The Redistributive Impact of EU Farm Payment Reforms in the UK and Ireland

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Abstract

The agricultural sector in Europe is heavily dependent on support payments made as part of the Common Agricultural Policy (CAP). In 2013, a political agreement on a CAP reform was reached that led to the introduction of a Basic Payment Scheme (BPS). The agreement allowed for a wide range of implementations across EU member states with BPS implementation options ranging from models with flat rate per hectare payments determined at regional or national level, to models where existing historically determined payment rates per hectare transition towards, but not to, a flat rate per hectare. This paper explores the role that such payments and changes in their distribution could play in reducing farm income inequality in the UK and Ireland. Flat rate per farm payments are also considered here to explore how a more dramatic reform would reduce inequality. Movement towards flat rate per hectare payments does not uniformly decrease inequality of Farm Net Value Added (FNVA) in contrast to what one may anticipate a priori, in fact in Wales, Scotland and Northern Ireland the inequality of FNVA increases in this analysis. In contrast, flat rate per farm payments reduce inequality substantially.

Keywords: **Common Agricultural Policy, Income Inequality, Gini coefficient, Reform**

1 Introduction

For many years, the agricultural sector in Europe has been heavily dependent on support payments from the EU made under the Common Agricultural Policy (hereinafter "CAP"). In communicating the CAP reform objectives for the period 2014-2020, the European Commission (EC) highlighted that it sought to create a simpler, more efficient, effective and fairer CAP. At the core of these objectives was Commissioner Ciolos's desire to introduce a "*more level playing field*" for farmers across the EU (Ciolos 2010). The 2011 commission proposals reflected this desire, "*with a view to a more equitable distribution of support, the value of entitlements should converge at national or regional level towards a uniform value. This is done progressively to avoid major disruptions*" (European Commission 2011). In 2013, member states reached agreement regarding the range of policy options which could be undertaken at a national level. Member states differed in terms of their policy choices. Some member states opted to implement policies involving the payment of a uniform flat rate per hectare at either the national or regional level. Other member states selected options which entailed some convergence in the value of payments but did not involve a uniform value of payments across farms (Anania et al., 2015, p. 77).

In this paper, we analyse the distributional effect of alternative policy scenarios on the farm income distribution in both Ireland and the United Kingdom. The considered policy scenarios are based on the 2011 EC proposals and are assessed in light of the objectives of the Common Agricultural Policy (CAP), stated aim in Article 39 of the Treaty of Rome, "to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture". To the extent that inequities exist in terms of land holdings, inequities will persist once a flat rate per hectare is introduced, thus the flat rate per hectare reform cannot necessarily be viewed as a means to ensure a *fair* standard of living for all persons engaged in agriculture (see, for instance, Sinabell et al. 2013, p. 326). Nonetheless, since support payments for many farms represent a large share of total income, it is important to explore what implications such reforms might have for farms in the EU. Presently, few studies have explored the potential impact of the current round of reforms.

The motives for reform outlined in the 2011 EC proposals differed from those which influenced the 2003 Fischler reforms, where the main concern was the potentially trade-distorting

nature of production-based payments. The 2003 Fischler reforms led to a shift towards `decoupled' payments, with the Single Payment Scheme (SPS) being introduced from 2005 on-wards. Swinnen (2015) concludes that the 2003 reforms constituted a more radical set of reforms relative to those undertaken in 2013/2014. Under the SPS, member states had a number of options regarding implementation, with many countries including Ireland, Scotland and Wales adopting the historic approach whereby payments were farm-specific, based on production decisions during the reference period (2000-2002). Some countries, adopted a regional approach whereby all farms within a region would receive an equal payment per hectare. Other countries including England and Northern Ireland adopted combinations of the historic and regional approach and are referred to as having adopted a hybrid approach. Member States that joined the EU in 2004 and 2007 were allocated payments under the separate Single Area Payment (SAP) scheme which consisted of flat rate per hectare payments applied to all farms.

There is considerable divergence in the implementation of the 2013 CAP reform within the regions of the UK (England, Northern Ireland, Scotland and Wales) and Ireland, as noted by Allen et al. (2014). Some of the differences in implementation reflect different starting points, e.g. England had already transitioned by 2012 to a flat rate per hectare payment model under the implementation of the 2003 CAP reform. Other differences in implementation reflect differences in land use with differing land types attracting different levels of direct payments across the regions of England, Wales and Scotland. Other differences in the implementation of the reform across the five regions reflect differing policy priorities in the UK and Ireland, e.g. in England, Wales and Scotland at least some of the budget in Pillar 1 of the CAP is being transferred to Pillar 2, whereas in Ireland no transfer is planned for the period to 2020. In section 3, we outline in some detail the content of the 2011 EC proposals.

This analysis does not constitute an attempt to implement all of the detail of the differing CAP implementation decisions taken in Ireland and the regions of the UK (see Allan et al. for detail on these). Rather the six reform scenarios considered here provide insight into the likely impact of the flattening provisions of the CAP reform agreement on farm income inequality across the differing regions of UK and Ireland that would arise if a flat rate per hectare direct payment model was implemented in all regions. In light of the stated objectives of the CAP referring to ensuring a *fair* standard of living for the agricultural community, we also examine the impact of introducing payments on a flat 'per farm' rather than on a flat 'per hectare' basis, which represents a difference conceptualization of a fair system, one by which payments are equal across farms irrespective of the size of the farm holding. We consider both the 'per farm' and 'per hectare' reforms with payments determined at 3 levels: at a National level and, using the Nomenclature of Territorial Units for Statistics (NUTS) administrative region identifiers, at NUTS2 and NUTS3 levels. Thus we consider six hypothetical reform regimes in total.

One of the main objectives of the CAP reform adopted in 2013 is to reduce the gap in the levels of support between member countries, regions and farmers over the period 2014-2020, with the aim of making the CAP fairer (European Commission 2013b, p. 3). As discussed by Mishra et al., (2009) farm income inequality impacts upon economic well-being, including farm family health; farm technology adoption; agricultural productivity; and the growth of the agricultural sector. Thus it is important to explore the extent to which policies alleviate inequality. Income inequality amongst farm households is a research topic that has been receiving more attention in recent times (Allanson, 2006 and Keeney, 2000). A number of studies have applied decomposition techniques to identify the contribution of various factors towards changes in the farm income distribution. The Lerman-Yitzhaki (L-Y hereafter) decomposition is used frequently in the literature to decompose farm income inequality (Keeney 2000; Severini and Tantari 2013b; Mishra et al., 2009).

The remainder of this paper is structured as follows: we begin by discussing the reform proposals and their implementation within the regions analysed; next we discuss the data used in this analysis and the methods applied. We present and discuss the results before concluding.

2 Farm Income Inequality

One of the main objectives of the CAP reform adopted in 2013 is to reduce the gap in the levels of support between member countries, regions and farmers over the period 2014-2020, with the aim of making the CAP fairer (European Commission 2013b, p. 3). As discussed by Mishra, El-Osta and Gillespie (2009), farm income inequality impacts upon economic well-being, including farm family health; farm technology adoption; agricultural productivity; and the growth of the agricultural sector. Thus it is important to explore the extent to which policies alleviate inequality.

