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agricultural policy in Tuscany
with comparative results for Scotland

(Revised version: January 2007)

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# An analysis of the redistributive effects of agricultural policy in Tuscany with comparative results for Scotland

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## Abstract

The paper provides an empirical study of the redistributive effects of agricultural policy in Tuscany which finds that the provision of support increased absolute income inequality within the agricultural community because the distribution of transfers was both vertically and horizontally inequitable. These conclusions are shown to hold whether or not non-farm incomes are taken into account and for a range of alternative definitions of the agricultural community. The results for Scotland are broadly comparable except that the distribution of transfers was progressive not regressive, reflecting differences between the two regions in the degree of dependency of agriculture on support.

## 1. Introduction

The improvement of the income position of the agricultural community is a prominent if poorly defined objective of agricultural policy in many countries. In particular, one of the main objectives of the Common Agricultural Policy (CAP) is 'to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture' (European Union, 2002, Article 33). However there has been relatively little empirical work to characterise and quantify the effects of farm support programmes on the distribution of income within the agricultural community. One set of studies (see e.g. Roberts and Russell, 1996; Rocchi et al. 2005; Cavalletti and Rocchi, 2006) has examined the distributional effects of agricultural policy using macroeconomic models in which the agricultural household sector is disaggregated by total household income class. In particular, Rocchi et al. (2005) present a SAM-based model for Italy which shows *inter alia* that agricultural households in higher total income classes receive a larger share of the total value of CAP support accruing to the sector. A second line of work (see e.g. Keeney, 2000; OECD, 2003; Allanson, 2006a, 2006b) has sought to explore the issues using farm business survey data. The use of micro-level data allows a more detailed characterisation of the redistributive properties of agricultural policy, but limitations in farm business survey coverage and content have typically restricted the scope of such studies to the commercial farm sector and the analysis to measures of farming income. Thus Allanson (2006a, 2006b) is only able to establish that agricultural support would have had an equalizing effect on the distribution of farming income across full-time farms in Scotland but for the adverse distributional consequences of horizontal inequities induced by farm support measures. What remains to be shown is whether these estimates of the redistributive effects of the CAP are specific to the empirical setting or might hold more generally for broader measures of

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income, more inclusive definitions of the agricultural community and other regions of the European Union.

The main contribution of this paper is to report the results of a microeconomic study of the redistributive effects of agricultural support in Tuscany that serves to throw light on all three of these issues. First, the study offers a broader analysis of the impact of farm income support on the economic welfare of the farming community by taking into account both farm and non-farm sources of income. Farm households that are entirely dependent on agricultural production for their livelihoods are a minority, with most also relying on some combination of income from other gainful activities, pensions, social security and other payments to a greater or lesser extent (Eurostat, 1996). Yet the design of agricultural policy almost entirely fails to take the overall income situation of farm households into account. Second the study explores the implications of using less restrictive definitions of the agricultural community than the commercial farms sector. In particular, the paper provides additional results based on both "broad" and "narrow" definitions of the agricultural household sector, where the former covers all households which derive some income from agriculture while the latter is limited to those for which farming is the main source of income. Finally, the paper provides a comparative study which can serve to establish whether the results obtained for Scotland are peculiar to that country or might be more generally characteristic of the effects of the CAP. The choice of Tuscany for this purpose is likely to highlight any variability in the distributional consequences of the CAP across the European Union given the marked differences in both output mix and farm structures between the UK and Italy. Conversely, the identification of common features would help to establish the generality of any conclusions regarding the redistributive effects of the CAP.

The paper is organised as follows. The next section briefly summarizes the measures that are used to characterise and quantify the redistributive effects of agricultural policy. The

third section describes the population-weighted micro-level data employed in the analysis, which are derived from the Italian Agricultural Business Survey (REA) for 2002 and, for comparative purposes, the Scottish Farm Accounts Survey (FAS) for 2002/03. The following section presents the main findings of the study on the redistributive effects of agricultural support in Tuscany, comparing the results from using alternative definitions of income and the agricultural community, and those obtained for Scotland. The final section offers a summary and considers the need for further research into the redistributive effects of agricultural policy across the whole of society not just the agricultural community.

## 2. Measurement of the redistributive effects of agricultural policy

The study is based on the methodology proposed in Allanson (2006b) to measure the redistributive effects of agricultural policy due to the transfers accruing to farmers from the provision of support. In this approach, the overall redistributive effect is defined as the difference between the inequality of pre-transfer and post-transfer farm incomes. Specifically, $R=A_X-A_Y$ is defined as an index of the overall redistributive effect, where $A_X$ and $A_Y$ are the absolute Gini indices of pre-transfer and post-transfer incomes respectively. Hence, $R$ will be equal to half the change in the average absolute difference between all distinct pairs of incomes in the population as a result of the provision of support. Alternatively, if the policy evaluation function is given by the Sen (1973) welfare index $W=\bar{y}-A$, where $\bar{y}$ is average income, then $R$ may be interpreted as how much more or less would have to be given to each farmer under a distributionally neutral policy of flat-rate payments to yield a welfare level equal to that under the actual support programme.

*2.1 Decomposition of the overall redistributive effect*

The index $R$ is decomposed to provide an explicit characterisation of the redistributive properties of farm income support measures. The first step in the procedure identifies

horizontal inequities due to the violation of the 'classical' principle of the equal treatment of pre-transfer income equals. Such violations may arise due to systematic differences in the organization and level of support for different commodities, such that the level of transfers received by farmers with identical pre-transfer incomes depends upon the type of farm in terms of the choice of enterprise mix. Moreover, even after controlling for both pre-transfer income and farm type, the incidence of transfers may still vary due to the heterogeneity of individual farms in terms of natural resource endowments, managerial ability and historical development.

The key to this step is the specification of a set of 'reference' functions that determine the post-transfer incomes that farmers with a given level of pre-transfer income would receive in the absence of each of the two possible sources of classical horizontal inequity (HI). Consider a population of $N$ farms made up of an exhaustive set of $K$ mutually exclusive farm types ($k = 1,... K$). Let $x=(x_1,... x_k,... x_K)$, $t=(t_1,... t_k,... t_K)$ and $y=(y_1,... y_k,... y_K)$ be the vectors of observations on pre-transfer income, transfers and post-transfer incomes respectively, where $x_k$, $t_k$, and $y_k$ are constituent sub-vectors of observations on farms of type $k$. By definition, $y=x+t$. Moreover the relationship between transfers and pre-transfer incomes can be written as:

$$t_k = E[t_k|x_k] + \varepsilon_k = f_k(x_k) + \varepsilon_k; \qquad k = 1,....K \qquad (1)$$

where the farm type transfer function $f_k(x_k)$ is defined as the expected value of transfers conditional upon type and pre-transfer income; and $\varepsilon_k$ is a vector of 'disturbance' terms having zero mean at each pre-transfer income level.

