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FARM HOUSEHOLD INCOMES AND REFORMING THE CAP

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Abstract

Low and variable farm income has been a main rationale for heavy government intervention in agricultural markets and income transfers to farmers whether in Europe in response to disruptive agricultural imports and low world prices at the end of the 19th century or in the US in response to the Great Depression. While the future of the Common Agricultural Policy (CAP) is again discussed and new directions are examined, it is fundamental to know to what extent low and variable farm income is still a problem in contemporary European agriculture and a valid rationale for designing the new CAP. In this context, this paper first examines the income level and distribution of farm households compared to those of non-farm households for a selection of OECD countries. Second, the paper econometrically investigates whether explanations for low farm income given in the literature apply to the selected OECD countries for the 1980-2000 period. Third, the paper concludes with some policy implications.

Both the descriptive and econometric analyses use the microeconomic dataset from the Luxembourg Income Study (LIS). This dataset contains socio-demographic, income and expenditure data that are collected at the household level through household-based budget surveys. These data are recorded in the LIS dataset in a harmonized way for the 30 countries that currently participate in the LIS. Average income levels as well as indicators of poverty and inequality are calculated for farm and non-farm households for the OECD countries that have at least three waves of data in the LIS dataset with a minimum of 30 identified farm households surveyed in each wave[1]. Three sets of explanations for low farm household income drawn from the literature review of Gardner (1992) are successively investigated: (i) the commodity market conditions, (ii) the earning disequilibrium between sectors, and (iii) the compensating differential for skill differences and non-pecuniary aspects[2].

Preliminary results confirm that in most of the 12 selected OECD countries the average farm household income is greater than the average non-farm household income. Lower average farm household income tends to occur sporadically for some years in only six of the 12 selected OECD countries. In five of the nine selected European countries, the average farm household incomes clearly tend to improve compared to the average non-farm household incomes during the 1985-95 period. They are well above the average household incomes. The incidence of poverty tends to be less severe among farm households than non-farm households except for two European countries. In contrast, the intensity of poverty tends to be more severe among farm households than non-farm households in most countries. This implies that in general there are relatively fewer poor farm households compared to non-

[1] In this study, the distinction between farm and non-farm households is made according to the household's income sources. We used here the 'narrow' definition of a farm household in which the household's farm self-employment income is greater than 50% of its factor incomes. A non-farm household is defined as a household whose farm self-employment income is nul. The 12 OECD countries included in this analysis are the following: Australia, Canada, Finland, France, Germany, Ireland, Italy, Luxembourg, Norway, Poland, United Kingdom and United States.

[2] Gardner, B.L. (1992). "Changing Economic Perspectives on the Farm Problem", Journal of Economic Literature, 30 (1), 62-101.

farm households but the severity of their poverty is stronger. In addition, the income distribution is more equal among farm households than non-farm households in all countries.

In the final version of the paper, it is expected that each set of explanations for low farm household income would play a role in understanding the evolution of farm household incomes across countries. Depending on whether one set of explanations tends to dominate the others in one particular group of countries, public interventions can be designed and emphasized in a new CAP for improving and stabilising incomes of farm households.

Keywords: Farm household income, poverty, Common Agricultural Policy, European Union, OECD.

JEL Classification: Q10, Q18.

Introduction

At the time when the future of agricultural policy is again debated in many developed countries and new directions are examined, it is fundamental to assess to what extent low and unstable farm income still prevails in contemporary agriculture and identify which factors determine incomes of farm households. In the 20th century, low and unstable farm income has historically been used to rationalise public support to farming in developed countries. However, an accumulation of evidence during the 1970s and 1980s discussed by Gardner (1992) dismisses the prevalence of a low-income problem among farmers in the United States (US) since the second half of the 1960s. Less evidence is available for other developed countries. Scattered national statistics collected by EUROSTAT (2002) between 1972 and 1999 suggest that farm households have on average income close or higher than other households in most of the 15 member states of the European Union (EU) during that period. An OECD (2003, p. 3) study also confirms that, "in most OECD member countries, farm households enjoy, on average, income levels that are close to those in the rest of the society."

To what extent income distribution and poverty incidence differ between the farm households and non-farm households are also relevant research questions for gearing future policy. In that respect Gardner (2000) reports that both income inequality and poverty continue to fall among US farm families during the 1970s, 1980s and 1990s to the point that the poverty rate for farm households falls below the poverty rate for non-farm households in the late 1980s. Another OECD (2001) study, however, concludes that income inequality and low-income incidence and intensity are greater among farm households than among other households in most of the 14 OECD member countries for which data are available from the middle of 1980s to the middle of 1990s. The study warns that these findings may, however, be affected by underestimating farm household incomes because incomes in-kind and asset values are not accounted for and incomes from self-employment, including from farming, may be under-reported in household income surveys.

Plausible causes of the prevalence of low farm incomes in the US until the early 1960s have been proposed in the literature on the farm problem. The review of these causes by Gardner (1992) distinguishes three complementary frameworks of possible explanations. The first framework corresponds to the basic farm problem model that focuses on the commodity market conditions. The second framework, instead, examines the factor market conditions to explain an earning disequilibrium between the farm and non-farm sectors. The third framework considers the compensating differential for skill differences and non-pecuniary aspects of farming to explain low farm relative to non-farm earnings. To understand growth in incomes of farm households relative to non-farm households that prevailed in the US since the 1940s, Gardner (2000) focuses on adjustments in the labour market with increasing economic integration between the farm and the non-farm sectors, in particular migration off farms and non-farm sources of income for households remaining on farms. He finds that labour-market integration is by far the predominant factor in the improvement of economic condition of low-income farm households between 1960 and 1980 in the US, not specifically

agricultural variables such as government payments, agricultural productivity growth or farm-size growth.

Assessing the extent of low farm income is fraught with many measurement and accounting difficulties. Low farm income has generally been evaluated by comparing the average income of farm households to the average income of non-farm households at the country level using a combination of individual farm account data, household income survey data and sector-level aggregated income data. When income comparisons do exist, for example, from USDA, EUROSTAT (1999 and 2002) and OECD (1999 and 2003), they are sensitive to the sources of information, the methods of estimation and the definitions of incomes and farm households versus non-farm households that are used. Because sources, methods and definitions can also differ when estimating farm and non-farm household incomes and comparing their ratios across years and countries, analyses of income comparisons across years and countries are flawed and generalisations on the extent and origin of income differences impossible to make. These difficulties may also explain why factors identified in the economic literature, for example in Gardner (1992), which may result in low farm incomes have never been tested systematically across different years and countries using empirical data. The conclusion of the OECD (2003, p. 33) study acknowledges "the absence of adequate information on the income situation of farm households" for properly designing and implementing income policies that are still prominent in most OECD countries.

This paper has the ambition to fill this gap by using meaningful income comparisons between farm and non-farm households for eleven developed countries over a period covering the last 30 years. The first section of this paper compares the average income levels of farm households to those of non-farm households by using the same harmonized data set for years and countries for which data are available and applying consistently the same definitions of household categories across the eleven selected countries over the 30-year period. The second section compares indicators of poverty and income distribution between farm households and non-farm households. The third section econometrically tests factors that may explain the disparity of incomes between farm and non-farm households across ten of the eleven countries over the last 25 years. This is the first time that such systematic comparative and explanatory study is proposed in the literature.