The analysis of earnings within other sectors of the economy is studied extensively (see, for example, Melly, 2006 and Mumford and Smith, 2009). These issues are just as important in the agricultural sector as elsewhere in the economy and income inequality amongst farm households is a research topic that has been receiving more attention in recent times (Allanson, 2006; Keeney, 2000 and Phimister, Roberts and Gilbert, 2005 *inter alia*). A number of studies explore the effects of previous CAP reforms on income inequality. Keeney (2000) applies a Lerman-Yitzhaki (L-Y hereafter) decomposition of FFI inequality, similar to that employed here, to determine the role played by inequalities in the different component income streams and find that FFI inequality is driven by the inequality of market income with subsidies having an equalizing effect. The L-Y decomposition is applied elsewhere to decompose changes in the farm income distribution in Italy (Severini and Tantari 2013b) and in the United States (Mishra et al 2009).

While numerous studies of the farm income distribution have involved a decomposition of inequality by income source, few studies have addressed the issue of re-ranking in the distribution. Exceptions include (Allanson (2008), Allanson et al (2016) and Deppermann et al (2016), all of which involved a decomposition of inequality change into vertical and horizontal components.[1] This re-ranking issue becomes relevant, when farms change their ranking in the farm income distribution during the period under study. Ignoring this issue can lead to misleading conclusions regarding the direction and the extent of change in income inequality. In their study of farm income inequality in Scotland, Allanson et al., (2017) observed a rise in farm income inequality between 1995 and 2009 but found that most, if not all of the increase, could be attributed to re-ranking in the distribution i.e. the horizontal component. The author's concluded therefore that there is 'no evidence that relative income growth due to farm business size changes was associated with initial incomes'. Deppermann et al (2016) concluded that the abolition of direct payments would increase relative farm income inequality in Germany and that the vertical component would account for the majority of the rise in inequality.

In examining, the broad extent of inequality in direct payments, Sinabell et al. (2013) find considerable differences between countries in the extent of concentration in direct payments between EU member states during the 2000 to 2010 period. They conclude that CAP reforms between 2000 and 2010 failed to deliver fairness since direct payments became less concentrated in only a few member states. The divergence in concentrations across countries is not attributable to differences in the decoupling model (historic, regional or hybrid) implemented. Severini and Tantari (2015) reported similar findings and concluded that a large part of the concentration of the Direct Payments is generated 'by the way land is distributed among farms'.

[1] The vertical component can be considered to be the degree of 'progressivity' which amounts to the change in inequality based on the rankings of the baseline distribution while the horizontal component is the effect of re-ranking.

While the studies above focus on the standard Gini coefficient which measures relative inequality, some authors have focused instead on absolute inequality as measured by the generalized Gini,defined as the standard Gini coefficient multiplied by the mean of the variable of interest. Deppermann et al (2016), Allanson and Rocchi (2008) and Allanson (2008) all report that support payments increase absolute inequality in farm incomes and we speculate that this may also be the case in the UK and Ireland since larger and more productive farms tend to receive higher payments. In this study our focus (as in Severini and Tantari, 2013a) will be on relative inequality. Readers interested in broader issues relating to the inequality of farm household incomes in Ireland are directed towards Higgins (1986), Matthews (2000), Keeney and O'Brien (2008) and CSO (2008). The literature on the issue of farm income inequality in the UK is also substantial, see Allanson (2006, 2007), Allanson and Rochi (2008) and Phimister et al. (2004).

3 Farm Reform Proposals and Member State Implementation

In this section, we outline in greater detail the EC reform proposals as published in October 2011 (European Commission, 2011). The Commission proposal envisaged that all Member States would move to a flat area payments model by 2019 for the Basic Payment Scheme and Pillar I direct income supports would become linked explicitly with environmental objectives (so-called "greening"). The ultimate agreement on CAP reform reached in June 2013 (EC, 2013) between the European Commission, the European Parliament and the Council (i.e. the Member States) was less radical than the original Commission proposals. Member States retained a wide range of options regarding implementation over the period 2015 to 2020 (See, Matthews 2013; DAFM 2013) for more detail on the agreement. Allen et al. (2014) provides comprehensive details on the implementation of the CAP reform agreement in Ireland and the four regions of the UK.

At one end of the continuum of policy options lay the original European Commission idea of a flat Basic Payment Scheme payment by 2019, now known as "full convergence". At the other end is what has come to be known as the approximation or "partial convergence" model (Matthews, 2013). Under the full convergence model, all farmers in a Member State or region of a Member State would receive the same level of BPS support payment per hectare by 2019. Under the partial convergence model farmers with payments below 90% of the national/regional average BPS payment per hectare will have their payments raised by at least one-third of the difference between their current payment and 90% of the national average. This increase in support is financed by reductions to payments to farmers with initial BPS payments above the national/regional average BPS payment per hectare. All farmers by 2019 will receive at least a minimum BPS payment of 60% of national/regional average BPS payment per hectare. Farmers with payments of 90% or more and less than 100% of the national average payment would see no change in their BPS receipt.

The reform agreement also allowed for differing levels of payment for differing land types (as allowed for under the 2003 CAP reform). Within the reform there are also options for Member States to introduce subsidies that are coupled to production, subsidies for regions with particular agronomic challenges, subsidies that are only paid on the "first" hectares of a farmers holding with the upper limit of entitlement set at the average farm size. Indeed, a number of countries including France and Germany have chosen to allocate additional subsidies on the first number of hectares up to this threshold (European Commission 2016). We focus only on the full convergence model since this should lead to a greater reduction in inequality than would the partial convergence approach and hence gives a better representation of the reduction in inequality that `could' be achieved.

3.1 Hypothetical Policy Regimes considered

To assess the impact of the policy change, we initially, for comparison purposes, assume that in the baseline scenario the values of all variables of interest are identical to their 2012 levels. Next we consider a set of counterfactual scenarios in which various reforms of Pillar 1 payments, along with their associated impact on Farm Net Value Added (FNVA), are assumed to have occurred. To calculate FNVA, as in Severini and Tantari (2013b) we assume that market income and Pillar 2 payments are unchanged. An important limitation of this approach is that it ignores behavioural changes associated with changes to the system of support payments. Some reassurance is provided by the relatively small change in production decisions projected by Erjavec *et al.* (2011) under a more severe reform scenario, which involved a move to a €100 flat rate per hectare payment.

We consider six stylized regimes representing different possible implementations of CAP reforms. In Regime 1, it is assumed that payments are determined based on a National flat rate per hectare, while in Regimes 2 and 3 the flat rates per hectare are determined at a NUTS2 and NUTS3 level respectively. Since these payments are per hectare, considerable inequality will persist across farms due to variation in farm sizes. Thus the impact on the distribution of Pillar 1 payments is likely to be less than one may anticipate in light of payment rates being equalized. In Regimes 4-6, we assume that the flat rate per farm is determined at a National, a NUTS2 and a NUTS3 level respectively. Such reforms would be consistent with an attempt to use Pillar 1 payments to equalize farm incomes but would involve shifting subsidies towards smaller farms which may be less productive and these Regimes are included chiefly to illustrate the extent of redistribution that would be possible, if so desired, to act as a comparator for Regimes 1 to 3.