The characterisation of transfers given by (1) allows for two possible sources of classical HI. First classical HI may arise between farms of the same type due to the dispersion of transfers $t_k$ about the conditional mean $E[t_k|x_k]$. Accordingly, the non-stochastic reference function $h_W(x)=(g_1(x_1),...g_k(x_k),...g_K(x_K))$, where $g_k(x_k)=x_k+f_k(x_k)$, is identified as the vector

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of post-transfer incomes that the population of farms would receive in the absence of within type HI. Let $A_W$ be the absolute Gini index of $h_W(x)$ then within type HI is measured as the difference in inequality between $h_W(x)$ and $y$, that is $H_W = A_W - A_Y$, which will be asymptotically non-positive though this condition may not hold in any particular finite sample drawn from the population. Only if $\varepsilon_k = 0$, and hence $y = h_W(x)$, will there be a one-to-one mapping from pre-transfer to post-transfer incomes for type $k$ farms and hence no within type HI.

Classical HI may also arise due to systematic discrimination between farm types, which is assumed to change the distribution but not the overall value of transfers at any given pre-transfer income. Accordingly, the non-discriminatory reference function $h_B(x) = E[y|x]$ may be identified as the vector of post-transfer incomes that the population of farms would expect to receive in the absence of discrimination, where:

$$h_B(x) \; = \; \sum_{k=1}^{K} w_k(x)\, g_k(x) = x + \sum_{k=1}^{K} w_k(x)\, f_k(x) \equiv x + f_B(x); \qquad \sum_{k=1}^{K} w_k(x) = 1; \qquad (2)$$

the weights $w_k(x)$ are locally determined by the relative frequencies of the farm types at any given pre-transfer income, $f_B(x)$ is identified as the non-discriminatory transfer function, and $1$ is the unit vector. Let $A_B$ be the absolute Gini index of $h_B(x)$ then between type HI is measured as the difference in inequality between $h_B(x)$ and $h_W(x)$, that is $H_B = A_B - A_W$, which again will be non-positive asymptotically but may not be so in finite samples. Only if $f_k(x_k) = f(x_k) \; \forall k$, and hence $h_W(x) = h_B(x)$, will there be a one-to-one mapping from pre-transfer incomes to expected post-transfer incomes for all farms and hence no between type HI.

The identification of the classical HI contributions to the overall redistributive effect $R$, leaves a residual equal to the difference in inequality between pre-transfer and non-discriminatory post-transfer incomes, $A_X - A_B$. The final step in the decomposition procedure decomposes this residual into separate horizontal and vertical components:

$$A_X - A_B = \bar{y}_B[C_B - G_B] + [\bar{x}G_X - \bar{y}_B C_B] = H_R + V \tag{3}$$

where $G_X$ and $G_B$ are the (ordinary) Gini coefficients of pre-transfer and non-discriminatory post-transfer income, $\bar{x}$ and $\bar{y}_B$ are the corresponding mean incomes, and $C_B$ is the concentration index obtained when non-discriminatory post-transfer incomes are ranked by pre-transfer income.

The horizontal inequity component $H_R = \bar{y}_B[C_B - G_B]$ in (3) measures the redistributive effect of systematic changes in the ranking of farms between the pre-transfer and non-discriminatory post-transfer income distributions, where $[C_B - G_B]$ is the reranking index of Atkinson (1980) and Plotnick (1981). $H_R$ is non-positive by definition, capturing the idea that systematic reranking is a manifestation of procedural unfairness in the provision of support. Only if $h_B(x)$ is increasing in $x$ over the whole range of pre-transfer incomes will there be no systematic reranking of farms.

Finally the vertical equity component $V = [\bar{x}G_X - \bar{y}_B C_B] = -C_{T_B} \bar{t}_B$ measures the impact of differences in non-discriminatory policy transfers between farms with different pre-transfer incomes, which may be interpreted as an index of gross redistributive effect. This in turn depends on the distribution and scale of policy transfers, where $C_{T_B}$ is the concentration coefficient of non-discriminatory transfers ranked by pre-transfer income and $\bar{t}_B$ is the mean level of non-discriminatory transfers. Let $D = -C_{T_B}$ be a disparity index that is positive (negative) if support is progressive (regressive) in absolute terms such that mean non-discriminatory transfers are a decreasing (increasing) function of pre-transfer income, and that equals zero if the transfer schedule is uniform. For any given $D$, $V$ will be proportional to the average level of non-discriminatory transfers $\bar{t}_B$. In general, $V$ will be more positive (or less negative) than $R$ due to the various sources of HI that detract from the redistributive effectiveness of policy.

*2.2 Reference function estimation*

The reference functions $h_W(x)$ and $h_B(x)$ may be directly estimated as in Allanson (2006b), but an indirect approach based on the estimation of the transfer functions is preferable inasmuch as this yields more meaningful regression summary statistics. Accordingly, the set of farm type transfer functions $f_k(x_k)$ in (1) is estimated from a sample consisting of $n_k$ observations on transfers and pre-transfer incomes for each farm type. The choice of a suitable non-parametric technique for the purpose gets round the need to impose any parametric assumptions on the form of the $f_k(x_k)$ functions. In this study, the variable span smoother of Sasieni (1998) is used to fit a local linear regression to the observations on $t_k$ and $x_k$ in the neighbourhood of each data point in the sample. The same local regression technique is also applied to the pooled sample of $n=\sum n_k$ observations in order to directly estimate the non-discriminatory transfer function $f_B(x)$ in (2).

Local linear regression may be expected to provide reasonable approximations to $f_k(x_k)$ and $f_B(x)$ so long as the curvature of the unknown functions is not excessive (Hastie and Loader, 1993). Moreover, the procedure ensures that the predicted level of non-discriminatory transfers at any given pre-transfer income will automatically reflect the farm type composition of the pooled sample in the neighbourhood of that point.

## 3. Data sources and derivation of variables

Calculation of the redistributive effect measures requires access to individual farm data on pre-transfer and post-transfer incomes. The empirical study is based on weighted micro-level data from the Italian Agricultural Business Survey (REA) for Tuscany in 2002 and the Scottish Farm Accounts Survey (FAS) for the farming year 2003/2003. The two surveys form the main source of microeconomic data on farm businesses in their respective countries, with sub-samples from each forming part of the European Union's Farm Accountancy Data

Network (FADN). Nevertheless there are significant differences between the surveys in terms of coverage and content, which constrain the common definition and derivation of variables used in the study.

