Farm Income Mobility and Inequality in Ireland 1994-2001

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Abstract

This paper uses eight years of data of the National Farm Survey (NFS) to analyse the statics and dynamics of the farm earnings distribution in the period 1994 to 2001, and asks the question: is the Irish farming sector close to a society where individuals move up and down the earnings ladder over time, or is it more similar to a society where individuals are stuck in the same step? I find that for those who find themselves in the middle of the Irish farm earnings distribution the answer is close to the former but for those at either end of the Irish farm earnings distribution the answer is much closer to the latter. In getting to this answer we look at earnings inequality, characterise transition probabilities and model earnings dynamics as a purely stochastic process.

Keywords: Family farm income, inequality, mobility, decomposition

JEL Classification: Q12, D63

1. Introduction

There has been extensive research done on the distribution of Irish earnings at particular points in time. On the other hand, surprisingly little attention has been given to the development of Irish farm earnings over time or to the mobility of individual family farm income. It is the aim of this paper to fill this gap in the research on Irish farm income by using Irish farm income panel data over the period 1994 – 2001 to analyse the inequality and mobility of farm earnings over time. This study involves an analysis of economic inequality in the Irish farming sector between 1994 and 2001. This analysis shall include measuring the level of economic inequality in the intervening years, the extent to which inequality and its composition changed and the influences on inequality over the period. This analysis shall use a number of measurements of inequality so as to measure the level of inequality at different points of the farm income distribution.

Agriculture's contribution to national income remains relatively important in Ireland by EU standards, with agriculture and food still accounting for about 8.9% of Gross Domestic Product (GDP) in 2003. This is despite extensive problems during the 1990s in several important markets. The BSE crisis in 1996, followed by the collapse of the Russian market in 1998 and problems in the Far East in the same year had a particularly strong impact on the Irish market and Irish farming in general. These impacts were further exacerbated by the poor weather conditions in 1998 that resulted in a fodder shortage and significant extra costs on farmers especially those involved in drystock farming. The gross figure for agricultural output at producer prices in 2003 was €4,731 million with beef and milk production accounting for 57%. Also the agri-food sector accounted for 9% of total employment in 2003. As well as this, farming is still seen as having a vital role in the economic and social life of rural communities in Ireland. However, employment in agriculture has declined significantly. This long-term downward trend in agricultural employment reflects an increase in part-time farming as well as a drop in the number of small holdings of less than 20 hectares.

According to Matthews (2000a) the most striking feature of aggregate income from Irish farming is its volatility. A short review of the 1990s is a confirmation of this viewpoint. The early years of the 1990s saw significant falls in aggregate farm income due in no small part to poor world commodity markets, the first BSE crisis in Britain and the outbreak of the Gulf war. In 1992, the MacSharry CAP reforms were introduced. The foundation of these reforms was a substantial cut in EU farm product prices that brought EU prices closer to world market levels. To make these price cuts politically acceptable to farmers the EU substituted away from the traditional market price support to direct payment of farmers, thus "decoupling" production from farm support. Many farming organizations predicted that these changes would be a disaster for Irish farming.

However, farm income levels actually improved in the years following the introduction of the reforms especially the years 1994 to 1996. A number of currency exchange rate changes and a peaking of world prices during this time blunted the immediate impact of the CAP reforms so that the expected

fall in farm incomes did not materialize. The EU even introduced export taxes on wheat in 1995 and 1996 in order to keep down the EU price. Aggregate farm income peaked in 1996. With the BSE crises that hit later on that year, farm incomes were to be negatively effected and also it is only at this stage that the full impact of the changes in institutional support arrangements began to impact at the farm level in Ireland. Farm income fell in 1997 and 1998. Aggregate farm income in 1998 was 14% below the 1996 level in real terms, and 7% below trend (Matthews, 2000b).

The autumn and winter of 1998 was a particularly difficult time for Irish farming. Prices for cattle, sheep and pigs dramatically fell. Along with this, the extreme weather conditions in the summer of 1998 led to fodder shortages and increased feed costs for many farmers. The Irish government introduced a number of measures in 1998 and 1999 including fodder aid that amounted to 41 million Irish pounds. In 1999, the government also introduced the new Farm Assist income support scheme designed to assist farmers with income difficulties. Farm incomes improved again in 2000 and 2001.

On 26 March 1999, in Berlin, the European Council concluded a political agreement on further reform of the CAP, known as Agenda 2000. Agenda 2000 is an action programme whose main objectives are to strengthen Community policies and to give the European Union a new financial framework for the period 2000-06 with a view to enlargement (Baldwin and Wyplosz, 2004). It is a continuation of the agricultural reform along the lines of the changes made in 1992, with a view to stimulating European competitiveness, taking greater account of environmental considerations, ensuring fair income for farmers, simplifying legislation and decentralising the application of legislation. The years immediately after the introduction of these reforms saw an improvement in the fortunes of Irish farming.

The year 2001 turned out to be a particularly positive one for the Irish farming sector. Farm income rose for the second successive year. According to Central Statistics Office (CSO) figures, the average weekly earnings of permanent agricultural workers rose 28.4% to €333.77 during the 1997-2001 period. More importantly, the potential disaster of a major animal disease outbreak (Foot and Mouth disease) was avoided. The preventative measures taken by the general public during the crisis underlined how central farming remains to Irish society. The foot and mouth crisis in 2001 threatened not just the agrifood sector, but also the economy as a whole. An economic evaluation of the effects of foot and mouth has confirmed that a widespread outbreak would have cost at least €5.6 billion and over 12,000 jobs (Department of Agriculture, Food and Rural Development, 2002).

The success of the Irish economy over the 1990's has attracted enormous attention both at home and abroad. Between 1994 and 1999, per capita income (GNP) grew at an unprecedented 7.9%. Unemployment fell from 11% as recently as 1997 to below 5% in early 2001. There are a number of possible explanations given for this growth. The most common are the high levels of foreign investment, the well-educated workforce, huge monetary transfers from the EU and social partnership. The growth rate of income in Ireland over the 1990's significantly exceeded the EU average. As a result average real incomes have increased substantially over the period 1994 - 1999. However, while the increase in average incomes is undisputed, there exists some doubt that these gains have been shared equally across individuals. As can be seen from the preceding discussion on aggregate farm

income over the period 1994 to 2001, the farming community did not benefit to the same extend as the rest of the Irish population from the "Celtic Tiger". It is against this backdrop that we investigate the distribution of farm income and the mobility of farm level income.

The structure of this paper is as follows. Section 2 shall review the literature surrounding inequality in the Irish economy and in Irish farming. Section 3 shall discuss the data uses in this paper. The methodology used to measure farm related inequality shall be discussed in Section 4. Section 5, 6 and 7 shall present and discuss the results of calculations carried out and finally, the main findings and recommendations of this study are presented in section 8.