4 Data

For this study we use FADN data for 2012 for farms in Ireland and UK. The FADN data includes a weighting factor which gives the number of farms represented by each sample farm. All analysis is carried out after applying the sample weights so that results are representative at a national level. Since our focus is on the inequality of farm incomes on family farms, as in Severini and Tantari (2013b) we exclude all partnerships, corporate and other non-family farms (n=251), specialist granivores (n=106), farms for whom a NUTS2 region identifier was not available (n=92) and farms with a Total Utilized Agricultural Area (Total UAA) of less than 5 hectares (n=52), leaving us with a total sample size of 3,144 observations representing 159,018 farms (79,042 in Ireland and 79,976 in the UK). The analysis excludes off-farm income due to the non-availability of such information in the FADN data. All values are converted to real 2012 euros using Harmonized Indices of Consumer Prices (HICP) for Ireland and the UK that are available from Eurostat.

5 Methods

As an initial means to assess the distributional effects of the reform regimes, we divide farms into deciles of (a) Total Utilised Agricultural Area (UAA) and (b) FNVA in the baseline scenario and then explore the share of FNVA and Pillar 1 payments received by farms in each decile. To assess the impact of the different reform regimes on income (and Pillar 1 payment) inequality, we construct a set of Lorenz curves (Lorenz, 1905). A commonly used summary measure for the Lorenz curve is the Gini coefficient (G) which can be defined as twice the area between the Lorenz curve and the line of perfect equality - provided that the variable in question is non-negative.

For a variable which can take negative values (such as FNVA), provided that the mean of the variable is positive, *G* can instead be calculated as the Gini Mean Difference divided by twice the mean:

$$G = \frac{1}{2n^2\mu_y}\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j| \qquad [2]$$

However, *G* is no longer bounded from above by 1 if the mean is negative. *G* satisfies the principle of transfers so that a transfer of income from relatively richer farms to relatively poorer farms will lower the value of *G* with the decrease being larger the greater the difference in the farms' initial ranks. Comparing *G* in each of the reform regimes to that in the baseline allows us to assess whether inequality would decrease and if so to quantify the reduction in inequality. In addition to the formula above, there are a plethora of alternative formulations for *G* and one convenient expression is:

$$G = \frac{2cov(y_i,i)}{n\mu_y} = \frac{2cov(y_i,F)}{\mu_y} \qquad [3]$$

where the data is sorted in ascending order of income and then *i=1,…,n.* Preserving this ranking it is possible to calculate the concentration index for some other variable *x* as:

$$CI(x) = \frac{2cov(x_i,i)}{n\mu_x} = \frac{2cov(x_i,F)}{\mu_x} \qquad [4]$$

This measures how another variable is distributed with respect to the distribution of *y*. If *x* is equally distributed across the distribution of y, then *CI(x) = 0*, if *x* is concentrated more heavily amongst individuals with high *y*, then *CI(x)* > 0 and if *x* is more heavily concentrated amongst individuals with low values if *y* then *CI(x) < 0.* Such concentration indices are used in the decomposition approaches discussed next.

Lerman and Yitzhaki decomposition:

Lerman and Yitzhaki (1985) proposed a method to decompose overall income inequality to determine how much of the inequality is attributable to its source components. Suppose that Income (*y*) is comprised of *K* components (y_k), $y = y_1 + y_2 + \ldots + y_k$. The covariance between *y* and the individuals rank in the income distribution can be written as the sum of the covariances for the components $cov(y_i, F) = \sum_{k=1}^{K} cov(y_{ki}, F)$. This allow us to rewrite *G* as:

$$G = \frac{\sum_{k=1}^{K} 2cov(y_k,F)}{\mu_y} \qquad [5]$$

This can then be rearranged to give the Lerman and Yitzhaki decomposition[2]:

$$G = \sum_{k=1}^{K}\frac{cov(y_k,F)}{cov(y_k,F_k)} \times \frac{2cov(y_k,F_k)}{\mu_{y_k}} \times \frac{\mu_{y_k}}{\mu_y} \text{ or } G = \sum_{k=1}^{K} R_k \times G_k \times S_k \qquad [6]$$

[2] To see this, note that G can be re-written as: $G = \frac{\sum_{k=1}^{K} 2cov(y_k,F)}{\mu_y} \times \frac{\frac{cov(y_k,F_k)}{\mu_{y_k}}}{\frac{cov(y_k,F_k)}{\mu_{y_k}}}$.

Where R_k is the `Gini Correlation' between Income component *k* and total income, G_k is the Gini coefficient for y_k and S_k is the share of component *k* in total income.

The `concentration ratio' for a particular income component is calculated as $C_k = R_k \times G_k$. A C_k=0 indicates that all individuals receive an equal amount of y_k. A positive C_k indicates that y_k accrues mainly to individuals with higher total income and a negative C_k indicates that y_k accrues mainly to individuals with lower total income.

Lerman and Yitzhaki (1985) show that the effect on the overall Gini of an *x%* change in income component *k* is:

$$\frac{\partial G}{\partial x_k} = S_k(R_k G_k - G) \qquad [7]$$

The percentage effect can be found by dividing across by G:

$$\frac{\frac{\partial G}{\partial x_k}}{G} = \frac{S_k R_k G_k}{G} - S_k \qquad [8]$$

If this percentage effect is positive, income component *k* increases inequality, if it is negative it decreases inequality. In the present context FNVA is decomposed by market income, Pillar 1 payments and Pillar 2 payments for each of the regimes, illustrating any differences in the impact of the reform regimes on income inequality.[3]

Jenkins and Van Kerm decomposition:

Jenkins and van Kerm (2006) show that the change in income inequality over time can be additively decomposed into terms representing the progressivity of income growth and the extent of re-ranking. While Jenkins and van Kerm focus on changes income over time here we focus on changes in *y* (FNVA) over regimes.[4] The change in G between regimes 0 and 1 would be:

$$\Delta G = \frac{2cov(y_1,F_1)}{\mu_{y_1}} - \frac{2cov(y_0,F_0)}{\mu_{y_0}} \qquad [9]$$

By adding and subtracting the concentration index for y_1 based on the ranking of y_0, this can be rewritten as:

$$\Delta G = \left[\frac{2cov(y_1,F_1)}{\mu_{y_1}} - \frac{2cov(y_1,F_0)}{\mu_{y_1}}\right] - \left[\frac{2cov(y_0,F_0)}{\mu_{y_0}} - \frac{2cov(y_1,F_0)}{\mu_{y_1}}\right] = [R] - [P] \qquad [10]$$

The first term, *R*, captures the effect of changes to the ranking of farms while the second term, *P*, captures the progressivity of changes in *y*. As Jenkins and van Kerm point out, this means that progressive changes to income will reduce inequality unless they are offset by concomitant income mobility. In the context of this paper, the Jenkins and van Kerm decomposition allows us to

[3] For unweighted data the Lerman and Yitzhaki decomposition can be obtained using the user written Stata-command – descogini – (Lopez-Feldman, 2006). For this paper an adjusted version which allows the use of weights was programmed.

[4] Since the total pool of Pillar 1 subsidies remains constant across the regimes income growth in this context is 0, nonetheless the Jenkins and van Kerm decomposition allows us to explore whether policy changes are altering the ranking of farms or merely changing their relative incomes.

decompose the effect of each reform regime into a part that is due to making farms in general better off (P) and a part that only serves to switch the position of farms in the income distribution (R). This approach is quite similar to the approach of Allanson (2006).