Comparisons of farm and non-farm household income levels

Both the comparative and econometric analyses use the microeconomic dataset from the *Luxembourg Income Study* (LIS). This dataset contains socio-demographic, expenditure and income data that are collected at the household level through national household-based budget surveys. These data are recorded in the LIS dataset in a harmonized way for the 30 countries that currently participate in the LIS. Using this microeconomic dataset that are harmonized across households, years and countries has the great advantage that the same

source of information for household incomes and characteristics is used making comparisons across household categories, years and countries meaningful. Compared to macroeconomic or sector data, household data also allows the examination of the incidence of low income.

In this paper, average income levels as well as indicators of income distribution are calculated for farm and non-farm households for developed countries that have at least three waves of data survey in the LIS dataset. Furthermore, the income averages are calculated for survey waves that contain a minimum of 30 identified farm households to limit the risk that sampling errors affect the statistical results. Applying these selection criteria, 59 waves of data survey covering eleven developed countries are used for the comparisons of income levels.

Table 1 reports the eleven countries, the LIS databases and the survey waves that are used for the comparative and econometric analyses. The eleven selected countries include Australia, Canada, Finland, France, Germany, Ireland, Italy, Luxembourg, Norway, the United Kingdom (UK) and the United States (US). Canada and the US have the longest time series available spanning from the late 1960 to early 2000. Luxembourg has the shortest time series available from 1985 to 1994. After the middle of 1990s, national household-based budget surveys from many European countries (for example, France, Germany, Ireland, Italy and the United Kingdom) have ceased to separate incomes from farm self-employment and other self-employment.

Table 1 also gives the sample sizes according to household categories and the proportions of farm households in the household samples. In this paper, the distinction between farm and non-farm households is made according to the source of the household's net disposable incomes. A distinction is made between a 'broad' definition of a farm household in which the household's farm self-employment income is not null and a 'narrow' definition of a farm household in which the household's farm self-employment income is greater than halve of its factor incomes. When the 'broad' definition of a farm household is used, then a counterpart 'narrow' definition of a non-farm household is that of a household whose farm self-employment income is null. Similarly, when the 'narrow' definition of a farm household is used, then a counterpart 'broad' definition of a non-farm household is that of a household whose farm self-employment income is lower than halve of its factor incomes. The definition of these household categories follows the same definition used in the OECD (2001) report that has evaluated the incidence of low income among farm households compared to other households for 17 OECD countries using also the LIS dataset but for survey waves between the middles of 1980s and 1990s. As in this OECD (2001) report, the net disposable income of a household is adjusted to account for its size using an equivalence elasticity of 0.55 (see Förster, 1994).

Table 1. Unweighted sample size in the LIS by definition

			Sample size					Sample size (% to all hh)	
				Non-farm households		Farm households		Farm households	
Country	LIS Database	Wave	All hh	Narrow def. (a)	Broad def. (b)	Broad def. (c)	Narrow def. (d)	Broad def. (c)	Narrow def. (d)
Australia	AU81H	1981	17021	16804	16897	217	124	1.27	0.73
	AU89H	1989	16331	15967	16083	364	248	2.23	1.52
	AU95H	1995	6819	6667	6737	152	82	2.23	1.20
	AU01H	2001	6786	6657	6703	129	83	1.90	1.22
	AU03H	2003	10210	10044	10113	166	97	1.63	0.95
Canada	CA71H	1971	25927	24243	25007	1684	920	6.50	3.55
	CA75H	1975	26569	25102	25707	1467	862	5.52	3.24
	CA81H	1981	15136	14064	14605	1072	531	7.08	3.51
	CA87H	1987	11960	11249	11345	711	315	5.94	2.63
	CA91H	1991	21647	20639	21258	1008	389	4.66	1.80
	CA94H	1994	40849	39414	40276	1435	573	3.51	1.40
	CA97H	1997	33843	32555	33299	1288	544	3.81	1.61
	CA98H	1998	31218	29865	30749	1353	469	4.33	1.50
	CA00H	2000	28970	27647	28557	1323	413	4.57	1.43
Finland	FI87H	1987	11863	8836	10517	3027	1346	25.52	11.35
	FI91H	1991	11749	9058	10828	2691	921	22.90	7.84
	FI95H	1995	9262	7392	8414	1870	848	20.19	9.16
	FI00H	2000	10423	7742	9301	2681	1122	25.72	10.76
	FI04H	2004	11229	8696	10362	2533	867	22.56	7.72
France	FR79	1979	11044	10132	10432	912	612	8.26	5.54
	FR84BH	1984	11977	11391	11478	586	499	4.89	4.17
	FR89H	1989	9038	8524	8630	514	408	5.69	4.51
	FR94H	1994	11294	10999	11089	295	205	2.61	1.82
Germany (e)	DE73H	1973	46770	45177	45661	1593	1109	3.41	2.37
	DE78H	1978	46068	44751	45194	1317	874	2.86	1.90
	DE83H	1983	42752	41449	42068	1303	684	3.05	1.60
	DE84H	1984	5194	5136	5157	58	37	1.12	0.71
	DE89H	1989	4411	4350	4376	61	35	1.38	0.79
	DE94H	1994	6379	6332	6349	47	30	0.74	0.47
Ireland	IE87H	1987	3294	2629	2899	665	395	20.19	11.99
	IE94H	1994	3192	2755	2856	437	336	13.69	10.53
	IE95H	1995	2830	2458	2540	372	290	13.14	10.25
	IE96H	1996	2644	2297	2385	347	259	13.12	9.80
Italy	IT87H	1987	8027	7861	7898	166	129	2.07	1.61
	IT89H	1989	8274	8088	8142	186	132	2.25	1.60
	IT91H	1991	8188	8031	8070	157	118	1.92	1.44
	IT93H	1993	8089	7969	8004	120	85	1.48	1.05
	IT95H	1995	8135	7986	8044	149	91	1.83	1.12
Luxembourg	LU85H	1985	2049	1971	1990	78	59	3.81	2.88
	LU91H	1991	1957	1888	1909	69	48	3.53	2.45
	LU94H	1994	1813	1752	1771	61	42	3.36	2.32
Norway	NO79H	1979	10414	9713	10080	701	334	6.73	3.21
	NO86H	1986	4975	4542	4830	433	145	8.70	2.91
	NO91H	1991	8073	6331	7433	1742	640	21.58	7.93
	NO95H	1995	10127	9236	9810	891	317	8.80	3.13
	NO00H	2000	12919	11849	12596	1070	323	8.28	2.50
UK	UK79H	1979	6777	6702	6717	75	60	1.11	0.89
	UK86H	1986	7178	7115	7130	63	48	0.88	0.67
	UK91H	1991	7056	6997	7020	59	36	0.84	0.51
	UK95H	1995	6797	6742	6755	55	42	0.81	0.62
USA	US69H (f)	1969	11978	10710	11313	1268	665	10.59	5.55
	US74H	1974	12328	11100	11698	1228	630	9.96	5.11
	US79H	1979	15928	15463	15690	465	238	2.92	1.49
	US86H	1986	12600	12348	12500	252	100	2.00	0.79
	US91H	1991	59038	57933	58608	1105	430	1.87	0.73
	US94H	1994	66014	64446	65628	1568	386	2.38	0.58
	US97H	1997	50320	49269	50040	1051	280	2.09	0.56
	US00H	2000	49633	48503	49392	1130	241	2.28	0.49
	US04H	2004	76447	74553	76074	1894	373	2.48	0.49
Sum	59	59	1029833	980119	1007014	49714	22519	4.83	2.19

Source: The LIS database

(a) Incomes from farm-self-employment are null.