*3.1 Italian data*[1]

The Italian Farm Business Survey (REA) has been carried out annually since 1999 by the National Institute of Statistics (ISTAT, 2005). The main goal of the survey is to provide microeconomic information compatible with the new European System of National Accounts (ESA95) with reference to the agricultural sector. Accordingly the REA sample is designed to represent the universe of agricultural holdings, with farms chosen to be representative of their economic size and type at the regional level where the economic size of businesses is measured in terms of standard gross margins and the farm type classification is based on the relative importance of the various crop and livestock enterprises. The inclusion in the observation field of all holdings makes the survey representative of the totality of agricultural households, whatever the importance of farming as a source of income.

The REA sample for Tuscany in 2002 consisted of 643 farms, of which 569 were operated by households. Data are available on a sufficient range of financial variables to identify farming income but the underlying physical quantities are not generally recorded in the database. Complete data on hours and remuneration, both on and off the farm, are also available for each economically active farm household member and for any other partners and directors who are actively engaged in the farm. This allows for an estimation of the total income of farming households and an assessment of their relative position within the income

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[1] Access to the Italian data was authorised as part of the research project on "The use of microeconomic information for the analysis of income distribution in Tuscan Agriculture" funded by the Regional Government of Tuscany and carried out by the Department of Agricultural and Resource Economics of the University of Florence.

distribution of the society. The data is weighted by size and type according to the number of holdings enumerated in the 5th General Agricultural Census 2000, to yield summary statistics for the population of agricultural holdings. With 83459 farms in the sampling frame, the sampling fraction for each size and type is 0.77 per cent on average.

*3.2 Scottish data*

The FAS is an annual survey of farm businesses carried out on behalf of the Scottish Executive Environment and Rural Affairs Department (SEERAD). It is designed as a survey of full-time commercial businesses representing the main farm types in Scotland. The field of observation therefore excludes farms smaller than 8 Economic Size Units (ESUs) as well as specialist livestock units larger than 200 ESU and certain minor farm types (most notably horticulture and specialist pigs and poultry farms). Farms in the survey are chosen to be representative of their economic size and type, but part-time farmers and those with substantial involvement in other agricultural or non-farm activities are excluded as a rule so the survey results are likely to understate both the prevalence of pluriactivity and the importance of non-farm income sources.

The survey is conducted on an accounting year basis with a typical year-end in early March so FAS 2002/03 centres on the 2002 production and subsidy year. Accounts for 429 farms were collected in 2002/03, but the effective sample size is reduced to 376 once farms directly affected by the FMD outbreak are excluded from the analysis.[2] Data was collected on a wide range of physical and financial variables, including crop areas, livestock numbers, quotas, production, sales, revenues, subsidies and costs, which allows for the detailed identification of policy transfers as well as of farm income, together with information on other sources of income recorded by income class. The data is weighted by size and type

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[2] SEERAD (2004) notes that the resultant sub-sample is still sufficient "to give a representative picture of full-time Scottish farm businesses".

according to the number of farms enumerated in the June 2002 Agricultural Census, to yield summary statistics for the population of full-time farms. With 14708 farms in the sampling frame, the sampling fraction for each size and type is 2.6 per cent on average.

*3.3 Definition and derivation of variables*

The first issue relates to the identification of the agricultural community which is a notoriously poorly defined concept (Hill, 1990). In the case of Italy, the information available allows us to work with three different definitions of the agricultural community that are commonly used in the literature. The most inclusive is based on the total population of holdings, defined as the set of all farms of at least 1 hectare plus those of less than 1 hectare producing more than a specified amount of output (at least 2066 Euro in the case of Italy) or marketing a certain proportion of their output. This is the field of observation covered in the General Census of Agriculture and corresponds both with the universe as defined by FADN and the definition of 'agriculture' as an industry in the National Accounts framework. This universe will encompass some holdings that are operated by corporate entities using hired managers and workers exclusively. A second more restrictive definition includes only holdings operated by individuals or households, whether with or without the employment of additional hired labour. This corresponds to the broad definition of the agricultural household institutional sector as employed in the Total Income of Agricultural Households methodology (Eurostat, 1995) and may be further restricted to include only holdings operated by households that gain the major part of their income from agriculture. Finally, the universe includes both commercial and non-commercial holdings where the former are defined by FADN to be farms that are "large enough to provide a main activity for the farmer and a level of income sufficient to support his or her family". A third definition therefore is limited to those holdings that can be classified as commercial in the sense of exceeding a minimum economic size, which in the case of Italy in 2002 was set by FADN at 4 ESU. For Scotland,

the limited information available restricts the analysis to this third commercial definition of agriculture, for which the threshold size was fixed at 16 ESU in 2002, within which may be identified a sub-set of farms operated by individuals or households.

The second question concerns the definition of post-transfer income. For Italy, the information allows us to consider concepts of both farm income and total household income. (Post-transfer) farm income is measured by cash income, which represents the cash return to the group with an entrepreneurial interest in the farm, which typically will consist only of members of the household,[3] for their manual and managerial labour and on all their investment in the business. Being the difference between total receipts and total expenditure, this measure is seen to correspond closely to the income position as perceived by the farm household (see, for example, Department of the Environment Food and Rural Affairs (DEFRA), 2002) and to be broadly comparable with other non-farm sources of income. (Post-transfer) total household income is equal to the sum of farm income and non-farm incomes, including income from other gainful activities, pensions, social security and other payments. Using information on the total number of household members further allows the measurement of household income on a per-capita basis. This measure may be more appropriate for an analysis of the impact of agricultural policy on the welfare of the agricultural community. For Scotland, cash income as recorded in FAS must be supplemented by wages paid to family workers, which are separately identified, to yield a comparable measure of farm income. FAS also records non-farm income sources, but of the farmer and spouse only, leading to a total income measure which can serve as a lower-bound estimate of household income that will be exact if there are no other household members that

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[3]  Household and non-household members of the entrepreneurial group are not separately identified in the REA survey; however numbers of the latter are likely to be negligible. In the case of Scotland, 97% of farms in the FAS sample operate as sole traders and partnerships, of which only 1% include non-family members.

have non-farm sources of income. A per capita measure is also workable using information on the number of household members actively involved in the management or operation of the farm business.