6 Results

As an initial means by which to investigate the effects of the various reform regimes, we divide farms into deciles based on their Total UAA (Fig. 1) in the baseline (2012) and examine how the share of FNVA and Pillar 1 payments that accrue to farms in each decile changes under each of the reform regimes. A similar analysis is conducted using deciles of baseline FNVA (Fig. 2). We discuss results for Ireland here but the general pattern of results is similar across the countries.

In figure 1, one can see the strong link between Pillar 1 payments and Total UAA, partly a product of the Fischler reforms. This link is reinforced under regimes 1 to 3 which consist of flat per hectare payments; interestingly there is little difference between payments determined at a national level (Regime 1) and those at a NUTS3 level (Regime 3) with the exception of Scotland. In figure 2, one can see that the top 3 deciles of FNVA receive almost 60% of Pillar 1 subsidies. This changes little under flat rate per hectare payments, (Regimes 1 to 3), unlike the flat rate per farm regimes (4 to 6), where each farm receives an equal share of payments. In the bottom panel of Figure 2 we can see that the top 30% of farms, in terms of FNVA, receive approximately 75% of FNVA in the baseline. Flat rate per hectare payments reduce this to approximately 70% while flat rate per farm payments reduce this to approximately 60%. Thus even a fairly extreme redistribution of Pillar 1 payments (Regimes 4 to 6) is not sufficient to lead to dramatic equalisation of farm incomes.

Inequality and mobility measures:

Table 2 presents the Gini coefficients for Pillar 1 payments and FNVA in the baseline and under each of the regimes for each country. The corresponding Lorenz curves are available in the appendix. In Table 2, we see that under the existing regime (baseline) there is very high inequality in FNVA in each country. Pillar 1 payments are more equally distributed in all off the countries suggesting that they may serve to reduce inequality, although we will revisit this more formally using decomposition analysis. Turning to the reform regimes, we find that per hectare payments (Regimes 1 to 3) reduce the inequality of Pillar 1 payments in Ireland but surprisingly, increase this inequality in the other regions. This leads these reforms to increase inequality in FNVA. While surprising, this could be explained by the distribution of Total UAA being less equal than the baseline distribution of Pillar 1 payments hence an increase in the linkage between payments and Total UAA will increase inequality. In general the spatial level at which payments are determined has little impact on inequality except in Scotland. On the other hand, determining payments based on a flat rate per farm (Regimes 4 to 6) dramatically decreases inequality of Pillar 1 payments in all countries and leads to an associated reduction in inequality in FNVA.

Lerman and Yitzhaki Decompositions:

To understand the role played by Pillar 1 payments in farm income inequality, we decompose the Gini coefficient for FNVA for each country using the L-Y decomposition. Table 3 reveals the results for the baseline scenarios. With the exception of England (49%), market income tends to contribute a very small share of FNVA, ranging from 12% in Ireland to 18% in Wales.

Thus agriculture in the UK and Ireland appears to be more heavily reliant on the CAP than Italy and *prima facie* one would expect to observe a larger impact from any potential reforms to the system relative to those identified in Severini and Tantari (2013a) for the Italian case. The concentration of support payments (Pillar 1 and Pillar 2) is much lower in the UK and Ireland than the concentration of Market Income, where the presence of many farms earning negative incomes inflates the Gini to be much greater than 1 in all countries except England. Pillar 1 payments display fairly high correlation with FNVA (0.6 to 0.8), suggesting that for Pillar 1 payments the equalizing impact on FNVA is attributable largely to its lower concentration. This explains why in Column 7 of Table 4, given their large share in FNVA in most of the countries, Pillar 1 payments have a smaller share in explaining the inequality of FNVA (between 22% and 38%). Pillar 2 payments are less correlated (0.2 to 0.46), and hence their share of inequality is low (3.9% to 7.6%).

In Table 4, we report the L-Y decomposition results pertaining to Pillar 1 payments under each of the six scenarios (Table 1 provides the associated Gini coefficients for FNVA for comparison).[5] A move toward per hectare payments slightly reduces the share of Pillar 1 payments in inequality for Ireland but slightly increases it for England and Wales. A more dramatic increase is observed for Northern Ireland and particularly Scotland and this appears to be a combination of increased correlation (R_k) between Pillar 1 payments and FNVA and increased inequality in payment levels (G_k) following the reforms. Nonetheless, the elasticity of FNVA Gini with respect to a 1% change in Pillar 1 payments is negative and relatively large for each country showing that the pillar 1 payments reduce farm income inequality. The limited impact of the spatial level at which payment rates are determined for most countries (with the exception of Scotland) is once again evident. Turning to the farm based payments, the Gini coefficients are zero when payments are determined at a national level since each farm receives an equal payment. That noted, even when payments are determined at a NUTS3 level the Gini coefficient remains very low. This suggests that there would not be much heterogeneity in terms of payment levels across the different regions within a country. The elasticities show that flat rate payments have a much larger impact on reducing inequality than hectare based payments as one would expect.

Jenkins and van Kerm Decompositions:

In table 5, we display the results based on the decomposition approach of Jenkins and van Kerm, which distinguishes between vertical and horizontal inequality with the latter captured by the re-ranking term, *R*. The progressivity term captures whether the regime change serves to transfer subsidies towards poorer farms. With the exception of Northern Ireland in per hectare reforms ($P<0$), the reforms are progressive ($P>0$) in all regimes. Thus poorer farms under the baseline tend to benefit from the reforms. In Northern Ireland, the changes tend to be slightly regressive. However, in all of the countries the reforms lead to a re-ranking of farms and in the cases of Northern Ireland, Scotland England and Wales, this re-ranking is sufficient to increase the overall level of inequality of FNVA following reforms involving per-hectare payments. In the case of farm-based payments, the progressivity of the reforms is sufficient to outweigh the re-ranking, leading inequality to decrease overall.

7 Discussion and Conclusions

The agricultural sector in the EU is heavily reliant on support payments under the Common Agricultural Policy to ensure financial viability. The 2011 EC CAP reform proposals sought the introduction of a Basic Payment Scheme (BPS) which would replace the existing SPS and the SAP

[5] The full results for each country/regime are available from the authors on request.

schemes. Under the `full convergence' implementation of the BPS, farms would receive a flat rate per hectare. This paper explores the potential impact of this change on farm income inequality in Ireland and the countries in the UK. Furthermore this paper also explores the impact that a more dramatic reform, flat rate farm based payments, would have on inequality.

Under the SPS, there is considerable farm income inequality. In Ireland, the top 30% of the FNVA distribution receive almost 60% of Pillar 1 subsidies and approximately 75% of FNVA. The Gini coefficients range from between 0.53 to 0.66 across the countries, with Northern Ireland exhibiting the greatest inequality and Wales the lowest. Under the full convergence model involving flat rate per hectare payments, the distribution of farm income in Ireland is not subject to dramatic changes. This outcome is in contrast with that found under the flat rate per farm regimes, where each farm receives an equal share of Pillar 1 payments. However, even with flat rate per farm payments, the share of FNVA accruing to the top 30% is still approximately 60%. Thus even a fairly extreme redistribution of Pillar 1 payments (i.e. a flat rate per farm) is not sufficient to lead to dramatic equalisation of farm incomes. Whether payments are determined at a national level or at NUTS2 or NUTS3 level leaves the results largely unchanged in most countries although in Scotland the spatial level matters somewhat.