2. Review of the Literature on Irish Income Inequality

As already mentioned much of the research carried out in the area of Irish earnings distribution has focused on particular points of time and on the population in general. Very little research exists that looks at the dispersion of earning in the farming population on its own. A study by Barrett, Fitzgerald & Nolan (2000) found that earnings inequality in Ireland increased between 1994 and 1997, albeit at a slower rate than in the 1987 to 1994 period. In a paper by Cussen (2004) disposable income inequality is found to have increased between 1994 and 2000, both when measured using income and expenditure data. Therefore according to the research in these papers inequality, in general, was found to have increased during the 1990s[1].

A paper by O'Neill and Sweetman (1999) provides a detailed description of Irish inequality at a point in time using both expenditure and income to measure resources. Inequality both within and between groups is examined; defined on the basis of family composition, work status of head of household, working composition of household, as well as the education level of the head of household. To carry out this decomposition between changes in within-group inequality and changes in between-group inequality O'Neill and Sweetman follow the approach used by Jenkins (1995) and use the mean logarithm deviation (MLD) to measure inequality. At the aggregate level one of the main results that emerges is the similarity of the income and expenditure distributions both at a point in time and in terms of their evolution over time. Neither measure of resources indicates a change in inequality over time. A more detailed analysis of inequality shows that the bulk of inequality in Ireland at a point in time stems from differences among households with similar measured characteristics, rather than differences between groups. A similar analysis as that used by O'Neill and Sweetman will be used here to decompose family farm income into within- and between-group inequality by different farm and farm holder characteristics.

As one can see from the preceding review of the literature the issue of earnings inequality in the farming community and earnings mobility has received far less attention by researchers in recent years. Recent research has however highlighted the need for a dynamic analysis of the distribution of farm earnings (Keeney, 2000). By shifting the focus of research attention away from "who is paid what at a

[1] Other work on inequality in Irish earnings can be found in Callan et al. (1998), Nolan and Hughes (1997), Nolan and Maitre (2000), O'Neill and Sweetman (1999), Sexton et al. (1999) and Barret et al. (2000).

particular point in time" to "who remain in different levels within the earnings distribution from one period to the next" one can assess the causes of earnings immobility rather than its symptoms. Evidence on the degree of mobility across different earnings thresholds from one period to the next can reveal to what extent the ranking of individuals within the earnings distribution is in a transitory state or in a prolonged episode of their earnings career.

One significant piece of literature that looks at Irish farm income distribution is work carried out by Keeney (2000). This thesis investigates some of the microeconomic effects of the application of direct payments to support Irish agriculture. She finds that system of farming and stocking density are the 2 most important factors in explaining changes in the distribution of farm income over the period 1992 to 1997. She also finds that farm income inequality between these 2 years falls by 14% as measured by the mean log deviation distribution indicator. The income distribution effects of direct payments are analysed using a Gini decomposition method as used by Podder (1993). Keeney associates the reduction in farm income inequality that occurred over the period of the implementation of the MacSharry reforms with types of payments which have conditions attached that target support to low income farms.

Other research on the distribution of farm earnings has looked at the nature and extend of low-income farm households (Haase and Tovey, 1996). Work by Callan et al. (1996) and Callan et al. (1999) using Irish Household Income data have shown that farm households have traditionally had an above average likelihood or risk of poverty. Frawley et al. (2000) assess the factors underlying the emergence of the low-income farm households and the effectiveness of farm income and general welfare policies in countering the lack of viability of the sector. They found that low-income farm households were distributed evenly throughout the state and were found to be closely associated with small farms and drystock farm systems. They also find however that low income farm households are no more deprived than the average of all households in the state.

3. The Data

In this paper we use the Irish National Farm Survey (NFS) to examine the distribution of Irish farm earnings. The NFS is an annual survey of a sample of Irish farms collected by Teagasc. It is designed to collect and analyse information relating to farming activities as its primary objective. One of the main objectives of the National Farm Survey is to determine the financial situation on Irish farms by measuring the level of gross output, costs, income, investment and indebtness across the spectrum of farm systems and sizes. Farmers are randomly selected from the farm population and participate voluntarily in the National Farm survey. The data set for our analysis comprises of a sample of 2,577 farms in the years 1994 to 2001, representing farms that participated in the Survey at any time during this period. The NFS is a panel dataset with a rolling set of farms being interviewed year on year. Farms remain in the sample for on average 3.64 years giving a total number of 9390 observations.

Within the National Farm Survey farms are classified into farming systems based on the EU farm typology as set out in the Commission Decision 78/463. In the NFS, farms are classified as follows:

Dairying are farms engaged in specialist milk production, Dairying and Other are dairy farms combined with some other activity, Mainly Cattle are specialist cattle farms mainly involved with cattle rearing, Cattle Other are other specialist cattle farms involved in fattening and other mixed livestock, Mainly Sheep are specialist sheep farms and Tillage are farms involved in specialist cereals, oilseeds and protein crops, general field cropping or field cropping combined with grazing livestock.

Most farmers' standard of living depends on their own labour and perhaps that of one or more other members in their household, working with them on the family farm. However, in the last decade in particular, off-farm employment has become an increasingly more important source of earnings for farming households. According to the National Farm Survey (NFS) Report 2002 (Teagasc, 2003), on 35% of farms the main farm operator held an off-farm job compared to 33% in 2001. For the majority of farm families in Ireland, the money earned (and received in the form of farm grants and subsidies) from on-farm employment largely determines how well off its members are, and thus the extent of observed inequality of living standards between farm families.

The unit of income that is used in this paper to examine inequality is Family Farm Income per farm (FFI). Family Farm Income as defined in the National Farm Survey is calculated by deducting all the farming costs from the value of farming gross output. Family Farm Income represents the financial reward to all members of the family, who work on the farm, for their labour, management and investment. It is important to note however that FFI does not include income from non-farm sources and therefore may not be equal to household income. The occurrence of the farmer having an off-farm job is highest in the small farm size groups, while the spouse is most likely to have an off-farm job in the intermediate size groups (NFS Report 2002, 2003). For this reason, the levels of inequality presented in this paper may be an over estimate of inequality between Irish farm households as the income variable used in this paper does not include earnings from off-farm employment. Therefore, the differences in household income between small, intermediate and large farms may be much less.

In order to compare the welfare of the inhabitants of different households, equivalence scales are used. In this paper we focus on outputs from the farming enterprise, ignoring other sources of income. As a result our measures do not capture the overall income of the households. Therefore because we are not focusing on the welfare of the farming households, we will also ignore in this paper the size of the farming household, concerning ourselves more with factors that influence the level of production, including farm land size, labour time, direct costs and farming system. In effect our investigation is into inequality between the actual farms, not the population of individuals living on these farms.