Pre-transfer income is simply defined as post-transfer (farm, total household or per capita) income, less the net value of transfers due to the provision of support, where the latter is assumed equal to that part of gross support which accrues to farm occupiers as owners of factors of agricultural production. Three types of support are identified in the analysis. First, to calculate the impact of market price support on the value of farm output and the cost of purchased feed and seed inputs, estimates of the gap between domestic market and border prices for agricultural commodities, measured at the farm gate level, are taken from OECD (2005) and Rapanà (2006). As the available data on Tuscany refer only to broad categories of output, namely crops, livestock and livestock products, weighted estimates of market price support by output category are constructed for this purpose using FADN data on the average composition of farm output by farm type and region.[4] Second, direct support payments cover those payments made under CAP 'Pillar I' commodity schemes, after taking account of the implicit loss in revenues resulting from obligatory set-aside requirements under the Arable Area Payment scheme. Third, the value of other grants and subsidies includes all other payments to farmers except for those in respect of permanent improvements.

The net value of this support to farmers will depend on the extent to which it results in increased returns to the farm-owned factors of production and hence in increased farm incomes. Following OECD (2003, Part II), the static effect on farm income of a unit increase in output revenues, whether due to market price support, output payments or a reduction in set-aside requirements, is identified as the combined income share of the farm-owned factors

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[4] The use of individual farm rather than FADN farm-type average data on output composition by output category yields very similar estimates of the main redistributive effects in the case of Scotland.

of production, while that of a unit increase in direct payments, grants or subsidies to individual inputs (i.e. land and breeding livestock) is simply the farm-owned share of those inputs. Estimates of the combined income share of land, labour and capital by farm type are derived from the cross-section survey data as the average of the ratio of gross value added to output revenue. Income shares attributable to land and labour are then separately estimated from sub-samples containing only those farms with hired labour and rented land respectively, to leave a residual share that is assumed to accrue to capital. Farm-owned shares of factors of production are derived for each farm from the sample data. This approach recognizes that farmers may not be the ultimate beneficiaries of farm support programmes, which will also reward other suppliers of agricultural inputs including landlords. Moreover, the effective incidence of support is allowed to vary depending on the mix of support measures.

## 4. Empirical findings

This section focuses on the results for Tuscany relating to the redistributive effects of agricultural policy on the farm incomes of all holdings, and on the total household incomes of the broadly defined agricultural household institutional sector. Comparisons are drawn where appropriate with the results from using alternative definitions of post-transfer incomes and the agricultural community, and those obtained for Scotland.

### 4.1 Descriptive statistics

The upper panel of Table 1 presents weighted summary statistics on farm incomes by farm type for the universe of all farms in Tuscany. The first column presents the results for all farm types and shows that farm income was 10553 euros on average, but that 21% of farms recorded losses in spite of the support available. The main source of support was provided in the form of direct payments but market price support was also significant with domestic producer prices for most livestock and livestock products well above corresponding world

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price levels. Leakages to other owners of factors of production mean that farmers are estimated to have received only 65% of the gross value of support on average. Overall, the net value of transfers to farmers was 22% of post-transfer farm incomes, compared to 103% in Scotland, reflecting the lower levels of support for Mediterranean products (Tracy, 1998).

The remaining columns of the top panel present comparable summary information for the eight distinct farm types identified in the FADN General Type classification. Post-transfer income levels were highest on specialist granivore and horticulture farms, which are typically much larger business enterprises. Direct payments only provided the main source of support on crop farms, but are much more significant as a source of transfers given the lower income transfer efficiency of market price support measures.[5] Gross support varied across types, with the highest levels on specialist granivore farms and the lowest on specialist permanent crop farms. Average transfers to farmers follow a broadly similar pattern but differences in transfer efficiency rates lead to a lower degree of variation across farm types. Controlling for average levels of post-transfer income, dependency on policy transfers by farm type varies inversely with international competitiveness (see IRPET, 2004), being particularly low on specialised permanent crop and specialised horticulture farms engaged in the production of wine and ornamental plants respectively. Overall, the dispersion of average incomes by farm type was lower for post-transfer incomes than for pre-transfer incomes, implying that the provision of support generally served to reduce rather than exacerbate farm income disparities between farm types in Tuscany. This was also the case in Scotland (see Allanson, 2006b), though OECD (2003, Part I) reports that the provision of support increases average income disparities between farm types in most countries.

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[5]  The average value added share of output revenues is positive for all farm types, ranging from 0.44 to 0.70, as is the residual share accruing to the farm-owned factors of production on all but a handful of mixed cropping farms that are heavily reliant on both hired labour and rented land and for which the residual share is set equal to zero.

The lower panel of Table 1 reports a similar set of summary statistics on total household incomes by farm type for the broad definition of the agricultural community. The first column again presents the results for all farm types and shows that average total household income was 20003 euros, of which just less than 50% was derived from farming. Even net of the value of policy transfers, less than 2% of farms recorded a negative income. Total household income levels were highest on specialist granivore farms and lowest on mixed crops-livestock farms, with the ranking of the farm types by total household income roughly the same as that by farm income. In contrast, the ranking of farm types by non-farm income is almost the reverse of that by farm income, with specialist granivore and horticulture farms particularly dependent on farming as a source of income relative to the much lower levels of dependence on non-specialised crop and livestock farms. Overall, non-farm income sources generally served to reduce rather than exacerbate income disparities between farm types in Tuscany with the dispersion of total household incomes by farm type slightly lower than that of farm incomes. The picture that emerges of the relationships between farm, non-farm and total household incomes is broadly similar to that painted by Hill (1999) from reviews of available microeconomic data in a number of countries.

Table 2 reports regression summary statistics from the non-parametric estimation of the transfer functions, together with comparable results from the linear regression of transfers on pre-transfers incomes. The first point to note is that the predictive power of the non-discriminatory transfer function, defined as the square of the correlation coefficient between the fitted and observed values (see Zheng and Agresti, 2000), is superior to that of the linear model for all definitions of the agricultural community and measures of income. Pre-transfer income is highly significant in the linear model, but the assumption of linearity can generally be rejected in favour of the non-discriminatory function using an appropriate F test procedure (Cleveland and Devlin, 1988, p.599). Second the predictive power of the set of farm type

functions is superior to that of the non-discriminatory function in all cases. The set of restrictions implicit in the pooled non-discriminatory function are consistently rejected, implying that farm type had a significant influence on the level of transfers conditional on pre-transfer income. Third, the predictive power of the non-parametric models is higher using the farm rather than the household concept of income, which is not unexpected in the absence of any direct link between transfers and non-farm incomes.