The inequality of Pillar 1 payments is considerably lower than the inequality in FNVA across all countries. Based on the Lerman-Yitzhaki decomposition, the inequality of Pillar 1 payments explains between 20% and 31% of the inequality in FNVA depending on the country considered, while market income contributes between 63% and 75% with Pillar 2 payments contributing 3.9% to 7.6%. By recalculating the Gini coefficients under each regime, we find that per hectare payments reduce the inequality of Pillar 1 payments in Ireland but surprisingly, increase this inequality in the other regions (Northern Ireland, Scotland, England and Wales). This leads these reforms to increase inequality in FNVA. While surprising, this can be explained by the distribution of Total UAA in these regions which is less equal than the baseline distribution of Pillar 1 payments, hence an increase in the linkage between payments and Total UAA increases inequality in farm incomes. When payments are determined on a per-farm basis they serve to reduce the inequality of FNVA although significant inequality persists.

With the exception of Northern Ireland, all of the reform regimes are progressive. Thus poorer farms under the SPS tend to benefit from the reforms. In Northern Ireland, the changes tend to be slightly regressive. However, in all of the countries the reforms lead to a re-ranking of farms and in the cases of Northern Ireland, Scotland, England and Wales, this re-ranking is sufficient to increase the overall level of inequality of FNVA following reforms involving per-hectare payments. In the case of farm-based payments the progressivity of the reforms is sufficient to outweigh the re-ranking leading inequality to decrease overall in all countries.

In conclusion, movement to a flat rate per hectare payments does not uniformly decrease inequality of FNVA in all the regions considered, this is in contrast to what would have been anticipated a priori. In Northern Ireland and Scotland, the inequality of FNVA increases with a movement to a flat rate per hectare payment model. This type of outcome is likely to have provided at least some of the motivation for the three way categorisation of agricultural land in Scotland that has limited the redistribution of direct income support from more intensively farmed land in the Scottish lowlands to the more extensively farmed areas of the Scottish highlands.

The distributional consequence of payment reforms is an important consideration for policy makers. In the aftermath of a Brexit from the European Union, important decisions will be made with regard to British Agricultural Policy including those pertaining to the subsidy regime. Farm subsidies account for the majority of farm income in Northern Ireland, Scotland and Wales and a significant proportion of farm income in England. We find that farm subsidies are unequally

distributed and this implies that some groups may stand to lose significantly under the reforms examined in this paper. As discussed above, the impacts on farm income (FNVA) inequality may differ from a priori expectations. Although the approach adopted here does not take account of behavioural responses to changes in payment regimes, similar analyses could be performed on data from microsimulation models to account for such effects, subject to the farmer's behavior being adequately modelled.

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9 Appendix

Table 1

Summary Statistics for Farm Size and Farm Income Components

		Total UAA (hectares)		FNVA		Market Income		Pillar 1		Pillar 2	
Regions	**N**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
Ireland	79,042	50	40	28,960	36,239	7,577	27,329	15,771	14,629	5,612	5,322
Northern Ireland	10,557	81	93	23,894	34,673	-2,231	30,769	20,460	15,417	5,665	8,579
Scotland	11,606	329	638	57,485	77,461	-2,200	63,778	48,312	33,713	11,373	15,718
England	48,351	148	163	89,511	128,827	48,363	108,219	31,759	31,506	9,389	16,850
Wales	9,462	126	144	49,170	53,269	12,489	43,136	31,056	21,451	5,624	10,590
Total	159,018	107	215	50,319	84,437	18,906	69,245	24,228	25,162	7,185	11,588

Table 2

Inequality of FNVA and Pillar 1 Payments

	Gini Coefficient for FNVA					Gini Coefficient for Pillar 1 Payments				
Regime	**Ireland**	**Northern Ireland**	**Scotland**	**England**	**Wales**	**Ireland**	**Northern Ireland**	**Scotland**	**England**	**Wales**
0	0.58	0.66	0.65	0.58	0.53	0.41	0.36	0.33	0.43	0.34
1	0.55	0.75	0.83	0.58	0.55	0.34	0.43	0.57	0.45	0.40
2	0.55	0.75	0.77	0.58	0.55	0.34	0.43	0.51	0.45	0.39
3	0.56	0.75	0.75	0.58	0.55	0.36	0.43	0.47	0.44	0.39
4	0.43	0.55	0.53	0.47	0.42	0.00	0.00	0.00	0.00	0.00
5	0.44	0.55	0.53	0.48	0.42	0.05	0.00	0.04	0.14	0.01
6	0.45	0.55	0.56	0.49	0.42	0.12	0.00	0.13	0.17	0.05

Table 3

Lerman-Yitzhaki Decomposition of Baseline Gini

Country	Source	Sk	Gk	Rk	Share	% Change
Ireland	Total Income	100%	0.5785	1	100%	0.00%
Ireland	Market Income	26.16%	1.6433	0.881	65.47%	39.31%
Ireland	Pillar 1	54.46%	0.4115	0.7954	30.82%	-23.64%
Ireland	Pillar 2	19.38%	0.4916	0.2254	3.71%	-15.67%
Northern Ireland	Total Income	100%	0.657	1	100%	0.00%
Northern Ireland	Market Income	-9.34%	-6.1578	0.7289	63.80%	73.14%
Northern Ireland	Pillar 1	85.63%	0.3592	0.5741	26.88%	-58.75%

Northern Ireland	Pillar 2	23.71%	0.6332	0.4077	9.32%	-14.39%
Scotland	Total Income	100%	0.6499	1	100%	0.00%
Scotland	Market Income	-3.83%	-14.355	0.8174	69.09%	72.92%
Scotland	Pillar 1	84.04%	0.3344	0.6145	26.57%	-57.47%
Scotland	Pillar 2	19.78%	0.6265	0.2275	4.34%	-15.44%
England	Total Income	100%	0.5769	1	100%	0.00%
England	Market Income	54.03%	0.861	0.9237	74.49%	20.46%
England	Pillar 1	35.48%	0.4293	0.7704	20.34%	-15.14%
England	Pillar 2	10.49%	0.6969	0.4087	5.18%	-5.31%
Wales	Total Income	100%	0.5258	1	100%	0.00%
Wales	Market Income	25.40%	1.6929	0.8167	66.80%	41.40%
Wales	Pillar 1	63.16%	0.3427	0.6644	27.35%	-35.81%
Wales	Pillar 2	11.44%	0.7144	0.3764	5.85%	-0.0559

Table 4

Lerman and Yitzhaki decomposition - Impact of reform regimes on Pillar 1 payment contribution