Table 1 highlights some summary statistics for family farm income, gross output, total costs, age and farm size. As can be seen from the table family farm income can be calculated by deducting total cost from gross output. It is evident from table 1 that the average age of farmers is increasing over the 8-year period. The average age in 1994 was 51.8 compared to 52.8 in 2001. The size of the farm holdings is also increasing over the period. In 1994 the average size farm is 29 hectares compared to 36 hectares (ha) in 2001. This is not a surprising finding considering that the number of farms is falling year on

year, at a rate of about 2% per annum. Also, this entire decline is concentrated among smaller farms (less than 20ha) whose numbers fell from 85,000 to 67,000 between 1992 and 1999 (Matthews, 2000b).

Real Family Farm Income (FFI) is deflated using the Consumer Price Index taking 1996 as the base year. As can be seen, there has been relatively little movement in average Family Farm Income per farm, both in nominal and real terms, over the 1994 – 1999 period. However, when inflation is taken into account average FFI declined slightly from €10,982 in 1996 to €10,593 in 1999. It is only in 2000 and 2001 that we see a substantial increase in average FFI on previous years.

It is important to realise the importance of subsidy payments to Family Farm Income. In the pre-CAP reform years 1991-93, direct payments contributed 12.1% to total agricultural revenue and 22.4% to farm income over the period. By 1998, direct payments contributed 32% to gross agricultural revenue and 56% to farm income (Frawley and Keeney, 2000). The market value of agricultural output hardly changed in nominal terms over this period, with all of the increase in the value of agricultural output coming from the growth in direct payments. The impact on incomes of direct payments/subsidies to farmers increased significantly again in the aftermath of Agenda 2000 reforms, reaching a high of 90% of average Family Farm Income in 2002. For this reason it is vital that direct payments/subsidies are included in the unit of income used (as they are here) when analysing inequality in the Irish farming community.

4. Methodology

4.1 Introduction

The study of economic inequality is the analysis of differences across the population in access to, and control over, economic resources (Osberg, 1991). Inequality looks at the dispersion of a distribution, whether that is income, consumption or some other welfare indicator. There are two common approaches to choosing an inequality measure. One approach often referred to as the axiomatic approach, involves identifying a number of desirable conditions or axioms, inequality measurements ought to follow. The second approach is to choose the measure in accordance with its ability to satisfy the criteria of the social welfare function. The social welfare function approach ranks all the possible states of society in the order of (society's) preference. Cowell (1977) describes the respective criteria of the Axiomatic Approach and the Social Welfare Function Approach.

4.2 Cross-sectional Measures of Inequality

The analysis in this paper uses both approaches. The measures employed are the Mean Logarithmic of Deviation, the Income Weighted Theil and the Half Squared Coefficient of Variation Index (commonly referred to as the Generalised Entropy Class of inequality measures, I_0, I_1 and I_2), which complies with the Axiomatic Approach; and the Atkinson Index, which complies with the criteria of the Social Welfare Function Approach.

The general formula of the Generalised Entropy Class of inequality measures is given by

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]^{\alpha} - 1\right] \tag{1}$$

where the *y*'s are the individual incomes and $\bar{y}$ is the arithmetic average in a population of *n* individuals. If everyone has the mean income, then the value is zero. The mean income divides the population into an upper tail and a lower tail. In the upper tail the ratio is above unity and it is below unity in the lower tail. If α is equal to unity, then we have equal weighting of the ratios. When α is larger than unity, the high incomes have even higher income in the sum and the low-income ratios become even smaller in the measure of inequality. When α is smaller than unity, the lower tail ratios get closer to unity (become more important in the sum) and the higher value incomes get pulled back to the mean.

The three typical values of α in empirical research are zero, one and two, and these values result in the following three measures of inequality.

Mean log deviation $$GE(0) = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{\bar{y}}{y_i}\right] \tag{2}$$

Theil index $$GE(1) = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]\ln\left[\frac{y_i}{\bar{y}}\right] \tag{3}$$

GE(2) is half of the square of the Coefficient of Variation $= \frac{1}{\bar{y}}\left[\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2\right]^{1/2}$.

One other measure that is widely used in looking at inequality is the Lorenz curve based measure, the Gini coefficient (fails decomposability generally).

$$\text{Gini} = \frac{1}{2n(n-1)\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}|\bar{y} - y_i| \tag{4}$$

One of the main axioms which we usually require inequality measures to meet is that of decomposability. This requires overall inequality to be related consistently to constituent parts of the distribution, such as population sub-groups. For example if inequality is seen to rise amongst each sub-group of the population then we would expect inequality overall to also increase. Some measures, such as the Generalised Entropy class of measures, are easily decomposed into intuitively appealingly components of within-group inequality and between-group inequality. The Gini coefficient fails decomposability generally. In section 6 we decompose total inequality in family farm income by farm system and farm size as measured by the Mean Log Deviation.

The Atkinson Index is an inequality measures that explicitly incorporates normative judgments about social welfare (Atkinson 1970). The index is derived by calculating the so-called equity-sensitive average income (A_e), which is defined as that level of per capita income, which if enjoyed by everybody would make total welfare exactly equal to the total welfare generated by the actual income distribution. The equity-sensitive average income is given by:

$$A_e = (\sum_{i=1}^{n} f(y_i) y_i^{1-e})^{1/(1-e)} \tag{5}$$

where y_i is the proportion of total income earned by the *i*th group, and e is the so-called inequality aversion parameter. The parameter e reflects the strength of society's preference for equality, and can take values ranging from zero to infinity. When e > 0, there is a social preference for equality (or an aversion to inequality). As e rises, society attaches more weight to income transfers at the lower end of the distribution and less weight to transfers at the top. Typically used values of e include 0.5 and 2.

The Atkinson Index (*I*) is then given by:

$$I = 1 - A_e / \bar{y} \tag{6}$$

where $\bar{y}$ is the actual mean income. The more equal the income distribution; the closer A_e will be to $\bar{y}$, and the lower the value of the Atkinson Index. For any income distribution, the value of *I* lies between 0 and 1. While we are not measuring the welfare of individuals living on these farms, per se, given the policy interest of the income level of small farms, it is of interest to us to assess the robustness of our results to alternative social welfare weights that can be captured in the Atkinson measure.

4.3 Decomposing Inequality

In addition to overall inequality or variability of farm income, we are also interested in the variability of income of sub-groups of farms. In order to examine these issues, we decompose our inequality measures. This decomposability is useful as it allows one to consider what is driving changes in inequality in family farm income. The Mean Log Deviation index, and those of the Generalized Entropy class, can be decomposed into between- and within-group inequality in an additive way, but the Gini coefficient can not (Shorrocks,1980). To decompose the Mean Log Deviation index (i.e. GE(0) see equation 2), let *Y* be the total income of the population, *Yj* the income of a subgroup, N the total population, and *Nj* the population in the subgroup. Using L to represent GE(0):

$$L = \sum_{i=1}^{N} \frac{1}{N} \ln\left[\frac{Y}{Y_i N}\right] = \sum \left[\frac{N_j}{N}\right] L_j + \sum \frac{N_j}{N} \ln\left[\frac{N_j / N}{Y_j / Y}\right] \tag{7}$$

The first term in the above equation represents the within-group inequality and the second term represents the between-group inequality.