(b) Incomes from farm self-employment are lower than 50% of incomes from all sources.

(c) Incomes from farm-self-employment are not null.

(d) Incomes from farm self-employment are greater than 50% of incomes from all sources.

(e) Datasets earlier than 1994 refer to the former 'West-Germany' only; datasets after 1994 refer to the unified West- and East-Germany.

(f) Farm household sample sizes are calculated on the basis of gross income, not disposable personnel income as in the other countries and waves.

For these countries and waves, Figures 1 and 2 show the ratios of the net disposable income (DPI) of farm households narrowly defined to the DPI of non-farm households for years and countries that are selected. For Australia, Canada and the US, farm household income ratios reported from 1969 to 2004 in Figure 1 fluctuate between 60 and 160 per cent around the income parity level of 100 per cent. For the US, fluctuations of this ratio around the income parity level in the 1970s and 1980s reflect the boom and the bust of farming during that period. For Australia and Canada, the fall in the farm household income ratio in the 1990s and the early 2000s fellows a period during which the ratio was close to or higher than the income parity level of 100 per cent. These new series of farm household income ratios support the conclusion already reached in Gardner (1992) for the US that farm household incomes in these three countries are not chronically low on average.[3]

For European countries, farm household income ratios reported from 1973 to 2004 in Figure 2 are generally close to or higher than the income parity level of 100 per cent. For six of the eight European countries, there is a noticeable trend of increase in the farm household income ratios during the observed period. These farm household income ratios fluctuate less than those recorded in Australia, Canada and the US. Although the series of farm household income ratios stop short after the middle of 1990s for several European countries, they show that farm household incomes in all these eight European countries have definitively ceased to be low on average since the late 1980s.[4]

When the broad definition of a farm household is used, the income picture (not showed here) slightly changes. For Australia, Canada and the US, the farm household income ratios are higher and more stable than those calculated on the basis of a narrow definition of a farm household. For the US, the farm household income ratios are consistently above the income parity level of 100 per cent for the thirty years of observations while, for Canada, the ratios are also above the income parity level of 100 per cent except for two years of observations.

[3] Large discrepancies exist between this new series of US farm household income ratios reported here and the series reported by USDA and used in Gardner (1992). They result from the use of different sources of information and definitions of households and incomes. For example, USDA uses a broad definition of a farm household that includes all households in which one member is an operator associated with a farm business that has a minimum annual sale of USD 1,000 of agricultural products. This definition applies to some 2,050,000 US farms in 2004 and 2005.

[4] Differences in information sources and household definitions prevent the comparisons of these new series of farm household income ratios reported here for eight European countries with those reported in EUROSTAT (2001). Both series, however, confirm that average incomes of farm households are higher than those of non-farm households for most of the European countries and years.

Figure 1. Ratio of average DPI of farm households (narrow definition) to non-farm households (%) in Australia, Canada and USA

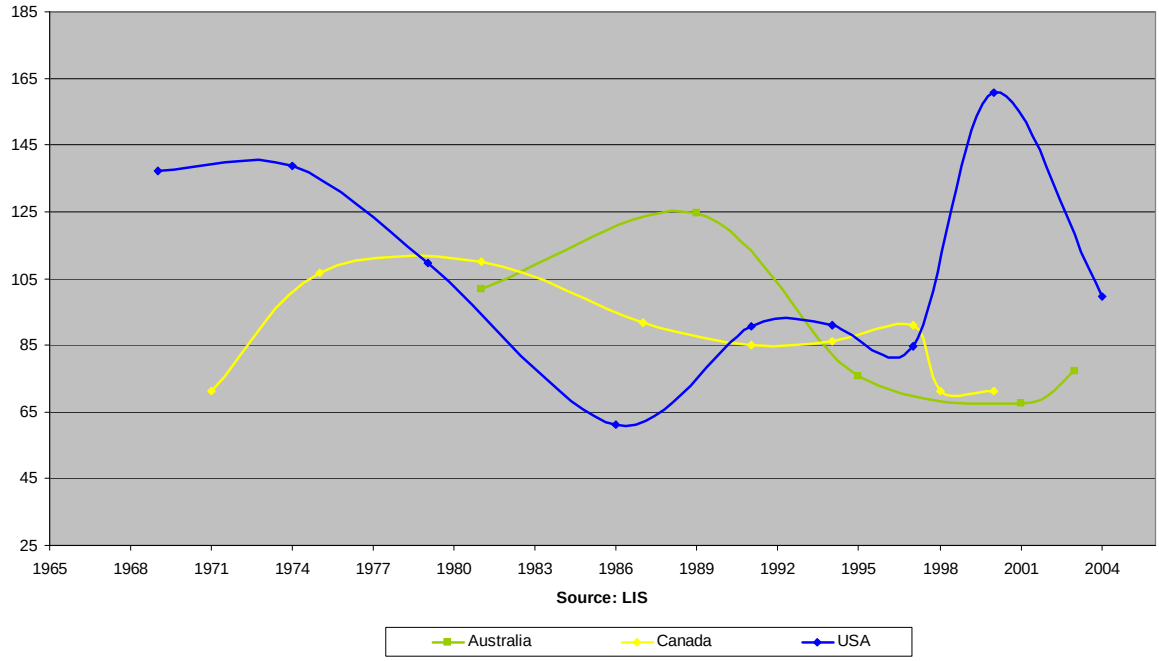
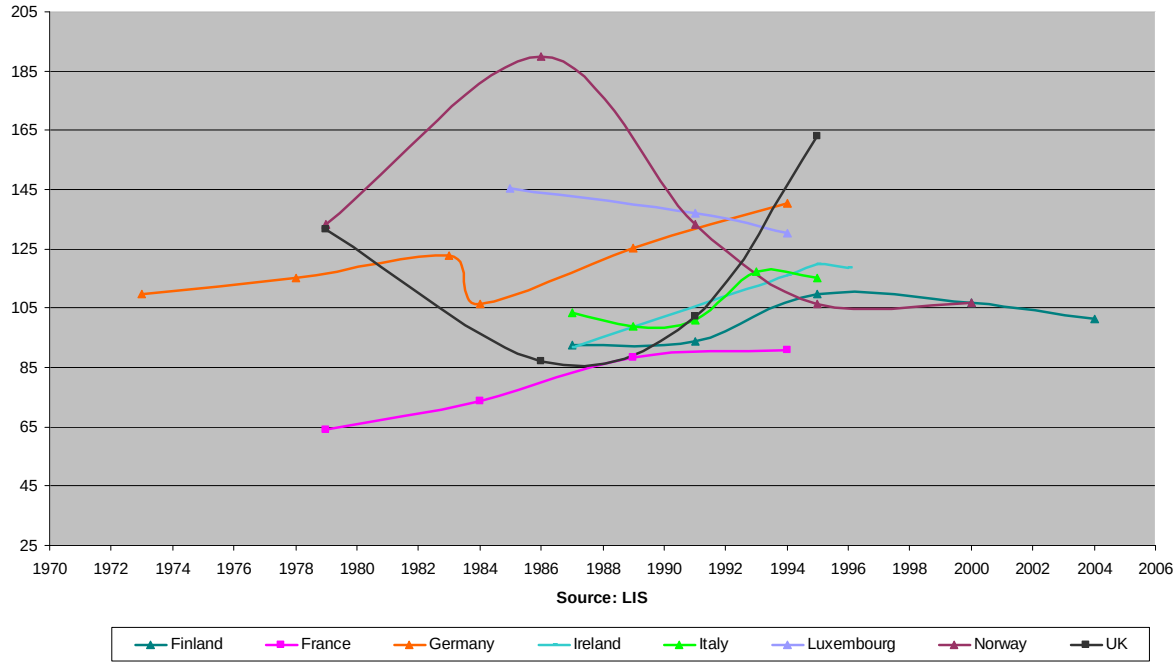