Regime:	Pillar 1 Payments	Ireland	Northern Ireland	Scotland	England	Wales
0	Gk	0.4115	0.3592	0.3344	0.4293	0.3427
0	Rk	0.7954	0.5741	0.6145	0.7704	0.6644
0	Share	30.82%	26.88%	26.57%	20.34%	27.35%
0	Elasticity	-23.64%	-58.75%	-57.47%	-15.14%	-35.81%
1	Gk	0.3421	0.4318	0.5697	0.4453	0.3977
1	Rk	0.7624	0.7167	0.8199	0.773	0.6857
1	Share	25.94%	35.49%	47.55%	21.08%	31.44%
1	Elasticity	-28.52%	-50.14%	-36.49%	-14.40%	-31.72%
2	Gk	0.343	0.4318	0.5082	0.4453	0.3945
2	Rk	0.7639	0.7167	0.7804	0.7769	0.683
2	Share	26.03%	35.49%	43.16%	21.13%	31.18%
2	Elasticity	-28.43%	-50.14%	-40.89%	-14.35%	-31.98%
3	Gk	0.3584	0.4318	0.4652	0.4445	0.3878
3	Rk	0.7693	0.7167	0.7742	0.7759	0.6811
3	Share	27.05%	35.49%	40.29%	21.07%	30.54%
3	Elasticity	-27.41%	-50.14%	-43.75%	-14.41%	-32.62%
4	Gk	0	0	0	0	0
4	Rk	0	0	0	0	0
4	Share	0.00%	0.00%	0.00%	0.00%	0.00%
4	Elasticity	.	.	.	.	.
5	Gk	0.0478	0	0.0437	0.14	0.0061
5	Rk	0.309	0	0.0286	0.2854	0.0645
5	Share	1.85%	0.00%	0.20%	2.94%	0.06%
5	Elasticity	-52.61%	.	-83.84%	-32.54%	-63.10%
6	Gk	0.123	0	0.1334	0.1673	0.0478
6	Rk	0.4089	0	0.3915	0.3312	0.1015

6	Share	6.11%	0.00%	7.83%	4.05%	0.72%
6	Elasticity	-48.35%	.	-76.21%	-31.43%	-62.44%

Table 5

Jenkins and Van Kerm decomposition by country - Impact of reform regimes on FNVA Inequality

		FNVA					
Country	Statistic	National flat rate per hectare	NUTS2 flat rate per hectare	NUTS3 flat rate per hectare	National flat rate per farm	NUTS2 flat rate per farm	NUTS3 flat rate per farm
Ireland	Change in Gini	-0.031	-0.03	-0.023	-0.149	-0.143	-0.13
Ireland	R-component	0.031	0.031	0.026	0.029	0.03	0.032
Ireland	P-component	0.062	0.061	0.049	0.178	0.173	0.163
Northern Ireland	Change in Gini	0.09	0.09	0.09	-0.108	-0.108	-0.108
Northern Ireland	R-component	0.059	0.059	0.059	0.069	0.069	0.069
Northern Ireland	P-component	-0.03	-0.03	-0.03	0.177	0.177	0.177
Scotland	Change in Gini	0.176	0.122	0.101	-0.119	-0.12	-0.089
Scotland	R-component	0.268	0.189	0.139	0.053	0.053	0.052
Scotland	P-component	0.092	0.067	0.037	0.173	0.173	0.141
England	Change in Gini	0.002	0.004	0.004	-0.105	-0.095	-0.091
England	R-component	0.007	0.006	0.006	0.013	0.014	0.014
England	P-component	0.005	0.002	0.002	0.117	0.109	0.105
Wales	Change in Gini	0.022	0.02	0.02	-0.103	-0.103	-0.102
Wales	R-component	0.038	0.036	0.031	0.041	0.041	0.041
Wales	P-component	0.016	0.016	0.01	0.144	0.144	0.143