4.4 Regression-based Decomposition of Inequality

Morduch and Sicular (2002) argue that decomposition by population groups is dependent on sample size, so that the use of many sub-categories often is not feasible given data constraints. The method also makes it difficult to examine the influence of variables such as age, which might be more properly regarded as continuous variables. Use of large numbers of categories, also make the calculations quite difficult. Because of these methodological problems, a regression-based method, has been developed by Gary Fields and utilised by Fields and Yoo (2000), Redmond and Kattuman (2001) and Morduch and Sicular (2002), to investigate the contribution made by such factors such as unemployment, labour force participation, family status, age distribution, education distribution etc to inequality.

The method starts with a decomposition of total income *Y,* into a regression equation as detailed in formula (8).

$$Y = X\beta + \varepsilon \tag{8}$$

Where X is an $n \times M$ vector of attributes and ε, an $n \times 1$ vector of residuals. The next step involves splitting for each unit, i, total income into the component Y_i^m, accounted for by each independent variable β_i as defined:

$$Y_i = \sum_{m=1}^{M+1} Y_i^m \qquad \text{For m = 1,…, M} \tag{9}$$

$$\text{where } Y_i^m = X_i^m \beta^m, \qquad \text{For m = M + 1}$$

$$Y_i^m = \varepsilon_i,$$

Instead of using a decomposition method for population groups, we can therefore use a decomposition method for income characteristics. Inequality is broken up into the "absolute factor contribution", S_f:

$$I = \sum_f S_f = \sum_f I\rho_f \chi_f \sqrt{II_f} \tag{10}$$

where ρ_f is the correlation between component f and total income and $\chi_f = \mu_f / \mu$ is factor *f's* factor share.

4.5 Income Mobility

It is commonly accepted that inequality declines as the accounting interval for earnings grows (Champernowne and Cowell, 1998). The main reason given for this is that multi-period inequality smoothes out temporal fluctuations (unless the cross-section distributions are identical over time). In other words, we would expect inequality to decline if earnings were measured over a time horizon of three years rather than one year. Furthermore, if we employ an inequality index, which is a strictly convex function of incomes relative to the mean, inequality measured over a span of T years will be lower than the weighted average of the inequalities within each year (Ramos, 1999).

Using this simple proposition, Shorrocks (1978) proposes the following summary mobility measure:

$$M_T = 1 - \frac{\mathrm{I}(\sum_{\mathrm{t}=1}^{\mathrm{T}} \mathrm{x}_\mathrm{t})}{\sum_{\mathrm{t}=1}^{\mathrm{T}} w_t I(\mathrm{x}_\mathrm{t})} \tag{11}$$

where $I(.)$ is an index of inequality, x is a vector of income measures (*e.g.* earnings) and $t = 1, ...,T$, denotes time. Cross-section (annual) inequality is weighted using shares of earnings in year t in total earnings in the T year period. This index, then, measures the proportion by which inequality for earnings measured over a T year period is lower than a weighted average of cross-section inequalities. M_T ranges from 0 (complete immobility or perfect rigidity) to 1 (perfect mobility). There is immobility if and only if (*i*) simple period relative inequality remains constant over time, and (*ii*) individuals do not change positions in the earnings distribution from period to period. At the other extreme, perfect mobility occurs when multi-period inequality, $\mathrm{I}(\sum x_t)$ is zero. That is, M_T evaluates a situation as perfectly mobile when after T periods total earnings are equal for all individuals, and not when there is a complete reversal of positions in the income distribution.

5. Empirical Results I: Trends in Farm Inequality

This section shall use the family farm income variable from the NFS to analyse inequality in the Irish farm sector between 1994 and 2001. Perhaps the best starting point (and perhaps the best way) to see how the shape of the Irish farm earnings distribution changes over time would be by direct observation of its frequency distribution. Figure 1 depicts the frequency density function estimates for the 1994 to 2001 family farm income distributions. The distribution for 1994 appears unusual in the fact that it is missing the usual lower tail of the distribution. This can be explained by the fact that just over 30% of farmers in that year had total costs greater than the gross output on their farms, giving them negative family farm income in that year. Other than 1994, the shape of the distribution remained much the same over the rest of the period. Having said this, the most obvious changes are that the mode has moved towards higher earnings ranges and the extent of clustering has decreased (Table 1 shows that the mean and standard deviation for the years 1997 to 2001 have also increased). Given these relatively small changes in the shape of the distribution one would not expect great changes in inequality over the

period apart from in 1999 where, there would appear from the graph, to have been a relatively large shift in the distribution. This sudden change may be explained by an increase in payments to farmers by the Irish government in 1999 after a particularly hard year for farming in 1998. These payments included fodder aid and a new Farm Assist income support scheme. Table 2 provides statistics summarizing the extent of equality in the distribution of nominal family farm income for the years 1994 to 2001. By examining each inequality measure across the different time periods we can get a summary of the change in the family farm income distribution over time. All the measures in Table 2 (with the exception of the CV measure) report a similar trend in farm income distribution, with 1999 having the highest inequality over the entire eight-year period. The occurrence of the lowest inequality over the period is not as clear-cut. However the general consensus according to $\alpha = 2$ of the Atkinson social welfare indices and the Generalised Entropy Class of inequality measures is that it occurs in 1996.

The general pattern that emerges for changes in inequality over the period is broadly similar across the different inequality measures. Inequality in farm income decreases from 1994 to 1996. This reflects the fact that this period, as discussed above, was a very stable and prosperous time for Irish farming. Farmers were receiving increased direct payments intended to compensate them for a fall in prices that was expected under the MacSharry Reforms of the CAP. However, this fall in prices never materialised in the 1994 to 1996 period due to a strengthening of world prices and the Irish pound devaluation in 1993. Also the Rural Environment Protection Scheme (REPS) was introduced in 1994. This significantly added to the income of the smaller sized farmers, again reducing inequality between the larger and smaller farms. It is interesting to note that over this same period, earnings inequality for the general Irish population was found to have increased between 1994 and 1997 (Barrett, Fitzgerald & Nolan, 2000). After 1996, family farm income inequality remains reasonably static from 1996 to 1998 but then increases dramatically from 1998 to 1999. This may be due in no small part to the crisis that hit Irish farming in these years as was discussed in the introduction. Finally in the remaining 2 years inequality, from a high in 1999, falls back again slowly towards pre-1999 levels. The unanimity across the different measures in table 2 reduces the possibility that the conclusions about subgroup effects derived later in this section are dependent on the particular inequality index employed.