Figure 2. Ratio of average DPI of farm households (narrow definition) to non-farm households (%) in selected European countries



For the selected European countries, the farm household income ratios are slightly higher for three of the eight countries. A more diversified source of incomes out of farming indeed tends to stabilise and increase the farm household incomes for a total of six countries

out of the eleven that are surveyed. That on average farm household incomes are not chronically low is even more evident for these eleven developed countries when a broad definition of farm households is considered. The farm income problem no longer exists in the eleven developed countries for which data of farm household incomes are available.

Comparisons of farm and non-farm household income distributions

The distribution of farm household incomes is now compared to the distribution of non-farm household incomes using the narrow definition of a farm household and its counterpart definition of a non-farm household. Four indicators of income distribution are calculated for each household category, wave and country. They include the low income rate, the low income gap, the Gini coefficient and the Sen index. As in the OECD (2001) report, the low income is defined as being 50 per cent of the median income of all households in the sample, so that the situation of the low income farm household is assessed relative to all households of the country in a particular year. This relative approach to the definition of low incomes facilitates cross-country comparisons. The first two indicators of income distribution are calculated from survey waves that contain a minimum of 30 identified farm households that are below the low income to limit the risk of sampling errors. This threshold restricts the analysis of the relative income distribution to five countries: Canada, Finland, France, Germany and the US. The ratios of one particular indicator for farm households to the same indicator but for non-farm households are then calculated and compared through the available observed period across countries.

Figure 3 shows the ratios of the low income rate (LIR) for farm households narrowly defined to the LIR for non-farm households across years for the five countries. The LIR measures the cumulative proportion of households within the population below the low income. It is a measure of the incidence of low income. Except for Germany during the 1973-83 observed period, the US in 1974 and Finland in 2000, the incidence of low income is much higher among farm households than non-farm households. The farms to non-farm LIR ratios, however, vary widely across countries and years making difficult to discern a pattern. These ratios fluctuate between 100 and 170 per cent for the US and 150 and 250 per cent for Canada during the 30-year period. In contrast to what Gardner (1992) reports, this new series of ratios of farm to non-farm poverty rates for the US indicates that the farm poverty rate has not converged and fallen under the non-farm poverty rate during the last three decades. Except for Germany before the middle of the 1980s, the proportion of low income households is also much higher among farm households than non-farm households in the other two European countries. France has a particularly higher proportion of low income households among farm households than non-farm households between 1979 and 1994. Even when the average incomes of farm households are close to or higher their parity level, the incidence of low income tends to be higher among farm households than non-farm households except for Germany.

Figure 4 shows the ratios of the low income gap (LIG) for farm households narrowly defined to the LIG for non-farm households for the same five countries. The LIG measures the difference between the average income of the low income households and the low income as a percentage of the low income. It is a measure of the intensity of low income. Except for Germany during the 1973-83 observed period, France in 1984 and 1989 and Finland in 2000, the intensity of poverty is much higher among farm households than non-farm households. Even when the average incomes of farm households are close to or higher their parity level, the intensity of low income tends to be higher among farm households than non-farm households except for Germany and, to a lesser extent, Finland and France.

Figures 5 and 6 show the ratios of the Gini income concentration index of farm households narrowly defined to the same Gini index of non-farm households. Here the income distribution analysis is extended to survey waves that contain a minimum of 30 identified farm households that are narrowly defined. Incomes are generally less equally distributed among farm households than non-farm households except for Germany during the observed 1973-83 period and Norway and the UK since 1991. Otherwise the Gini indexes are up to about 40 per cent higher for farm households than non-farm households suggesting a higher inequality in the distribution of farm household incomes than non-farm household incomes.

Figure 3. Ratio of low income rate of farm households (narrow definition) to non-farm households (%) in selected OECD countries

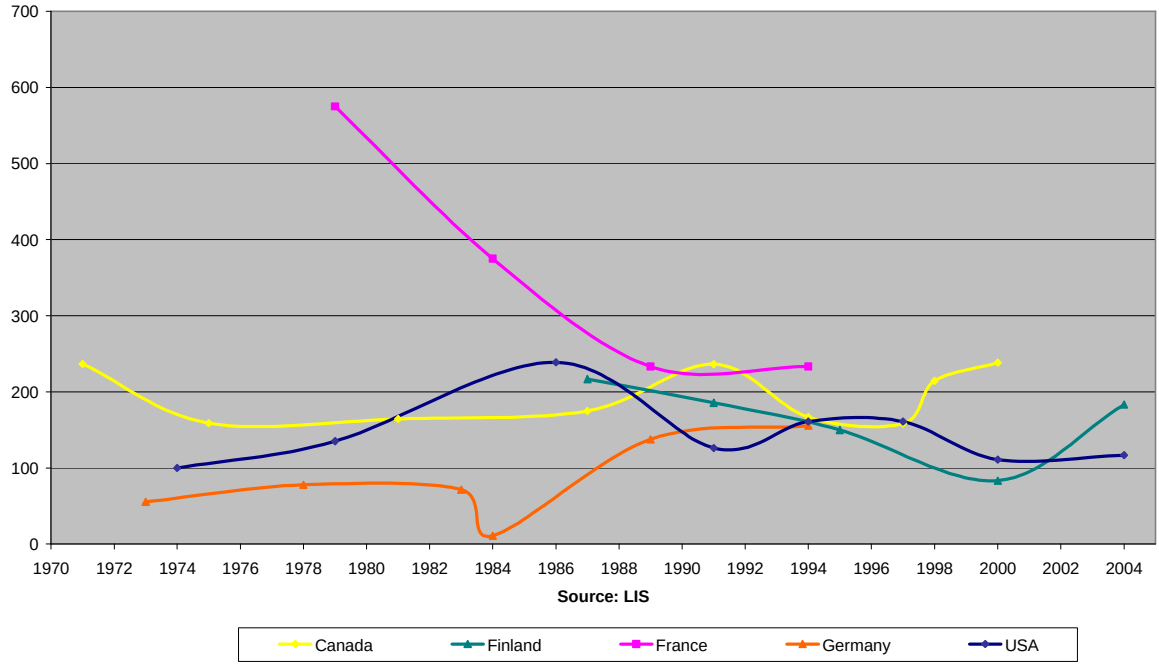


Figure 4. Ratio of low income gap of farm households (narrow definition) to non-farm households (%) in selected OECD countries