Figure 1

Share of Farm Net Value Added by Decile of UAA

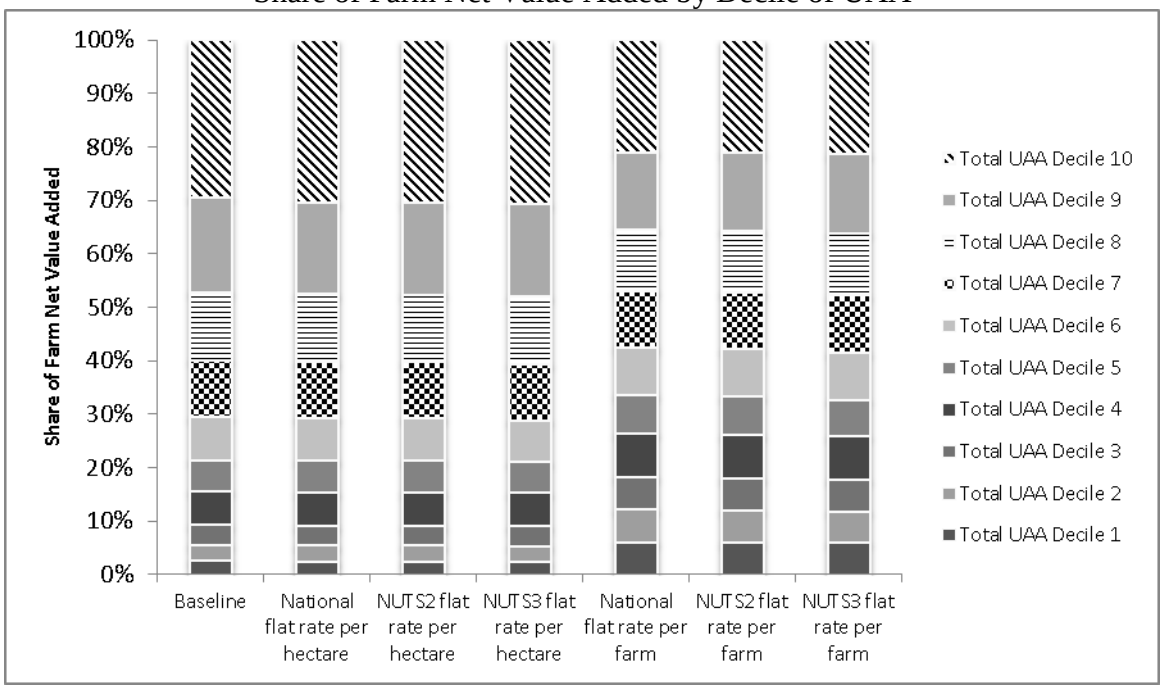

Figure 2

Share of Farm Net Value Added by Decile of FNVA

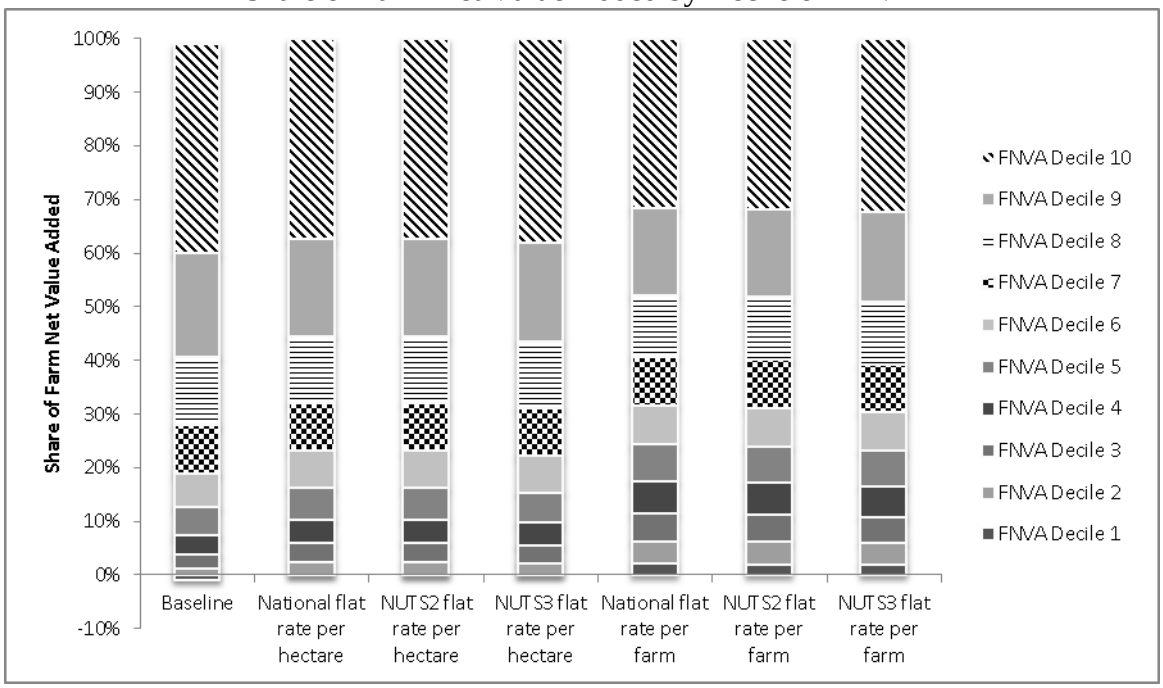

Figure 3

Share of Farm Net Value Added by Decile of Pillar 1 Subsidies

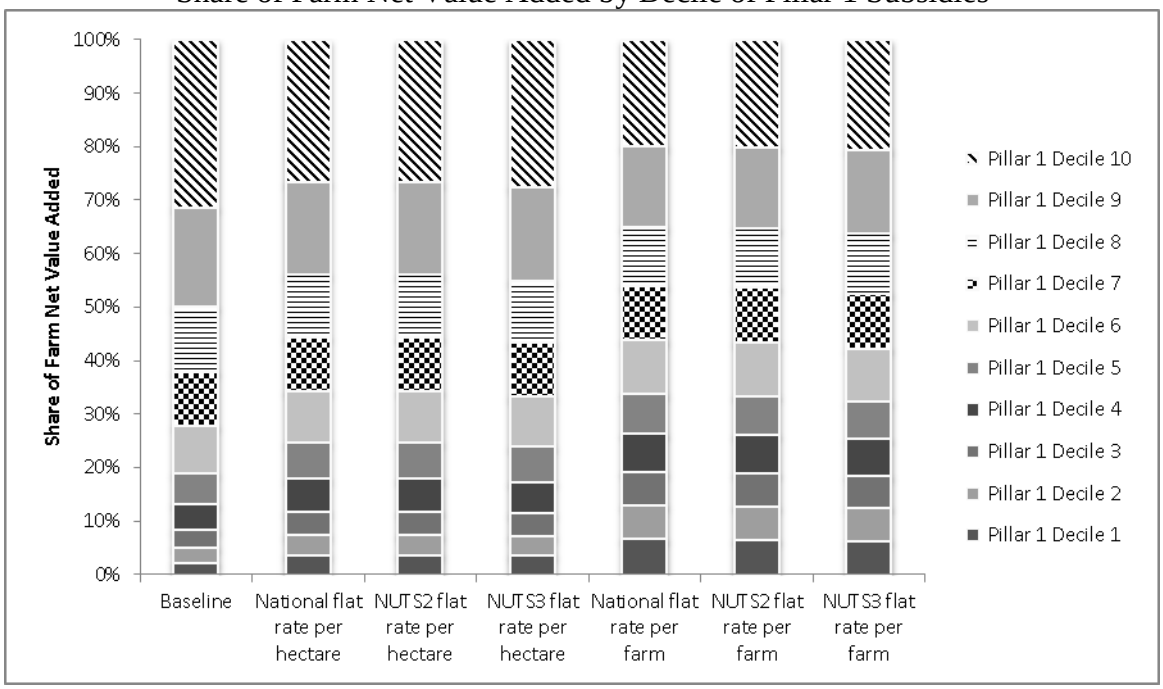

Figure 4: Lorenz curves for FNVA for Ireland