Table 3 uses real family farm earnings to analyse inequality in farm income and in general corroborates the trends seen above for nominal family farm income. This time however, 1994 has the highest inequality over the entire eight-year period. Table 3 reports inequality values for three of the Generalised Entropy family of indices—the Mean Log Deviation (MLD), the Theil Index and half the coefficient of variation squared—and for the Gini coefficient. Again for all indices, inequality decreases from 1994 to 1996 and then increases again until 1999. After 1999, inequality decreases again but only by a margin of 8% (as measured by I_1). Can these differences in inequality year on year be attributed to sampling errors of the estimates used to compute inequality? To answer this question we compute standard errors for the GE indices and the Gini coefficient using bootstrap methods. We then implement an *F*-test whereby the equality of all inequality values is checked. The null hypothesis of equality is rejected in favour of the alternative one of different inequality values.

6. Empirical Results II: Forces Driving Inequality

The common inequality indicators discussed above can be used to assess the major contributors to inequality, by different subgroups of the farming population as well as by income source. In the static decomposition that follows, the farm characteristics (the subgroups) of farm system and size are used as determinants of family farm income. A measure of inequality (the mean log deviation) is calculated independently for each subgroup within these groups. We will use a stationary decomposition, decomposing into within and between subgroup inequalities for each year of our data set, following the approach used by Jenkins (1995).

The results are shown in tables 4 and 5. The nearer the inequality measure is to zero the more equal the distribution of farm income within each subgroup. Tables 4 and 5 also show the population shares and the relative mean income of each subgroup in each year. The closer the relative mean income is to unity, the less significant is the subgroup characteristics effect on income distribution.

As can be seen from table 4, the indices of inequality did not change substantially for most farm systems over the years 1994 to 2001. However, if we compare just the years 1994 and 2001 we do see relatively large changes in certain systems. The dairy system reports a within-group inequality in 2001 that is 43% lower than in 1994. The mainly cattle system reports a similar sized decrease in inequality of 45% between these years. Only in the Cattle and Other system do we see an increase in inequality between these years but this is probably due to the fact that the share of the farm population in this group in 2001 is 19 times greater than in 1994.

The 1990s was a particularly turbulent time for the cattle sector. The radical reform of the Common Agricultural Policy (CAP) in the early 1990's initiated a phased reduction in the institutional support prices for cereals and beef of the order of 30% ((Dunne and O'Connell, 1998). Coupled with this was the BSE crisis in 1996. Indeed according to Dunne et al. (2001) it was only at this stage that that the full impact of the changes in institutional support arrangements began to impact at the farm level of cattle enterprises in Ireland. The highest levels of within-group inequality occur within the tillage system, with inequality ranging from 0.47 in 1999 to 0.65 in 1994. The dairy system demonstrates the lowest levels of inequality over the entire period ranging from 0.26 in 2001 to 0.41 in 1999. The individual subgroup inequality rates are quite close together in magnitude, suggesting that deviation from the mean group income occurs to much the same extent within each density group. For this reason we would expect the decomposition by farm system carried out below to show that within group differences play a key role in determining family farm income inequality.

Farm size and family farm income are strongly connected (Keeney, 1999). Table 4 shows that mid-sized sub-group's inequality values did not change dramatically over the period. The relative income for farms in the 20-30 ha subgroup ranges from 0.7 to 0.9 times the mean population income, suggesting that farms within this category tend to earn close to the average farm income for all farms. For the smallest sized farms (<10 hectares) inequality seems to fluctuate substantially year on year. It is

53% lower in 1999 than it was in 1994 and 30% lower in 2001 than it was in 1994. Having said that however, the share of the farm population in this group in 1999 and 2001 is approximately double that of 1994.

For the largest farm sub-group of >100ha, inequality ranges from 0.25 in 2001 and 0.44 in 1994. The share of the farm population in this group however is very small at between 3 and 4%. The 10-20ha subgroup has the largest population shares of any of the subgroups averaging 26% over the eight year period. There is also very little fluctuation in the inequality levels year on year for this particular group and the relative mean income for farms in this subgroup is less than half the average farm income for all farms. Indeed, the individual subgroup inequality rates for all farm sizes are quite close together in magnitude, suggesting that deviation from the mean group income occurs to much the same extent within each density group. For this reason we would expect the decomposition by farm size carried out below to show that group differences play a key role in determining the distribution of farm income across all farms.

At least part of the value of any given inequality measure will reflect the fact that farms are of different sizes and composition. This inequality is referred to as the "between-group" component. But for any such partition of the farming population, some inequality will also exist among those farmers within the same subgroup; this is the "within-group" component. Table 6 shows the within and between-group components of aggregate inequality decomposed for farm system and farm size for each year over the 8 year period. In all cases for farm system, the absolute level of the within-group component of total inequality dominates the between-group component. In 2001, the within-group component of farm system dominates the between-group component by a ratio of 72:28. This is the highest within-group explanatory factor of income distribution for any year. What this tells us is that differences in family farm income within the different farming systems has a much greater bearing on the total level of inequality than differences in FFI between the different systems.

Decomposition by farm size paints a very different picture. In this case the absolute level of the between-group component of total inequality dominates the within-group component in 2 years, 1994 and 1997 and the ratio of within to between is very close to 1:1 for all other years. This pattern suggests that changes in total income inequality attributable to farm size differences is due just as much to differences between farms of different sizes as to differences of income within each size category. The magnitude of the between-group component shows a decreasing trend over the period, falling from 0.351 in 1994 to 0.246 in 2001. This suggests that any reduction in total income inequality due to farm size may be as a result of the levelling of incomes between larger and smaller farms. All of these decomposition results are consistent with the pattern anticipated on the basis of the data in tables 4 and 5.

In Table 7, the percentage contributions of all the deterministic factors to inequality for 1994-2001, based on the I_2 decomposition, using the regression-based decomposition methodology are presented[2].

[2] Regression coefficients on which these estimates are based are available from the authors upon request.

The decomposition of contributions to income inequality by the residual term, the constant term, and all non-constant Xs are carried out on a year-by-year basis. The results show that labour hours supplied is by far the most significant single contributor to income inequality and its impact on inequality seems to fluctuate over the years. They contribute to over 50% of inequality in 1994 and 2001. The lowest contribution of labour hours supplied occurs in 1999 when it contribution falls to 36.7%. The amount of labour expended seems to matter least during the local maxima in the inequality measures in 1995, 1996 and 1999. This may be explained by the importance of exogenous shocks during these periods.

Farm size is found to contribute on average 8% to inequality year on year. The corresponding value for farm system is only slightly greater at 9%. Over time, the importance of farm size as a driver of inequality has declined, while farm system has increased. Comparing 1994 to 2001 we find that whereas farm systems contribution to farm income inequality rose by 47%, farm sizes contribution actually decreased by 62%. This may be due to the decoupling of agricultural production in the determination of farming supports. Results in Table 7 indicate that the impact on inequality by age of farm operator is negligible in any given year.