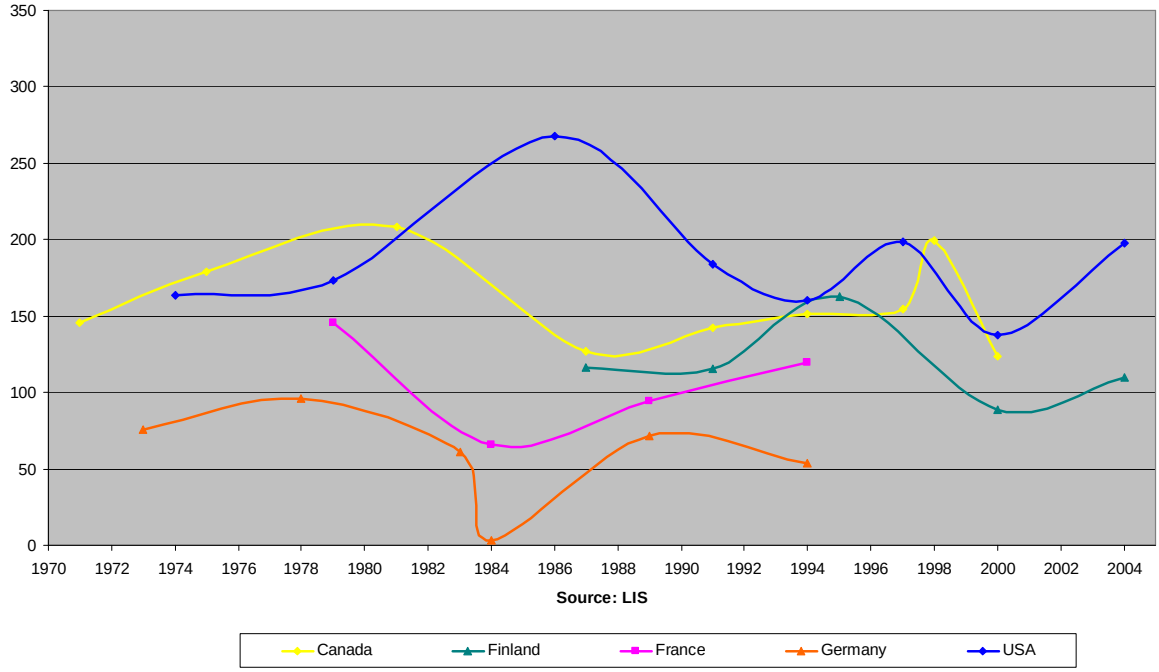


Figure 5. Ratio of the Gini index of farm households (narrow definition) to non-farm households (%) in Australia, Canada and USA

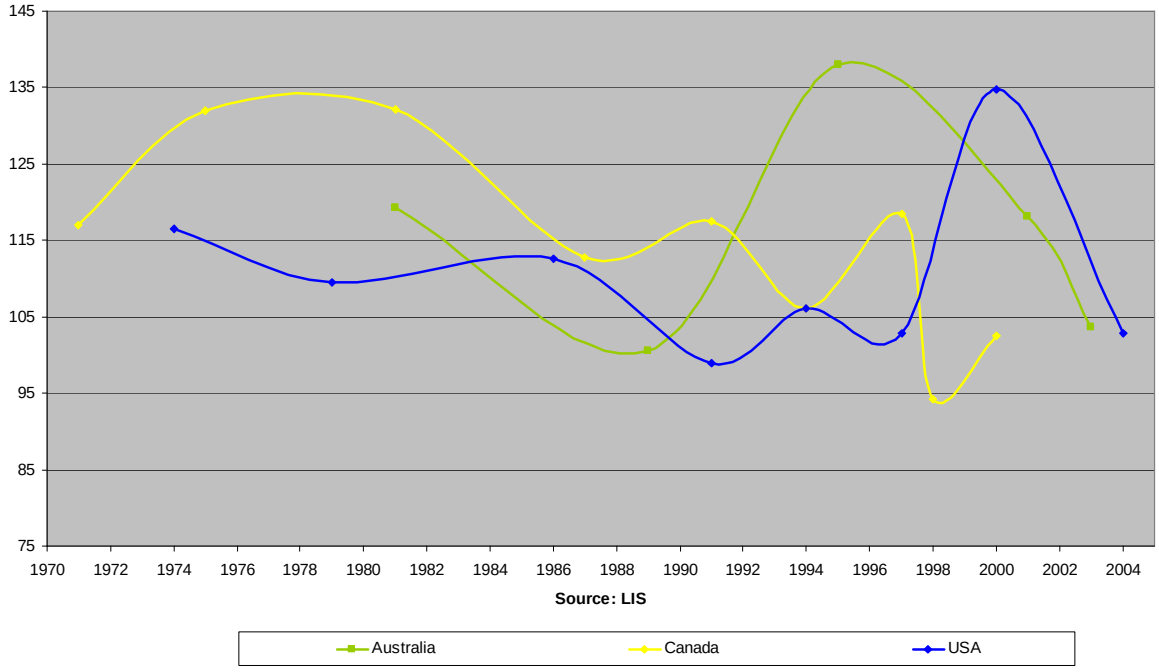


Figure 6. Ratio of the Gini index of farm households (narrow definition) to non-farm households (%) in selected European countries