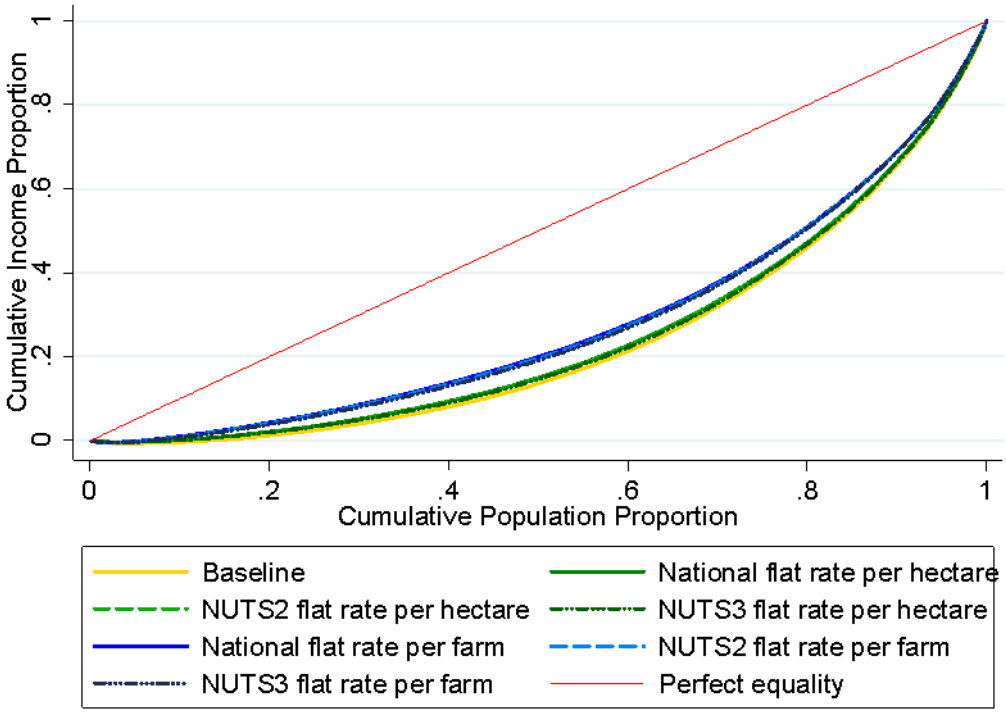

Figure 5: Lorenz curves for FNVA for Northern Ireland

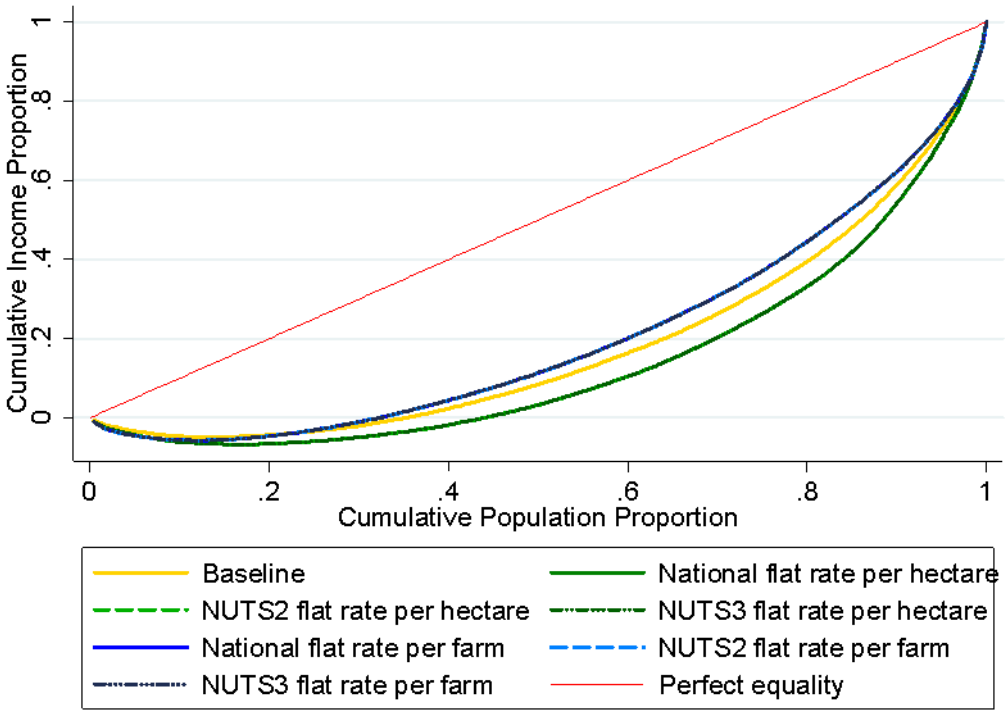

Figure 6: Lorenz curves for FNVA for Scotland

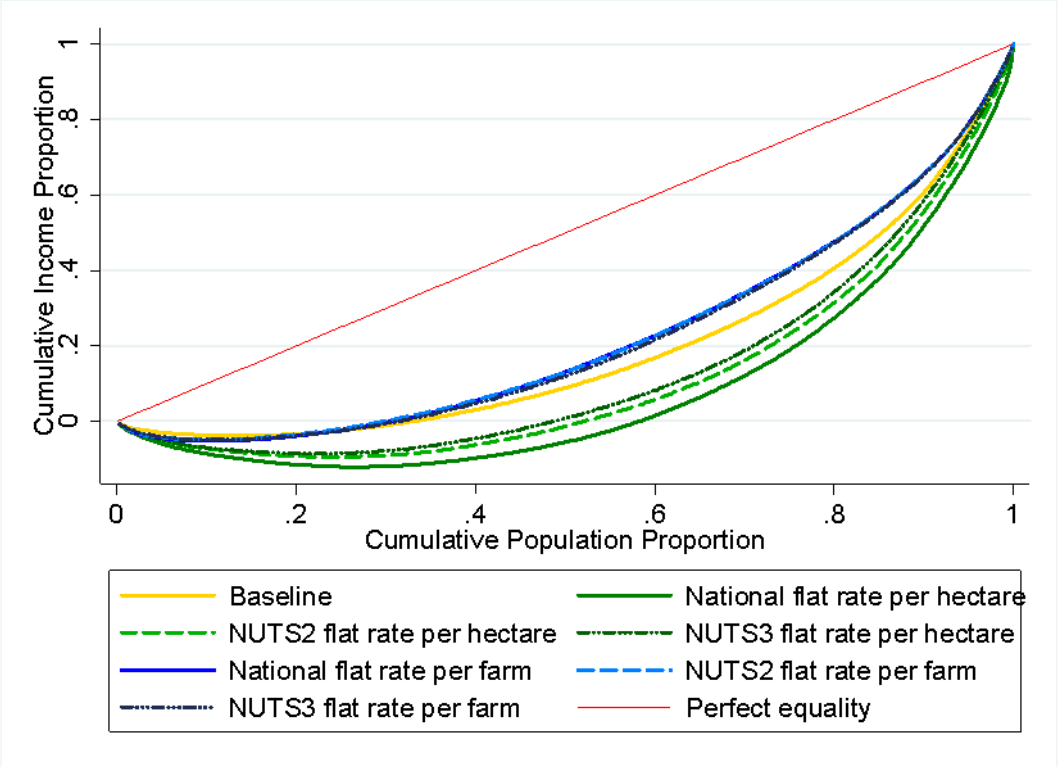

Figure 7: Lorenz curves for FNVA for England

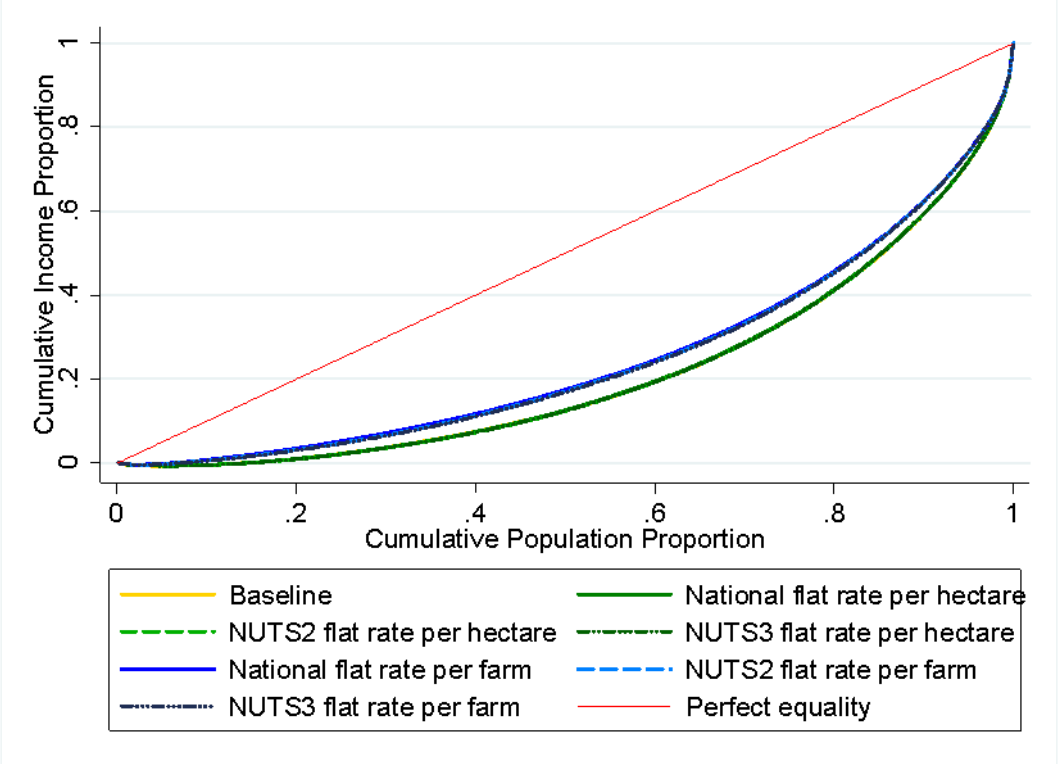

Figure 8: Lorenz curves for FNVA for Wales