7. Empirical Results III: Trends in Farm Income Mobility

We now turn our attention from the variability of farm incomes between farms at different points in time to look at mobility within the farm income distribution over time. In doing this we use the Shorrocks (1978) mobility index and also produce transitional indices. In order to compare levels of mobility, we compute transition matrices for all farmers for whom we were able to compute quintiles in consecutive years. Table 8 displays mobility values for different time horizons. Inequality measured over a two-year horizon is between 2.1% and 5.2% (depending on the index used) lower than the average inequality in the two years. For a three-year horizon, such reduction ranges from 9.8% to 26.2%; and when measured over eight years the reduction goes from 37.5% to 74.3%. Mobility, as measured by M_T, is smaller the more sensitive the inequality measure is to income differences at the middle of the distribution relative to differences at the bottom or at the top. As Table 8 shows, the time trend of mobility is quite sensitive to the index employed.

Earnings mobility, defined by Kalwij and Alessie (2003) as “a change in individuals’ ranks within the wage distribution” is an issue that is closely related to income inequality. This is of particular importance when interested in the so-called poverty trap that may occur at the bottom of the earnings distribution (Dickens, 2000a). Slone and Theodossiou (1996) highlight the importance of the extent to which low income is a transient phenomenon for any particular worker and the extent to which low income is associated with permanent low family incomes and therefore poverty. If low income is limited to young farmers lacking experience or undergoing training the welfare implications may not be of major policy significance, while if prime age farmers become trapped in the low end of the income distribution the implications would be potentially more serious.

An alternative way of measuring the mobility within the farm income distribution, other than the index employed above, is to use the whole NFS sample of farmers to analyse transitions within the distribution. Transitional matrices look at the actual change in different earnings brackets year on year. Table 9 shows the transition probabilities for farmers, for any two consecutive years. It is evident from the transitional matrices that mobility within the farm income distribution is relatively high in the middle of the distribution and lower at either end. For any two consecutive years there is a high probability of a farmer not being in the same quintile as he or she was in the previous year. This is particularly true for those farmers who find themselves in the second, third or fourth quintile. The bottom and top quintile groups are more likely to remain in those groups year on year. The top quintile in particular, for any two consecutive years shows very little mobility. This would indicate that the richest farmers are maintaining their income flows year on year. These are most likely the farmers in the dairy and tillage systems and those with the larger size farms.

Taking 2001/2000 as an example, we can see that the probability of being in the top quintile in 2001 conditional on being in that same quintile in the previous year is 82%. At the other end of the distribution, the probability of being in the lowest quintile conditional on being in that quintile in the previous year is 56%. The probabilities for the second, third and fourth quintiles for 2001/2000 ranges from 41 to 48%. The probabilities for any two consecutive years in table 6 are similar. Any movement that takes place in the farm income distribution is mainly of order one. Again taking 2001/2000 as an example, we can see that 27% of those in quintile 2 in 2001 were in the lowest quintile (1) in 2000. The probability of moving from one quintile into a quintile the following year that is 2 or more quintiles away is quite low. The broad implication of the results presented in table 9 is that some farmers are trapped in a repeating cycle of low family farm income, while those at the top end of the farm income distribution maintain their position year on year.

8. Conclusions

This paper has drawn on the 8 years of data of the National Farm Survey (NFS) to analyse the movements of the farm income distribution during the nineties, and ask the question: is the Irish farming sector close to a society where individuals move up and down the earnings ladder over time, or is it more similar to a society where individuals are stuck in the same step? We find that for those who find themselves in the middle of the Irish farm earnings distribution the answer is close to the former but for those at either end of the Irish farm earnings distribution the answer is much closer to the latter. In getting to this answer we looked at earnings inequality, characterised transition probabilities and modelled earnings dynamics as a purely stochastic process. In order to explain trends in the inequality of farm income, we also decomposed our inequality measures by population characteristic.

The general pattern that emerges for changes in inequality over the period is broadly similar across the different inequality measures used. The various inequality indices used all indicate that farm income decreases from 1994 to 1996. After 1996, family farm income inequality remained reasonably static from 1996 to 1998 but then increased dramatically from 1998 to 1999. Finally in the remaining 2 years

inequality, from a high in 1999, fell back again slowly towards pre-1999 levels. In regard to the decomposition we found that for farm system, the absolute level of the within-group component of total inequality dominated the between-group component in all years indicating that differences in farm systems do not have an overly important role in determining the total level of inequality within farm income. The decomposition also showed that for farm size the between-group component has a much greater role to play, suggesting that changes in total income inequality attributable to farm size differences is due just as much to differences between farms of different sizes as to differences of income within each size category.

Using the regression-based decomposition methodology of Morduch and Sicular (2002) with our farm survey data, we decomposed rural income inequality into contributions by individual deterministic factors plus the shares by the residual term. We found that based on the I_2 decomposition, among the deterministic factors, labour hours supplied was by far the most significant single contributor to income inequality. It is interesting to note however that during the exogenous shocks of 1998 and 1999 labour hours contribution falls to a low of 36%, indicating that labour supply has less of an impact on farm income variability in periods of economic uncertainty in the farming sector than in a stable economic climate. Other factors that may lead to inequality increases included farm size, farm system and cost per unit output. A factor that reduces income inequality was found to be being a full-time farmer.

By utilizing a mobility index we found that the data corroborates the intuition that inequality falls as we extend the time horizon over which farm income is measured. This implies some degree of mobility in the Irish family farm income distribution. In order to quantify the degree of mobility and to show its pattern we also estimated the transitional probabilities between quintile groups of the distribution. Year to year transition matrices are characterised by high stayer probabilities (larger for the bottom and top quintile groups) and short-range movements. On average an earner is more likely to move only one quintile up or down.

Areas for further research on the distribution of farm incomes include engaging in multivariate analysis to explain the transition probabilities we found in this descriptive study. Also additional inequality index analysis of pensions, social welfare payments and payments under programmes such as the Farm Assist scheme and the Rural Environment Protection Scheme (REPS) contribution to total farm income would provides further insight as to how different subcomponents affect farm income distribution. The direct payment and market income contribution to total farm income has been previously looked at by Keeney (2000). Finally, error component models could be used to study the covariance structure of farm income. These models would reveal the relative importance of the permanent and the transitory components of individual farm incomes and thus help us understand the dynamics of family farm income[3].

Findings from this study provide useful information for government policy-making purposes. Given the fact that farm income inequality has been shown here, to display low variability year on year,

[3] For an example of this technique see Dickens (2000b) analysis of the covariance structure of British male earnings using the British Panel Household Survey.

government agricultural policy should me aimed at improving the productive capacity of Irish farming rather than simply maintaining the statuesque through direct payment income support. Because of the low mobility within the farm income distribution, policies aimed at improving the income of farming, by improving their productive capacity, should have long lasting implications for the level of welfare of Irish farming. Re-orientating agricultural policy in this direction could give rise to a more sustainable basis for the continuation of a economically healthy and productive agricultural sector in Ireland.

