fiscal problems that has and is still facing. After 2010 the country has lived through some agonizing years with political turmoil and discussions about the annual disbursements from the country's creditors to pay up for public services and the extreme debt. These disbursements were in some years less than that year's total subsidies provided. Thus we have an economic oxymoron: the same authorities that denied public spending to the country's infrastructure, health, education, and public investment allowed direct income transfers to a particular group of society whose total contribution to economic value-added has been and is less than 5% and with visible positive externalities to the rest of the economy or its exports (comparing agriculture to, for example, tourism in Greece). Such discrepancies in terms of the allocation of European public resources have not been noted or addressed either in the literature or in economic policies – one cannot but ask how the country would have fared under a different allocation of resources during the crisis; after all European public funds must take into account special cases as has clearly have been done in the disbursement of funds from quantitative easing; why subsidies should be treated differently? In an era that the literature draws attention to other methods and ways of protecting agricultural income, in a country plagued with tax evasion in the agricultural sector too, when agricultural cooperatives failed many times over, making subsidies work for the whole of the economy becomes not just imperative for generating growth but a matter of good policies and social justice.

Our analysis is suggestive on some important positive directions, however, that not only coincide on some stated goals for reshaping the Greek productive structure but also make good economic sense. We find that there is a strong, possibly non-linear, relationship between subsidies and farm size. Thus, because of their redistributive nature, agricultural subsidies do not offer the maximum possible effect on the economy and for small farms and several prefectures can act as a productive disincentive; on the other hand, for larger farms subsidies might be way more useful, as the larger farms are those that drive the most of agricultural value-added – and this is a clear signal for using subsidies as a way to generate increasing returns to scale in agriculture. Left to their own devices, and in the current map of agricultural production and value-added, we find that subsidies *are* agricultural value-added and thus their contribution to growth will remain minimal and within the context of distortions of motives to work.

Further research on the finer details of our database is required to obtain a deeper understanding of the impact and distribution of subsidies in terms of particular agricultural activities. This is a sensible point to continue our current research in conjunction with the implications of the future of the CAP for Europe in general and Greece in particular.

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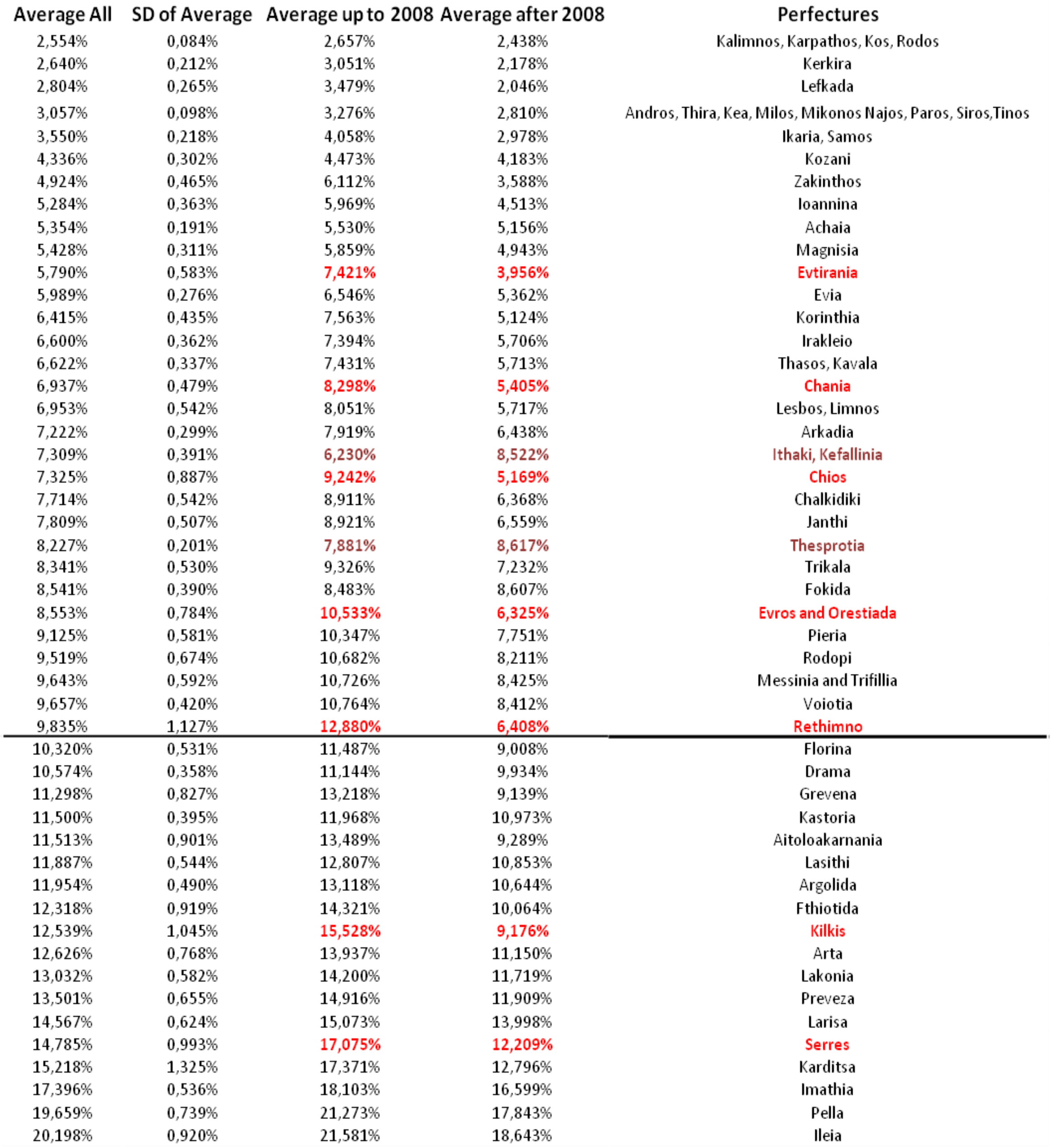
Appendix