Table 3 presents the main findings of the study for Tuscany. The first column provides the results on the redistributive effects of agricultural policy on farm incomes for the universe of all farms. Absolute inequality in post-transfer farm incomes is shown to have been substantial, implying that the average absolute income differential between farms was nearly double average income. In comparison, the distribution of pre-transfer income exhibited somewhat lower levels of absolute inequality. The provision of support thus increased absolute income differentials as indicated by the negative values of the index of net redistributive effect $R$ which is significantly different from zero at the 1% level. Overall, agricultural policy increased average farm income disparities by 15 per cent.

The decomposition of $R$ reveals three main points of interest. First, the distribution of non-discriminatory transfers was regressive in absolute terms, as indicated by the negative values of the vertical redistribution and disparity indices, $V$ and $D$. By implication, farmers with high pre-transfer incomes received a more than equal share of non-discriminatory transfers, which is consistent with the findings reported in Rocchi et al. (2005) for Italy as a whole. Second, the redistributive impact of the regressive distribution of non-discriminatory transfers was reinforced by the combined effect of the various sources of horizontal inequity, as measured by the sum of the indices $H_R$, $H_B$ and $H_W$. Third, the redistributive effect of within farm type HI was the dominant source of horizontal inequities, with neither the estimate of between type HI nor that of the systematic reranking effect significantly different

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from zero at the 5% level. By implication, the main factor underlying horizontal inequities was the stochastic nature of the relationship between transfers and pre-transfer incomes at the farm type level, rather than systematic discrimination between farm types due to the commodity organisation of agricultural support or systematic re-ranking due to the presence of income traps in the non-discriminatory benefit schedule.

The second column gives results on the redistributive effects of agricultural policy on farm incomes for commercial farms only. By definition commercial farms are of above average economic size and exhibit correspondingly higher average post-transfer incomes than the universe of all farms. Higher average income disparities also emerge due to the elimination of the mass of small non-commercial farms with similar income levels to each other. Moreover, the negative redistributive impact of policy is greater for two reasons. First the magnitude of $V$ increases because the higher average value of transfers to commercial farms leads to an increase in $\bar{t}_B$ which is only partly offset by the resultant decrease in the disparity index $D$. Second within HI is higher because the conditional absolute variation in transfer levels is increasing in pre-transfer incomes.

Comparable results to column 2 are given in the first column of Table 4 for the commercial farm sector in Scotland. Commercial farms in Scotland must be larger than 16 ESU so it is not surprising that average income and transfer levels are higher and that the size of the absolute redistributive effects is correspondingly greater. What stands out in contrast to the Tuscan results is the finding that agricultural support in Scotland was progressive not regressive in absolute terms. However this finding does not indicate that the nature of the support provision in Scotland was fundamentally different, with transfers roughly proportional to the volume of production in both regions (cf. European Commission, 1991). Rather it reflects the fact that the majority of Scottish farms were engaged in enterprises that were loss-making but for the provision of support, such that transfers in Scotland were

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negatively not positively correlated with pre-transfer incomes (see Allanson, 2006b). In general, the vertical stance of agricultural policy in a region may be expected to reflect the degree of dependency of the region's agriculture on support, with Tuscany and Scotland towards opposite ends of the spectrum within the European Union (see Zanias, 2002, Table 1; European Commission, 2001, Map 5.6).

Columns 3 and 4 of Table 3 give the results for Tuscany on the redistributive effects of agricultural policy on farm and total household incomes for farms run by individuals and households, that is for the broadly defined agricultural community. The first main finding that emerges from the two sets of results is the increase in absolute inequality when passing from a farm to a household definition of income. Farm households with low farm incomes tend to have higher non-farm incomes than those with higher farm incomes so the distribution of non-farm incomes is progressive in absolute terms with respect to farm incomes. Nevertheless, taking non-farm incomes into account increases income inequality because of differences in the levels of non-farm income earned by households with similar levels of farm income (i.e. due to horizontal inequities in the incidence of non-farm incomes). Second, the vertical stance of agricultural policy appears less regressive relative to the distribution of pre-transfer income when using the total household definition of income. This is due to the re-ranking of households in the pre-transfer distribution when non-farm incomes are taken into account, leading to a reduction in the negativity of the disparity index $D$ as farm-income poor households with low policy transfers move up the distribution at the expense of those with higher transfers. Third, the use of the total household income concept leads to an increase in measured within HI, as might be expected given that the provision of agricultural support is contingent on factors that are not directly related to non-farm incomes. In contrast, the likely effect on between HI is more ambiguous depending on the nature of any biases in agricultural policy relative to the non-farm income potential of households by farm type. And the impact

on the systematic reranking effect is likely to be small unless the relationship between non-farm and farm incomes is highly non-monotonic (see Hill, 1999, for a summary of evidence on this point).

Columns 5 of Table 3 also presents results for the broad agricultural community, but with total income measured in per capita terms to accord with the concern for 'the individual earnings of persons engaged in agriculture' expressed in the founding objectives of the CAP. The average number of household members is 1.77, so income levels, absolute income inequality and absolute redistributive effects are all understandably smaller when measured on an individual rather than a household basis. The distribution of transfer is also less regressive, as shown by the smaller negative value of the disparity index, reflecting the positive association between household income and household size that is observed in Tuscany (see Lam, 1997). Interpreting the income per capita results in welfare terms (Atkinson and Bourguignon, 2000), annual transfers per household member could have been cut by €612 with no effect on welfare if it had been possible to devise a distributionally neutral policy regime, or by roughly half the average per capita transfer observed in practice.

Column 6 of Table 3 gives the results on the redistributive effects of agricultural policy on total household incomes for the narrow rather than the broad definition of the agricultural community. Limiting the size of the community in this way leads to an increase in both the average economic size of farms and total household incomes. Moreover, the nature of the threshold criterion leads to an increase in income disparities due to the elimination of the mass of households with low farm incomes but high non-farm incomes. Finally, the negative redistributive impact of policy $R$ is also greater, both because $V$ is more negative as the higher average level of transfers $\bar{t}_B$ to farms more dependent on farming as a source of income is only partially offset by the resultant decrease in the disparity index $D$, and because of the increase in within HI due to the higher dispersion in transfer levels on farms with higher pre-

transfer incomes. These findings mirror those obtained from the comparison between all and commercial farms on the basis of farm incomes.

Finally, columns 2, 3 and 4 of Table 4 give results for Scotland on the redistributive effects of agricultural policy on farm, total household and per capita household incomes for commercial farms run by individuals and households. These results must be treated with some caution given the limitations of the data both on total income and household size. Nevertheless the main findings that emerge when passing from a farm to a household definition of income are similar to those for Tuscany. First, the distribution of household incomes would have been less unequal than that of farm incomes if it had not been for the adverse consequences of horizontal inequities in the incidence of non-farm incomes. Second, the vertical stance of agricultural policy appears more progressive relative to the distribution of pre-transfer income when using the total household definition of income due to the re-ranking of households in the pre-transfer distribution when non-farm incomes are taken into account. Third, the use of the total household income concept leads to an increase in measured within HI, reflecting the inherent limitations of agricultural support as a means to improve the overall welfare of the farming community. However, the distribution of transfers is somewhat less progressive when household income is measured on a per capita basis in spite of a similar positive association between household size and total income.