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Tables and Figures

Table 1. Summary Statistics for Farm Variables from the National Farm Survey

Year	N	Age	Farm Size (ha)	Gross Output	Total Costs	Nominal FFI	Real FFI	Growth %
1994	1279	51.8	28.9	33226.26	23401.68	9824.58	10330.79	
1995	1216	52.8	28.2	27652.04	17983.47	9668.57	9906.32	-4.1
1996	1166	51.1	32.3	31073.76	20158.99	10914.77	10991.32	11.0
1997	1190	51.4	32.9	29394.27	18335.31	11058.96	10982.09	-0.1
1998	1111	51.9	32.9	30231.93	19208.89	11023.04	10691.60	-2.6
1999	1116	52.3	33.3	36424.94	25323.19	11101.76	10593.28	-0.9
2000	1128	52.5	33.5	40899.99	27412.99	13488.52	12184.75	15.0
2001	1184	52.8	35.8	46019.85	30186.27	15833.58	13637.88	11.9
Total	9390		32.23	34365.38	22751.35	11493.38	11164.75	

Source: Calculations based on National Farm Survey data weighted to represent the entire farm population.

Table 2. Nominal Family Farm Income Equality by Distribution Indicator

	1994	1995	1996	1997	1998	1999	2000	2001
CV	1.233	1.229	1.083	0.977	0.996	1.194	1.098	0.981
Gini	0.610	0.600	0.547	0.533	0.532	0.640	0.604	0.587
Atkinson a = 0.5	0.278	0.250	0.206	0.212	0.211	0.246	0.232	0.231
Atkinson a = 1	0.504	0.458	0.392	0.404	0.399	0.463	0.441	0.437
Atkinson a = 2	0.866	0.774	0.945	0.798	0.701	0.844	0.806	0.817
75/25 Percentile Ratio	5.878	5.312	4.429	4.726	4.788	6.660	5.850	5.531
Mean Log Derivation	0.701	0.612	0.498	0.518	0.509	0.621	0.581	0.574
Theil Index	0.614	0.544	0.438	0.445	0.446	0.524	0.487	0.483

Source: Calculations based on National Farm Survey data weighted to represent the entire farm population.

Table 3 Earnings Inequality and Standard Errors for Real Family Farm Income

	I_0	I_1	I_2	Gini
1994	0.701	0.614	1.032	0.577
	[0.038]	[0.047]	[0.185]	[0.014]
1995	0.612	0.544	0.831	0.551
	[0.028]	[0.023]	[0.062]	[0.010]
1996	0.498	0.438	0.618	0.499
	[0.028]	[0.019]	[0.039]	[0.009]
1997	0.518	0.445	0.594	0.508
	[0.028]	[0.018]	[0.035]	[0.009]
1998	0.509	0.446	0.617	0.506
	[0.024]	[0.019]	[0.041]	[0.010]
1999	0.621	0.524	0.760	0.544
	[0.037]	[0.023]	[0.056]	[0.010]
2000	0.581	0.487	0.677	0.529
	[0.034]	[0.021]	[0.047]	[0.010]
2001	0.574	0.483	0.638	0.530
	[0.032]	[0.020]	[0.038]	[0.010]

Notes:
I_0 Mean Log Deviation with sensitivity parameter c = 0; I_1 Theil Index with sensitivity parameter c = 1; I_2 Half the Coefficient of Variation c = 2; Bootstrapped Standard Errors in parenthesis (1000 replications

Table 4. Time Paths of Population Shares, Relative Incomes and Inequality by Farm System

Farm System	Dairy	Dairy + Other	Mainly Cattle	Cattle + Other	Mainly Sheep	Tillage	Total
1994							
Population Shares	0.307	0.438	0.190	0.011	0.027	0.029	1.000
Relative Mean Farm Incomes	1.855	0.483	0.601	2.172	1.474	1.521	
Subgroup Inequality	0.383	0.581	0.506	0.311	0.598	0.652	0.506
1995							
Population Shares	0.172	0.160	0.146	0.328	0.141	0.053	1.000
Relative Mean Farm Incomes	1.967	1.542	0.392	0.568	0.604	1.614	
Subgroup Inequality	0.330	0.515	0.396	0.442	0.434	0.523	0.431
1996							
Population Shares	0.202	0.153	0.109	0.321	0.158	0.057	1.000
Relative Mean Farm Incomes	1.666	1.533	0.506	0.575	0.685	1.417	
Subgroup Inequality	0.303	0.349	0.224	0.450	0.392	0.512	0.123
1997							
Population Shares	0.191	0.137	0.212	0.268	0.140	0.051	1.000
Relative Mean Farm Incomes	1.795	1.600	0.526	0.559	0.721	1.453	
Subgroup Inequality	0.295	0.405	0.274	0.479	0.411	0.390	0.142
1998							
Population Shares	0.192	0.139	0.210	0.269	0.138	0.053	1.000
Relative Mean Farm Incomes	1.654	1.575	0.522	0.634	0.679	1.703	
Subgroup Inequality	0.300	0.414	0.398	0.398	0.392	0.483	0.385
1999							
Population Shares	0.194	0.132	0.210	0.260	0.151	0.053	1.000
Relative Mean Farm Incomes	1.789	1.679	0.482	0.545	0.631	1.761	
Subgroup Inequality	0.413	0.455	0.381	0.448	0.606	0.445	0.452
2000							
Population Shares	0.188	0.127	0.225	0.268	0.144	0.049	1.000
Relative Mean Farm Incomes	1.769	1.613	0.533	0.566	0.664	1.974	
Subgroup Inequality	0.334	0.452	0.380	0.559	0.350	0.475	0.429
2001							
Population Shares	0.174	0.121	0.272	0.218	0.147	0.067	1.000
Relative Mean Farm Incomes	1.973	1.595	0.486	0.561	0.777	1.400	
Subgroup Inequality	0.256	0.558	0.327	0.484	0.454	0.574	0.412

Source: Calculations based on National Farm Survey data weighted to represent the entire farm population.

Table 5. Time Paths of Population Shares, Relative Incomes and Inequality by Farm Size