Table A1 (Figure 2). Average Contribution to Value Added in Agricultural Production by Prefecture, except Attica and Thessaloniki (total, before and after 2008)



Average All	SD of Average	Average up to 2008	Average after 2008	Perfectures
2,554%	0,084%	2,657%	2,438%	Kalimnos, Karpathos, Kos, Rodos
2,640%	0,212%	3,051%	2,178%	Kerkira
2,804%	0,265%	3,479%	2,046%	Lefkada
3,057%	0,098%	3,276%	2,810%	Andros, Thira, Kea, Milos, Mikonos Najos, Paros, Siros,Tinos
3,550%	0,218%	4,058%	2,978%	Ikaria, Samos
4,336%	0,302%	4,473%	4,183%	Kozani
4,924%	0,465%	6,112%	3,588%	Zakinthos
5,284%	0,363%	5,969%	4,513%	Ioannina
5,354%	0,191%	5,530%	5,156%	Achaia
5,428%	0,311%	5,859%	4,943%	Magnisia
5,790%	0,583%	**7,421%**	**3,956%**	**Evtirania**
5,989%	0,276%	6,546%	5,362%	Evia
6,415%	0,435%	7,563%	5,124%	Korinthia
6,600%	0,362%	7,394%	5,706%	Irakleio
6,622%	0,337%	7,431%	5,713%	Thasos, Kavala
6,937%	0,479%	**8,298%**	**5,405%**	**Chania**
6,953%	0,542%	8,051%	5,717%	Lesbos, Limnos
7,222%	0,299%	7,919%	6,438%	Arkadia
7,309%	0,391%	**6,230%**	**8,522%**	**Ithaki, Kefallinia**
7,325%	0,887%	**9,242%**	**5,169%**	**Chios**
7,714%	0,542%	8,911%	6,368%	Chalkidiki
7,809%	0,507%	8,921%	6,559%	Janthi
8,227%	0,201%	**7,881%**	**8,617%**	**Thesprotia**
8,341%	0,530%	9,326%	7,232%	Trikala
8,541%	0,390%	8,483%	8,607%	Fokida
8,553%	0,784%	**10,533%**	**6,325%**	**Evros and Orestiada**
9,125%	0,581%	10,347%	7,751%	Pieria
9,519%	0,674%	10,682%	8,211%	Rodopi
9,643%	0,592%	10,726%	8,425%	Messinia and Trifillia
9,657%	0,420%	10,764%	8,412%	Voiotia
9,835%	1,127%	**12,880%**	**6,408%**	**Rethimno**
10,320%	0,531%	11,487%	9,008%	Florina
10,574%	0,358%	11,144%	9,934%	Drama
11,298%	0,827%	13,218%	9,139%	Grevena
11,500%	0,395%	11,968%	10,973%	Kastoria
11,513%	0,901%	13,489%	9,289%	Aitoloakarnania
11,887%	0,544%	12,807%	10,853%	Lasithi
11,954%	0,490%	13,118%	10,644%	Argolida
12,318%	0,919%	14,321%	10,064%	Fthiotida
12,539%	1,045%	**15,528%**	**9,176%**	**Kilkis**
12,626%	0,768%	13,937%	11,150%	Arta
13,032%	0,582%	14,200%	11,719%	Lakonia
13,501%	0,655%	14,916%	11,909%	Preveza
14,567%	0,624%	15,073%	13,998%	Larisa
14,785%	0,993%	**17,075%**	**12,209%**	**Serres**
15,218%	1,325%	17,371%	12,796%	Karditsa
17,396%	0,536%	18,103%	16,599%	Imathia
19,659%	0,739%	21,273%	17,843%	Pella
20,198%	0,920%	21,581%	18,643%	Ileia