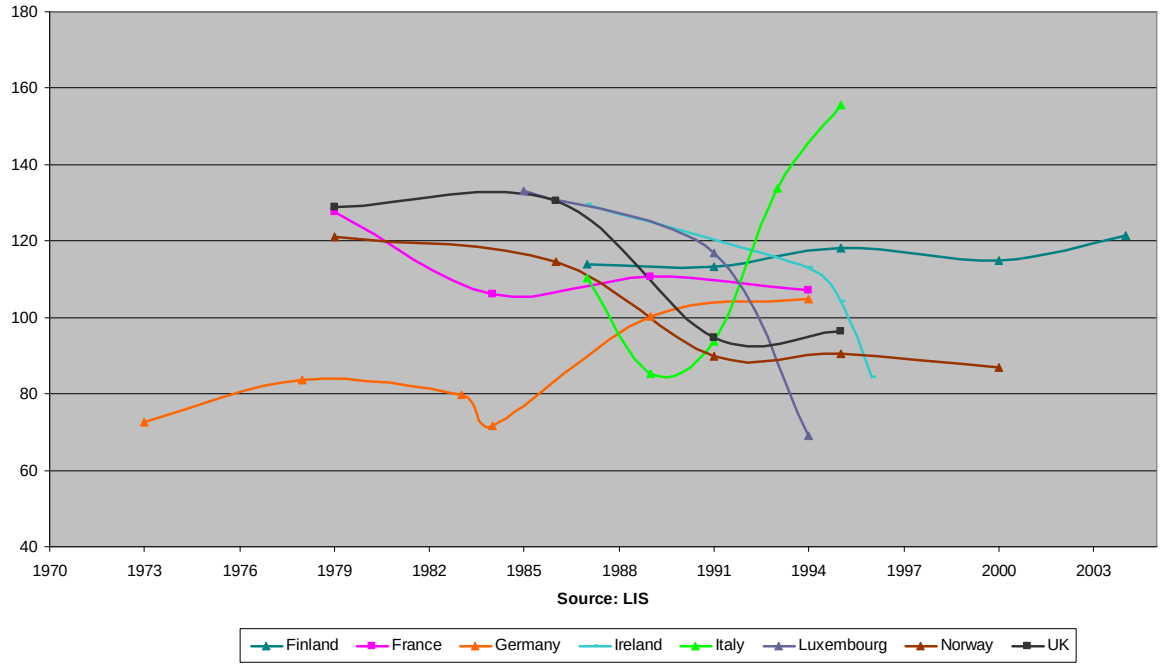
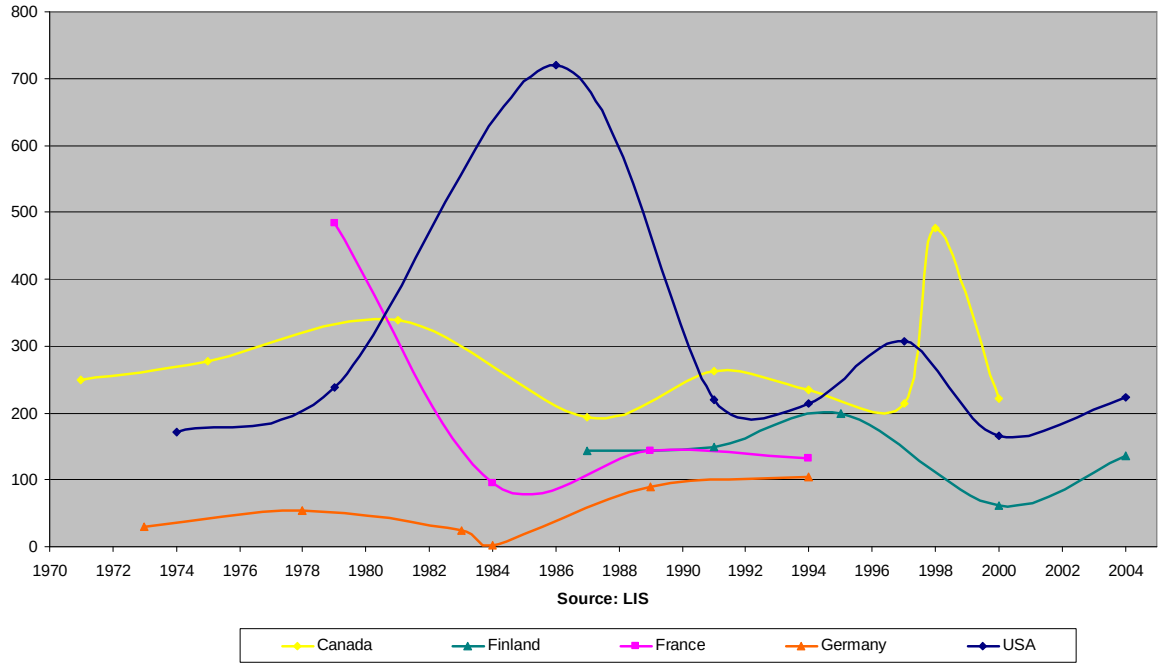


Figure 7 shows the ratios of the Sen index of farm households narrowly defined to the Sen index of non-farm households. The Sen index combines the LIR, the LIG and the Gini index of the low income households into a single indicator of poverty (see Förster, 1994).[5] It is a measure of degree of poverty. Here the income distribution analysis is scaled down to survey waves that contain a minimum of 30 identified farm households that are below the low income to limit the risk of sampling errors. The Sen index is lower among farm households than non-farm households in Germany during the observed 1973-83 period. The Sen index is generally higher among farm households than non-farm households in the other two European countries but much higher in Canada and the US. In sum, all indicators of income distributions show that, except for Germany between 1973 and 1983, the incidence and the intensity of low income as well as the disparity of income distribution are often much higher among farm households than non-farm households for the developed countries for which data of farm household incomes are available. These comparisons of income distributions between farm households and non-farm households confirm the conclusion reached in the OECD (2001) report. The incidence of low income and the disparity in incomes are most often higher among farm households than among non-farm households in the same country.

[5] The Sen index S is defined as follows: $S = LIR\,[LIG + (1\text{-}LIG)\,G_p]$ where LIR is the low income rate, LIG the low income gap and G_p the Gini income concentration index among the low income population.

Figure 7. Ratio of the Sen index of farm households (narrow definition) to non-farm households (%) in selected OECD countries



Testing factors explaining income disparity between farm and non-farm households

From the literature review of Gardner (1992), it is possible to distinguish three sets of plausible reasons for low income of farm households. First, low and unstable farm income is explained by a supply-demand model of aggregate commodities. The essential features of the model include very inelastic demand and supply of agricultural products, a faster growth rate of supply than demand and small transitory shocks of output or demand (Schultz, 1945; Cochrane 1958; Hathaway, 1964; Tweeten, 1971). The economic consequences of this basic model are declining and volatile farm prices and low incomes of farm people. This commodity-based supply-demand model prevails in the 1940s and 1950s to explain the farm income problem and remained classic among agricultural economists until the 1980s. According to Gardner (1992), no econometric work has, however, established commodity price trends as the cause of farm income trends.

It became evident that low farm incomes relative to non-farm incomes should not be primarily a matter of relative farm and non-farm commodity prices, but rather of factor market conditions that only a general equilibrium approach can incorporate. Consequently, chronically low farm income is, here, explained by the persistence of a disequilibrium between the farm and non-farm labour markets that keeps farm people with lower incomes in the farm sector (Johnson, 1959). To explain a lack of factor mobility and consequently low farm incomes, two approaches are investigated. The first approach considers factor-market disequilibrium as a short-run phenomenon attributable to adjustments costs in labour movement, in particular job search and moving expenses. These adjustment costs result in a short-term income differential when the demand for farm labour declines as a result of labour-

saving technical change, even when similar skills are involved. The second approach considers that long-run income differences are a matter of skill and age differences, non-pecuniary preferences for farming, income measurement problems, or other non-comparabilities between farm and non-farm people (Johnson, 1963). This second approach actually constitutes an application to labour of the neoclassical view that emphasizes fixities and irreversibilities in agricultural investment (Gardner, 1992): farm-specific skills are less valuable off the farm and shifting employment is costly. Both approaches would also imply that the farm labour force tends to become older as the demand for farm labour declines. The earning disequilibrium between the farm and non-farm sectors constitutes the second set of plausible reasons for low farm income. According to Gardner (1992), no empirical work has been able to test either the short or the long-run explanation of the earning disequilibrium.

However, empirical evidence has rendered it doubtful that income differences are still a matter of disequilibrium between the farm and non-farm labour markets in the US. In advanced well-integrated economies, income differences are more likely a compensating differential for skill differences or non-wage aspects of the two employments. This constitutes the third set of plausible reasons for low farm income. Johnson (1953) has tested this hypothesis but he could not attribute at that time the full difference of real labour returns between the average farm and non-farm workers to just the differences in income-earning capacity as a result of age, sex, and skill differences. That the income difference was substantially larger than what these differences in income-earning capacity can be accountable for has actually motivated the hypothesis of a disequilibrium between the farm and non-farm labour markets.

Using that theoretical background and empirical data, Gardner (2002) proposes and discusses leading plausible causes of growth in incomes that farm households have experienced in the US since 1950. These causes include agricultural productivity growth, saving and investment by farm people, expanding export markets, adjustment to disequilibrium via out-migration of labour, off-farm work opportunities for farm people in a growing general economy and improved skills of farm people. He adds that these causes may themselves result from more fundamental developments in research and extension, improved rural infrastructure, marketing services and rural schooling, lower costs of inputs and services, government subsidies and support and economic growth in the non-farm economy. It is, however, not certain how some of these causes such as technological progress and the resulting agricultural productivity increases may actually have contributed in the long run to farm income growth. Although empirical evidence suggests a close correspondence between growths in productivity and farm income in the US, some other causal factors listed above need to be considered as explanations for farm income growth.