## 5.   Conclusions

The main purpose of this paper has been to explore the robustness of estimates of the redistributive effects of agricultural policy to the use of alternative measures of income and definitions of the agricultural community. The European Commission has for many years expressed concerns about the inequitable distribution of farm income support (European Commission 1991, 1997, 2002) and in the recent Mid Term Review of Agenda 2000 made

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various proposals to improve the targeting of direct support payments (European Commission 2002, 2003). The decoupling of most direct payments from production can only increase the extent to which the purpose and distribution of support will be subject to question in the future.

The methodology employed in the paper is based on the use of population-weighted micro-level data to evaluate changes in the distribution of income within the agricultural community due to the provision of support. More specifically, the overall redistributive effect of agricultural policy is measured as the difference between the absolute Gini indices of pre-transfer and post-transfer incomes. This is a measure of the change in absolute inequality, which provides a benchmark of distributional neutrality more in accord with both public and official perceptions of fairness in the distribution of farm support than one based on the concept of relative inequality. The measure may be interpreted as the monetary value per farm of the change in inequality due to the provision of support. Moreover it may be decomposed into a vertical redistribution effect and various HI components, and thus serves not only to quantify but also to characterise the redistributive effect of agricultural policy.

The main set of empirical results presented in the paper are based on an analysis using individual farm records for 2002 from the Italian Agricultural Business Survey (REA) of Tuscany. These show that the provision of support increased absolute income inequality within the agricultural community because the distribution of transfers was both vertically and horizontally inequitable. The regressive incidence of transfers implies that farms with higher pre-transfer incomes also tended to receive larger policy transfers, consistent with the general perception that the bulk of agricultural support goes to those that do not need it (OECD, 2003). Horizontal inequities largely arose due to the stochastic nature of the relationship between transfers and pre-transfer incomes at the farm type level, rather than because of either systematic discrimination between farm types due to the commodity organisation of support or systematic reranking as a result of income traps in the transfer

schedule. The variation in the value of transfers received by farms of the same type with similar pre-transfer incomes points to the imperfect targeting of support under the CAP (see Allanson, 2006b, for further discussion).

The paper demonstrates that these findings concerning the redistributive properties of the CAP are robust to the specification of alternative measures of income and definitions of the agricultural community. First, moving from a farm to a total household measure of income tends to exacerbate post-transfer income differentials, but reduce the negative redistributive effects of agricultural policy as the regressivity of transfers is somewhat moderated by the re-ranking of farms in the pre-transfer income distribution when non-farm incomes are taken into account. Expressing total incomes in per-capita terms, that is on an individual rather than a household basis, leads to a further slight reduction in the regressivity of transfers due to the positive association between household income and size. Nevertheless the increase in income differentials due to the provision of support remains substantial relative to the average level of both transfers and post-transfer incomes. Second, moving from less to more inclusive definitions of the agricultural community, by relaxing the thresholds on the size of holding or dependence on farming income, tends to decrease post-transfer income differentials due to the inclusion of a mass of smaller holdings with low incomes. The redistributive effect of agricultural policy also falls as the impact of lower average transfers is only partially offset by resultant increases in transfer regressivity, but remains negative.

Additionally, the paper shows that to the extent that it is possible to generate comparable results for Scotland using Farm Accounts Survey data, then these tend to confirm the Tuscan findings in spite of the marked differences in both agricultural structures and average support levels between the two regions. Indeed, the only substantive difference in the results is the finding that the distribution of transfers is progressive not regressive in Scotland as a result of the chronic dependence of Scottish agriculture on support. The broad concordance in the

results suggests that the findings of the study may be more generally characteristic of the redistributive properties of the CAP throughout the European Union, with the vertical stance of agricultural policy in a region primarily determined by the degree of dependency of the region's agriculture on the provision of support.

Nevertheless the analysis is still confined within the agricultural household institutional sector, that is the subset of households for which farming is a source of income (whether primary or not). A fuller analysis would require a sample on the whole of the household sector, with the possibility to identify agricultural policy transfers both to households within the agricultural community and from those in other sections of society. Only then will it be possible to definitively assess the extent to which agricultural policy is capable of both identifying remaining low income problems among agricultural households and ensuring the equitable treatment of the agricultural community in relation to the rest of society.

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Table 1. Weighted Summary Statistics by Farm Type, Tuscany