Farm Size	< 10 ha	10-20 ha	20-30 ha	30-50 ha	50-100 ha	> 100 ha	Total
1994							
Population Shares	0.221	0.273	0.189	0.186	0.104	0.027	1.000
Relative Mean Farm Incomes	0.237	0.450	0.949	1.368	2.484	4.896	
Subgroup Inequality	0.485	0.331	0.313	0.254	0.327	0.444	0.351
1995							
Population Shares	0.215	0.274	0.194	0.187	0.104	0.026	1.000
Relative Mean Farm Incomes	0.273	0.482	0.923	1.481	2.418	3.915	
Subgroup Inequality	0.453	0.303	0.277	0.248	0.270	0.353	0.318
1996							
Population Shares	0.132	0.263	0.222	0.222	0.128	0.033	1.000
Relative Mean Farm Incomes	0.263	0.440	0.835	1.293	2.099	3.281	
Subgroup Inequality	0.304	0.237	0.268	0.226	0.273	0.312	0.257
1997							
Population Shares	0.122	0.274	0.225	0.219	0.129	0.031	1.000
Relative Mean Farm Incomes	0.213	0.426	0.830	1.321	2.183	3.219	
Subgroup Inequality	0.259	0.288	0.239	0.229	0.212	0.299	0.251
1998							
Population Shares	0.113	0.283	0.220	0.220	0.131	0.033	1.000
Relative Mean Farm Incomes	0.264	0.441	0.788	1.298	2.104	3.381	
Subgroup Inequality	0.230	0.286	0.302	0.239	0.261	0.277	0.269
1999							
Population Shares	0.114	0.260	0.221	0.232	0.138	0.035	1.000
Relative Mean Farm Incomes	0.245	0.395	0.729	1.289	2.027	3.699	
Subgroup Inequality	0.389	0.341	0.408	0.300	0.326	0.401	0.352
2000							
Population Shares	0.117	0.267	0.226	0.223	0.135	0.032	1.000
Relative Mean Farm Incomes	0.275	0.379	0.766	1.344	2.110	3.431	
Subgroup Inequality	0.316	0.317	0.357	0.304	0.248	0.402	0.316
2001							
Population Shares	0.120	0.242	0.191	0.240	0.168	0.038	1.000
Relative Mean Farm Incomes	0.312	0.374	0.691	1.200	1.998	3.017	
Subgroup Inequality	0.343	0.373	0.293	0.296	0.354	0.253	0.328

Source: Calculations based on National Farm Survey data weighted to represent the entire farm population.

Table 6. Within- and Between-Group Inequality, 1994 – 2001

	Year	Aggregate Inequality	Within-group Inequality	Between-group Inequality
Farm System	1994	0.701	0.506	0.195
	1995	0.612	0.431	0.182
	1996	0.498	0.375	0.123
	1997	0.518	0.376	0.142
	1998	0.509	0.385	0.124
	1999	0.621	0.452	0.170
	2000	0.581	0.429	0.152
	2001	0.574	0.412	0.162
Farm Size	1994	0.701	0.350	0.351
	1995	0.612	0.318	0.294
	1996	0.498	0.257	0.240
	1997	0.518	0.251	0.267
	1998	0.509	0.269	0.240
	1999	0.621	0.352	0.269
	2000	0.581	0.316	0.265
	2001	0.574	0.328	0.246

Note: Subgroups defined as per tables 8 and 9. Estimates based on equation 6 above.

Table 7. Contributions of Individual Determinants to Income Inequality (I_2, %)

	1994	1995	1996	1997	1998	1999	2000	2001
Farm System	7.6	8.6	6.4	8.7	8.2	9.4	9.4	11.2
Farm Size	10.4	8.6	11.2	9.4	7.9	6.4	6.4	3.9
Age	0.5	0.3	0.2	-0.1	0.1	-0.1	0.4	0.6
Cost per Unit Output	0.6	0.4	0.8	0.9	2.5	5.2	-0.7	2.2
Labour	47.1	37.6	39.7	43.5	43.0	36.7	43.2	48.8
Residual	33.8	44.5	41.7	36.7	38.4	42.5	41.2	33.2
Total	100.0	100.0	100.0	99.4	100.0	100.0	100.0	100.0

Note: Percentage contribution of individual characteristics to overall income inequality as measured by I_2.

Table 8. Earnings Mobility Index for Different Period Lengths

	I_0	I_1	I_2	Gini
1994-1995	0.052	0.050	0.070	0.021
1994-1996	0.262	0.222	0.278	0.098
1994-1997	0.352	0.277	0.356	0.118
1994-1998	0.375	0.287	0.361	0.124
1994-1999	0.455	0.343	0.442	0.145
1994-2000	0.486	0.368	0.477	0.153
1994-2001	0.734	0.610	0.743	0.375

Notes:

I_0 Mean Log Deviation with sensitivity parameter c = 0; I_1 Theil Index with sensitivity parameter c = 1; I_2 Half the Coefficient of Variation c = 2.

Table 9. Percentage in Earnings Quintile in Current Year, (Rows) versus Previous Year (Columns)

1995/1994	1	2	3	4	5	Total
1	56.67	21.38	4.73	2.63	1.39	12.48
2	25.33	42.76	17.16	3.01	0.56	12.75
3	8.67	26.90	41.42	22.56	1.67	17.25
4	6.00	8.28	33.14	51.13	14.44	24.31
5	3.33	0.69	3.55	20.68	81.94	33.21
Total	100	100	100	100	100	100
1996/1995	1	2	3	4	5	Total
1	52.94	21.10	6.90	2.74	1.22	9.03
2	20.59	39.45	15.52	2.28	0.61	10.14
3	11.76	27.52	41.38	11.87	1.53	15.72
4	10.29	10.09	32.76	60.27	14.68	28.43
5	4.41	1.83	3.45	22.83	81.96	36.68
Total	100	100	100	100	100	100
1997/1996	1	2	3	4	5	Total
1	41.30	14.00	6.80	2.40	0.94	7.83
2	27.17	51.00	21.09	5.20	0.00	13.23
3	19.57	27.00	53.74	18.80	0.63	19.07
4	7.61	6.00	15.65	57.20	15.72	25.25
5	4.35	2.00	2.72	16.40	82.70	34.62
Total	100	100	100	100	100	100
1998/1997	1	2	3	4	5	Total
1	62.82	16.95	8.28	3.03	0.27	9.45
2	24.36	40.68	17.83	2.60	0.27	10.71
3	8.97	33.90	44.59	21.21	2.45	18.38
4	1.28	8.47	28.03	56.71	18.75	26.79
5	2.56	0.00	1.27	16.45	78.26	34.66
Total	100	100	100	100	100	100
1999/1998	1	2	3	4	5	Total
1	65.31	45.13	15.19	5.02	2.25	16.51
2	15.31	30.97	16.46	7.11	0.56	9.87
3	10.20	16.81	43.67	20.92	2.54	16.30
4	6.12	6.19	18.35	48.54	13.52	21.39
5	3.06	0.88	6.33	18.41	81.13	35.93
Total	100	100	100	100	100	100
2000/1999	1	2	3	4	5	Total
1	54.07	18.52	11.43	2.09	1.63	14.21
2	20.93	40.74	11.43	4.19	0.00	10.63
3	14.53	30.56	50.00	16.23	3.00	17.38
4	5.23	5.56	25.00	58.12	20.16	24.03
5	5.23	4.63	2.14	19.37	75.20	33.74
Total	100	100	100	100	100	100
2001/2000	1	2	3	4	5	Total
1	55.97	27.00	8.86	4.76	0.53	13.07
2	26.87	41.00	26.58	5.71	0.53	13.59
3	10.45	22.00	40.51	25.24	2.12	16.45
4	4.48	8.00	17.72	48.57	14.59	20.33
5	2.24	2.00	6.33	15.71	82.23	36.57
Total	100	100	100	100	100	100

Figure 1. Family Farm Income Frequency Density Functions 1994 – 2001