Using an expanded error-correction model with US state data as well as US county data to test determinants of the annual rate of state-level median incomes of farm households between 1950 and 1990, Gardner (2002) shows that farm household income growth has little relationship from farming or its determinants such as farm productivity, government

programs, or investment in agriculture but, rather, from adjustment in labour markets, with off-farm migration and off-farm work by farm household members being the main mechanism of adjustment. Four hypothetical factors have received sustained attention to explain in particular growth in farm household incomes: (1) the development and diffusion of new agricultural technology, (2) the expansion and commercialisation of agricultural commodity markets, (3) the integration of farm people into the growing non-farm economy after 1945, and (4) government policies including regulatory institutions, public investment in infrastructure and commodity programs. Gardner (2002) concludes that evidence points firmly in the direction of the third hypothesis, the integration of farm and non-farm economies, to explain rising incomes of farm households in the US since 1945.

We now investigate to what extent factors that this literature review has revealed to explain convergence of incomes between farm and non-farm households in the US since 1950 also apply for the ten developed countries for which income data are available over the last three decades. We are particularly interested in testing whether the commodity market conditions, the government subsidies, the labour market conditions, the skill differences as well as the long term interest rates could explain the fluctuations and trends in farm household income ratios that are observed for these ten developed countries.

Commodity market conditions that can be favourable to farm household incomes are traced through the agricultural terms of trade. The agricultural terms of trade are calculated as the ratio of the deflated price indexes of agricultural products and means of agricultural production. These indexes are taken from national statistics (Australian Bureau of Agricultural and Resource Economics, Canada Statistics, Finland Statistics, National Agricultural Statistics Service of the USDA and Norway Statistics) for the non-EU countries and EUROSTAT for the EU member states.

Because farm household incomes can also depend on government subsidies, we also test whether subsidies allocated to farm direct payments and general agricultural services affect their incomes relative to those of non-farm households. Subsidies for farm direct payments and general agricultural services are taken from OECD. Subsidies for farm direct payments are expressed in percentage of the total value of agricultural production at farm gate and direct payments; subsidies for general agricultural services in percentage of the total value of agricultural production at farm gate only. The OECD reports subsidies for farm direct payments and general agricultural services for the EU as a whole, not by EU member state. Since 1986, it, however, specifies the output, the area, the animal and the input on which subsidies for farm direct payments are based. To calculate subsidies for farm direct payments by EU member state, each EU specific subsidy of farm direct payments is disaggregated by EU member state by applying the member's share in the EU corresponding output, area, animal number or input from EUROSTAT. The member's specific subsidies are then

aggregated at the member level and, then, expressed in percentage of the member's total value of agricultural production at farm gate and direct payments.[6]

The labour market conditions that may facilitate labour mobility between the farm and non-farm sectors and, hence, reduce the earning disequilibrium between the farm and non-farm labour markets are uneasy to translate in measurable variables. In the short run, higher unemployment is expected to increase adjustment costs in labour movement, in particular job search, as a result of fewer off-farm job opportunities. Greater economic growth is expected to affect relatively less incomes of the farm working population because of longer adjustment lags to economic opportunities in farming than in other occupational activities. Greater economic growth is also expected to be centred on urbanized areas and, hence, affect last rural areas. A higher population density may be a factor that would reduce off-farm job search and commuting or eventually moving expenses in rural areas. In the long run, a lower education and a greater age are expected to make employment shifting less attractive.

The annual standardised unemployment rates are taken from OECD. To reflect the unemployment situation of the country that has accumulated until a particular year to have an effect on the farm to non-farm household income ratio, a five-year average of the annual unemployment rates that precede that year is also used. The growth rates of real GDP per capita at 2000 constant prices (chain series) are taken from the Penn world table of Heston *et al.* (2006). Similarly, to reflect the economic growth of the country that has accumulated until a particular year to have an effect on the farm to non-farm household income ratio, a five-year average of the annual growth rates of real GDP per capita that precede that year is also used. As a crude indicator of population density in rural areas, population densities given by United Nations Data Demographic Statistics at the country level are used.

Higher long term real interest rate is a macroeconomic event that may affect farm household incomes by increasing debt services and generating financial hardships that can eventually lead to farm business failures such as during the US farm crisis in the middle of 1980s. Long term interest rates and producer prices for manufacturing are taken from OECD to obtain the long term real interest rates.

Income-earning capacity as a result of skill and age differences can also be captured by education level and age differences. Following the international standard classification of education from UNESCO (1999), three educational levels are distinguished using the highest attained level of education. The low education level corresponds to the primary and lower secondary education or any other formal education until the minimum age of 16 years. The medium education level corresponds to the upper secondary general and vocational education or any other formal education from the minimum age of 17 until the maximum age of 20 years. The high education level corresponds to the university and specialized vocational education or any other formal education from the minimum age of 21 years. For each

[6] The disaggregation of EU subsidies for farm direct payments by EU member state from 1986 to 2004 is available from the authors.

education level, a ratio of the percentage of household heads having reached that education level among the farm households to the percentage of household heads having reached that same education level but among the non-farm households is calculated per country and survey year from the LIS databases. A ratio of the average age of the heads of farm households to the average age of the heads of non-farm households is also calculated per country and survey year from the LIS databases.

An error components model, estimated by instrumental variable (*IV*) using generalized Hausman-Taylor instruments as described in Wyhowski (1994), is used to test whether above variables can explain the ratio of the average income of farm households narrowly defined to the average income of non-farm households across the ten developed countries over the 25-year period. Whereas Hausman and Taylor (1981) construct two instruments, $x_{i\bullet} = T^{-1}\sum_t x_{it}$ and $(x_{it} - x_{i\bullet})$, for every variable x_{it} that varies freely over time *t* and country *i*, Wyhowski (1994) constructs three instruments: $(x_{i\bullet} - x_{\bullet\bullet})$, $(x_{\bullet t} - x_{\bullet\bullet})$, and $(x_{it} - x_{i\bullet} - x_{\bullet t} + x_{\bullet\bullet})$. This decomposition allows the isolation of any possible correlation between error components and regressors in case of a two-way error components model (Wyhowski, 1994).

We test instrument exogeneity by the Lagrange multiplier (*LM*) or score test as described by Magdalinos (1988). It has been proposed by Hausman (1983) as an overidentification restriction test. On this *LM* statistic we base a downward testing procedure which consistently results in the correct vector of instruments, under the conditions stated in Andrews (1999). The actual algorithm that is used for instrument selection not only makes use of the *LM*-statistic, but also of the individual *t*-statistics of an auxiliary regression of the residuals on the excluded instruments. This dual testing makes use of information on the likely source of the misspecification. It can be argued in close analogy to Chatelain (2007), that tests on individual instruments have greater local power compared to the overall *LM* test and that a sequence of tests with greater local power improves the moment selection procedure with respect to a sequence of tests with less local power. Finally, we also test instrument relevance, i.e. weak instruments, by means of Shea's (1997) "partial R^2" measure for each endogenous regressor, corrected for degrees of freedom.