| Average per farm | General Type of Farming (FADN class) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Farm Income. Universe of all farms** | | | | | | | | | |
| Number of observations | 643 | 139 | 77 | 234 | 40 | 24 | 95 | 11 | 23 |
| *% of raised sample* | | *18.5%* | *2.8%* | *45.2%* | *6.7%* | *0.2%* | *18.6%* | *2.4%* | *5.7%* |
| Farm business size (ESU) | 11 | 18 | 43 | 9 | 8 | 48 | 8 | 9 | 7 |
| Post-transfer income (€) | 10553 | 11187 | 20853 | 12128 | 9900 | 60541 | 5575 | 8707 | 6962 |
| *Proportion of farms <0* | *21.2%* | *25.7%* | *9.0%* | *23.0%* | *21.6%* | *3.1%* | *21.4%* | *0.3%* | *7.3%* |
| Gross support (€) | 3503 | 5383 | 6265 | 1742 | 6466 | 9334 | 2997 | 7273 | 6467 |
| *Of which due to:-* | | | | | | | | | |
| Market price support | 1309 | 282 | 2410 | 872 | 4495 | 8277 | 864 | 4498 | 3727 |
| Direct support payments | 1527 | 4504 | 384 | 304 | 1847 | 585 | 1311 | 2592 | 2071 |
| Other grants and subsidies | 668 | 597 | 3471 | 565 | 124 | 472 | 822 | 184 | 670 |
| Transfers to farmers (€) | 2283 | 4321 | 2177 | 1015 | 4535 | 5816 | 1741 | 4517 | 3882 |
| *Of which due to:-* | | | | | | | | | |
| Market price support | 665 | 84 | 1029 | 428 | 3070 | 4369 | 315 | 2448 | 1714 |
| Direct support payments | 1261 | 3891 | 282 | 271 | 1393 | 1188 | 973 | 1898 | 1598 |
| Other grants and subsidies | 357 | 347 | 866 | 317 | 72 | 259 | 453 | 171 | 570 |
| *As % of post-transfer income* | *21.6%* | *38.6%* | *10.4%* | *8.4%* | *45.8%* | *9.6%* | *31.2%* | *51.9%* | *55.8%* |
| Pre-transfer income (€) | 8270 | 6865 | 18676 | 11112 | 5365 | 54725 | 3833 | 4191 | 3080 |
| *Proportion of farms <0* | *24.9%* | *31.1%* | *9.9%* | *25.8%* | *28.3%* | *6.9%* | *17.4%* | *68.1%* | *9.0%* |
| **Total Household Income. 'Broad' definition of agricultural community** | | | | | | | | | |
| Number of observations | 569 | 124 | 75 | 197 | 38 | 22 | 81 | 10 | 22 |
| *% of raised sample* | | *18.8%* | *2.9%* | *45.4%* | *6.0%* | *0.2%* | *18.5%* | *2.4%* | *5.8%* |
| Farm business size (ESU) | 10 | 18 | 43 | 9 | 8 | 48 | 8 | 9 | 7 |
| Post-transfer income (€) | 20003 | 20827 | 25972 | 20919 | 20708 | 47030 | 17080 | 24571 | 13056 |
| *Of which:* Farm income | 9633 | 10600 | 20782 | 10242 | 11222 | 39465 | 5425 | 9975 | 6895 |
| Non-farm income | 10370 | 10227 | 5190 | 10677 | 9485 | 7565 | 11654 | 14596 | 6160 |
| *Proportion of farms <0* | *1.1%* | *0.8%* | *5.8%* | *0.5%* | *0.2%* | *3.2%* | *0.8%* | *0.0%* | *7.3%* |
| Gross support (€) | 3131 | 4808 | 6273 | 1281 | 7393 | 9571 | 2499 | 7090 | 6380 |
| *Of which due to:-* | | | | | | | | | |
| Market price support | 1171 | 281 | 2408 | 597 | 5131 | 8408 | 715 | 4479 | 3673 |
| Direct support payments | 1385 | 4055 | 385 | 225 | 2121 | 673 | 1110 | 2427 | 2036 |
| Other grants and subsidies | 575 | 473 | 3480 | 460 | 142 | 490 | 674 | 184 | 670 |
| Transfers to farmers (€) | 2127 | 3879 | 2184 | 815 | 5292 | 5466 | 1659 | 4457 | 3841 |
| *Of which due to:-* | | | | | | | | | |
| Market price support | 644 | 85 | 1025 | 338 | 3595 | 3849 | 335 | 2537 | 1709 |
| Direct support payments | 1151 | 3519 | 282 | 189 | 1614 | 1381 | 884 | 1748 | 1562 |
| Other grants and subsidies | 332 | 274 | 876 | 288 | 82 | 236 | 440 | 172 | 571 |
| Pre-transfer income (€) | 17876 | 16948 | 23789 | 20104 | 15416 | 41564 | 15420 | 20114 | 9214 |
| *Proportion of farms <0* | *1.5%* | *0.9%* | *5.8%* | *0.7%* | *3.8%* | *3.2%* | *0.8%* | *0.0%* | *9.0%* |

Source: Own calculations using REA data. FADN Classes. 1 – Specialist field crops. 2 – Specialist horticulture. 3 – Specialist permanent crops. 4 – Specialist grazing livestock. 5 – Specialist granivores. 6 – Mixed crops. 7 – Mixed livestock. 8 – Mixed crops-livestock.

Table 2. Summary statistics from transfer function regressions

| Field of coverage<br>Income measure | All<br>Farm | Cmrcl<br>Farm | Broad<br>Farm | Broad<br>Hhld | Broad<br>Hhld/hd | Narrow<br>Hhld |
|---|---|---|---|---|---|---|
| *Predictive power of:* | | | | | | |
| Linear regression model | 0.134 | 0.122 | 0.070 | 0.064 | 0.054 | 0.058 |
| Non-discriminatory function $f_B(x)$ | 0.256 | 0.211 | 0.217 | 0.155 | 0.120 | 0.162 |
| Set of farm type specific functions $f_k(x)$ | 0.372 | 0.334 | 0.392 | 0.279 | 0.315 | 0.308 |
| | | | | | | |
| *F test of:* | | | | | | |
| Pre-transfer income effect | 98.85 | 78.66 | 42.36 | 38.56 | 20.11 | 35.17 |
| in linear model | *6.67* | *6.68* | *6.68* | *6.68* | *6.71* | *6.68* |
| Linearity in non-discriminatory function | 17.89 | 16.80 | 28.43 | 18.39 | 8.62 | 23.40 |
| | *6.72* | *8.91* | *10.07* | *16.79* | *8.77* | *20.04* |
| Farm type effects in farm type functions | 4.00 | 3.60 | 5.49 | 3.54 | 3.67 | 4.41 |
| | *2.58* | *2.31* | *2.57* | *3.28* | *2.45* | *3.06* |

Critical values of the F statistics at the 1% significance level are reported in italics.

Table 3.  Redistributive effects of agricultural support policy, Tuscany.

| Field of coverage | | All Farm | Cmrcl Farm | Broad Farm | Broad Hhld | Broad Hhld/hd | Narrow Hhld |
|---|---|---|---|---|---|---|---|
| Income measure | | All Farm | Cmrcl Farm | Broad Farm | Broad Hhld | Broad Hhld/hd | Narrow Hhld |
| Number of observations | $n$ | 643 | 567 | 569 | 569 | 569 | 357 |
| Population | | 83459 | 34075 | 81463 | 81463 | 144134 | 20313 |
| Average post-transfer income (€) | $\bar{y}$ | 10553 | 24455 | 9633 | 20003 | 11306 | 38060 |
| | | *1253* | *2456* | *1140* | *1314* | *712* | *3756* |
| *Of which:*           Farm income | | 10553 | 24455 | 9633 | 9633 | 5444 | 34919 |
| | | *1253* | *2456* | *1140* | *1211* | *633* | *3675* |
| Non-farm income | | - | - | - | 10370 | 5861 | 3141 |
| | | - | - | - | *584* | *349* | *394* |
| Average gross support (€) | | 3503 | 8115 | 3131 | 3131 | 1770 | 10096 |
| | | *357* | *713* | *355* | *352* | *192* | *1101* |
| Average transfers to farmers (€) | $\bar{t}$ | 2283 | 5378 | 2127 | 2127 | 1202 | 6986 |
| | | *233* | *470* | *238* | *236* | *132* | *758* |
| Average pre-transfer income (€) | $\bar{z}$ | 8270 | 19077 | 7506 | 17876 | 10103 | 31075 |
| | | *1105* | *2218* | *989* | *1175* | *639* | *3380* |
| Absolute Gini index of | $A_Y$ | 10049 | 20574 | 8678 | 10142 | 5485 | 24767 |
| post-transfer income | | *1112* | *2037* | *979* | *1007* | *519* | *2752* |
| Absolute Gini index of | $A_W$ | 9662 | 19579 | 8317 | 9627 | 5171 | 23445 |
| farm type specific reference income | | *1100* | *2029* | *967* | *995* | *512* | *2750* |
| Absolute Gini index of | $A_B$ | 9652 | 19700 | 8364 | 9751 | 5131 | 23257 |
| non-discriminatory reference income | | *1104* | *2033* | *974* | *999* | *515* | *2763* |
| Absolute concentration index of | $\bar{y}_B\,C_B$ | 9652 | 19700 | 8364 | 9751 | 5131 | 23242 |
| non-discriminatory reference income | | *1104* | *2034* | *973* | *999* | *515* | *2762* |
| Absolute Gini index of | $A_X$ | 8614 | 18105 | 7251 | 8990 | 4873 | 21682 |
| pre-transfer income | | *1030* | *1950* | *894* | *929* | *482* | *2677* |
| Index of redistributive effect | $R$ | -1434 | -2469 | -1426 | -1151 | -612 | -3084 |
| | | *165* | *314* | *170* | *159* | *90* | *403* |
| Index of vertical redistribution | $V$ | -1037 | -1595 | -1113 | -761 | -259 | -1559 |
| | | *171* | *317* | *173* | *162* | *96* | *448* |
| Disparity of net transfers | $D$ | -0.466 | -0.291 | -0.526 | -0.352 | -0.315 | -0.278 |
| | | *0.058* | *0.050* | *0.055* | *0.061* | *0.062* | *0.057* |
| Av. non-discriminatory transfers | $\bar{t}_B$ | 2283 | 5378 | 2127 | 2127 | 1202 | 6986 |
| | | *239* | *478* | *238* | *256* | *158* | *785* |
| Index of systematic reranking | $H_R$ | 0 | 0 | 0 | 0 | 0 | -16 |
| | | *21* | *22* | *22* | *3* | *1* | *91* |
| Between farm type classical HI | $H_B$ | -10 | 121 | 48 | 125 | -39 | -188 |
| | | *87* | *161* | *81* | *93* | *57* | *253* |
| Within farm type classical HI | $H_W$ | -387 | -995 | -361 | -515 | -314 | -1321 |
| | | *69* | *140* | *62* | *91* | *53* | *202* |

Source: Own calculations using REA data.  All measures are calculated using the population-weighted data.  Absolute Gini and concentration indices are estimated using the formulae in Lerman and Yitzhaki (1989) for weighted samples.  Bootstrap standard errors, based on 1000 replications, are reported in italics and reflect not only the inherent sampling variability of the measures given the stratified nature of the sample, but also the uncertainty about the exact values of non-farm income.

Table 4. Redistributive effects of agricultural support policy, Scotland.

| Field of coverage | | All cmrcl | Broad cmrcl | Broad cmrcl | Broad cmrcl |
|---|---|---|---|---|---|
| Income measure | | Farm | Farm | Hhld | Hhld/hd |
| Number of observations | $n$ | 354 | 336 | 336 | 336 |
| Population | | 13277 | 13069 | 13069 | 25093 |
| Average post-transfer income (€) | $\bar{y}$ | 49455 | 49310 | 65434 | 34078 |
| | | *1865* | *1927* | *2209* | *1352* |
| *Of which:* Farm income | | 49455 | 49310 | 49310 | 25681 |
| | | *1865* | *1927* | *1992* | *1180* |
| Non-farm income | | - | - | 16123 | 8397 |
| | | - | - | *1399* | *761* |
| Average gross support (€) | | 81594 | 81272 | 81272 | 42327 |
| | | *1561* | *1523* | *1594* | *1213* |
| Average transfers to farmers (€) | $\bar{t}$ | 51110 | 51028 | 51028 | 26576 |
| | | *1184* | *1186* | *1220* | *772* |
| Average pre-transfer income (€) | $\bar{z}$ | -1655 | -1718 | 14405 | 7502 |
| | | *1416* | *1390* | *1869* | *991* |
| Absolute Gini index of | $A_Y$ | 23496 | 23432 | 24077 | 13105 |
| post-transfer income | | *1160* | *1169* | *1187* | *643* |
| Absolute Gini index of | $A_W$ | 16235 | 16526 | 16979 | 9497 |
| farm type specific reference income | | *1196* | *1234* | *1260* | *738* |
| Absolute Gini index of | $A_B$ | 13692 | 13388 | 15097 | 8554 |
| non-discriminatory reference income | | *2057* | *2131* | *2180* | *1289* |
| Absolute concentration index of | $\bar{y}_B\,C_B$ | 13253 | 13023 | 14837 | 8016 |
| non-discriminatory reference income | | *2062* | *2150* | *2180* | *1291* |
| Absolute Gini index of | $A_X$ | 18762 | 18760 | 21195 | 11268 |
| pre-transfer income | | *1039* | *1097* | *1153* | *660* |
| Index of redistributive effect | $R$ | -4733 | -4672 | -2882 | -1838 |
| | | *1067* | *1081* | *1167* | *590* |
| Index of vertical redistribution | $V$ | 5510 | 5737 | 6358 | 3251 |
| | | *1305* | *1340* | *1319* | *806* |
| Disparity of net transfers | $D$ | 0.096 | 0.103 | 0.127 | 0.113 |
| | | *0.025* | *0.025* | *0.019* | *0.022* |
| Av. non-discriminatory transfers | $\bar{t}_B$ | 51110 | 51028 | 51028 | 26576 |
| | | *1905* | *1995* | *2228* | *1447* |
| Index of systematic reranking | $H_R$ | -439 | -365 | -260 | -537 |
| | | *148* | *168* | *41* | *20* |
| Between farm type classical HI | $H_B$ | -2543 | -3138 | -1882 | -943 |
| | | *1329* | *1365* | *1420* | *827* |
| Within farm type classical HI | $H_W$ | -7261 | -6906 | -7098 | -3609 |
| | | *613* | *610* | *669* | *359* |

Source: Own calculations using FAS data. The difference in sample size between the first and other columns is partly due to the dropping of a number of observations with incomplete records on non-farm incomes. See also the notes to Table 3.