Table 2 shows two series of similar econometric results whether unemployment rate and growth in GDP per capita are taken for the current year or the preceding five years. In line with previous econometric work for US households, the market conditions that are here encapsulated into the agricultural terms of trade play no role in explaining income differences between farm and non-farm households. In contrast, government programs such as farm direct payments and general agricultural services are significant at less than five per cent. The positive association between these direct payments and the farm household income ratio does not come as a surprise. These farm direct payments are relatively recent for the EU member states included into the econometric analysis and are not yet capitalised into the farm fixed assets such as farmland. Instead, the negative association between subsidies for general agricultural services and the farm household income ratio does come as a surprise. The

largest part of these subsidies is actually used for public stockholding in the EU until 1993 and for marketing and promotion in the other countries included into the econometric analysis during the whole recorded period. It is only in 1994 that these subsidies become more oriented to infrastructure, marketing and promotion in the EU. Since subsidies for public stockholding in the EU tend to be disbursed in years of unfavourable market conditions, the negative association between these subsidies and the farm household income ratio may rather reflect market conditions that temporally depress farm household incomes.

Table 2. Regression explaining the ratio of average farm household income to average non-farm household income in selected OECD countries (a)

Independent	Current year			Previous 5 years (c)		
variable (b)	Coefficient	Robust std. error	P>|t|	Coefficient	Robust std. error	P>|t|
Constant	13.76	4.34	0.00	20.50	5.86	0.00
Agricultural terms of trade	0.56	0.34	0.11	0.55	0.38	0.16
Farm direct payments support	0.13	0.04	0.00	0.16	0.04	0.00
General agricultural services support	-0.17	0.07	0.02	-0.17	0.08	0.05
Standardised unemployment rate	-0.38	0.13	0.01			
Standardised unemployment rate (5-year average)				-0.42	0.17	0.02
Growth in GDP per capita	-0.66	0.31	0.04			
Growth in GDP per capita (5-year average)				-0.88	0.34	0.02
Population density	-0.01	0.03	0.81	-0.05	0.03	0.17
Long term real interest rate	-0.02	0.01	0.07	-0.03	0.01	0.03
Low education ratio	-0.42	0.20	0.05	-0.40	0.24	0.10
High education ratio	0.11	0.05	0.05	0.15	0.07	0.04
Age ratio	-0.02	0.56	0.98	-1.05	0.81	0.21
Number of observations	46			46		
F(10, 35)	5.52			5.05		
Prob > F	0.00			0.00		

(a) Instrumental Variables Estimation of Error Components Model

(b) Expressed in natural logarithm

(c) For Standardised unemployment rate and Growth in GDP per capita

Variables that reflect labour market conditions for farm households such as unemployment rate and per capita economic growth are negative and significant at less than five per cent in both models. Per capita economic growth has a stronger negative effect on differences between incomes of farm and non-farm households than unemployment. Accumulation of per capita economic growth and unemployment in the previous five years tends to accentuate the negative effect. Population density is too crude an indicator for proximity to job opportunities to be significant. As expected, higher long term interest rates also have a negative effect on the farm household income ratio that is significant at less than ten per cent for the first model but five per cent for the second model. As expected, low and high education levels respectively have a negative and positive effects on the farm household income ratio that are significant at five per cent for the first model but ten per cent for the second model. The average age ratio is not significant. This variable needs to be corrected to account for non-farm households that are only still active.

In sum, accounting for the size of the reported elasticities in table 2, the econometric analysis confirms that incomes of farm households relative to non-farm households are

strongly influenced by the general labour market conditions in the economy and the marketable skills of farm household heads. It also shows that farm household incomes are weakly influenced by farm direct payments and, to an even lesser extent, long term real interest rates. Government programs such as output price support or input price subsidies have on average no impact on the well-being of farm households relative to the other households. It is our intention to test also the spouse education level with the same education indicators and productivity growth with an indicator of total factor productivity on the farm household income ratio. Because of risk of endogeneity excess labour in farming and income diversification out of farming are not tested. It is also our intention to extend this econometric analysis to the Canadian provinces and the US regions for which the sample size of farm households from the LIS dataset has a minimum of 30 households. For now, conclusions and recommendations are left for the reader.

References

Andrews, D.W.K. (1999). "Consistent Moment Selection Procedures for Generalized Method of Moments Estimation", *Econometrica*, **67**(3), 543-563.

Chatelain, J.B. (2007). "Improving consistent moment selection procedures for generalized method of moments estimation", *Economics Letters*, **95**(3), 380-385.

Cochrane, W.W. (1958). *Farm prices, myth and reality*. Minneapolis: U. of Minnesota Press.

EUROSTAT. (2002). "Incomes of agricultural households sector", Luxembourg.

EUROSTAT. (1999). "Incomes of agricultural households sector - 2001 report", Luxembourg.

Förster, M.F. (1994). "Measurement of low incomes and poverty in a perspective of international comparisons" in OECD Labour Market and Social Policy Occasional paper, No. 14, Paris.

Gardner, B.L. (2002). *American Agriculture in the Twentieth Century: How It Flourished and What It Cost*. Harvard University Press. Cambridge, Massachusetts, and London, England.

Gardner, B.L. (2000). "Economic Growth and Low Incomes in Agriculture", *American Journal of Agricultural Economics*, **82**(5), 1059-1074.

Gardner, B.L. (1992). "Changing Economic Perspectives on the Farm Problem", *Journal of Economic Literature*, **30**(1), 62-101.

Hathaway, D.E. (1964). *Problems of progress in the agricultural economy*. Glenview, IL: Scott, Foresman, 1964.

Hausman, J. (1983). "Specification and Estimation of Simultaneous Equation Models", in Giriliches, Z. Intriligator, M. (eds.), *Handbook of Econometrics*, Vol. I, North-Holland, Amsterdam.

Hausman, J.A., Taylor, W.E. (1981). "Panel Data and Unobservable Individual Effects"', *Econometrica*, **49**, 1377-1398.

Heston, A., Summers, R., Aten, B. (2006). Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Johnson, D.G. (1963). "Efficiency and Welfare Implications of U.S. Agricultural Policy", *Journal of Farm Economics*, **45**(2), 331-342.

Johnson, D.G. (1953). "Comparability of Labor Capacities of Farm and Nonfarm Labor", *American Economic Review*, **43**(3), 296-313.

Luxembourg Income Study (LIS) Database, http://www.lisproject.org/techdoc.htm (Australia 1981-2003, Canada 1981-2000, France 1979-94, Finland 1987-2004, Germany 1978-94, Ireland 1987-96, Italy 1987-95, Luxembourg 1985-2000, Norway 1979-2000, UK 1979-95, USA 1979-2004).

Magdalinos, M.A. (1988). "The Local Power of the Tests of Overidentifying Restrictions", *International Economic Review*, **29**(3), p.509-524.

OECD. (2003). "Farm Household Incomes: Issues and Policy Responses", Paris.

OECD. (2001). "Low Incomes in Agriculture in OECD Countries", AGR/CA/APM(2001)19/FINAL, Paris.

OECD. (1999). "Distributional Effects of Agricultural Support in Selected OECD Countries", AGR/CA/(99)8/FINAL, Paris.

Schultz, T.W. (1945). *Agriculture in an unstable economy*. NY: McGraw-Hill.

Shea, J. (1997). "Instrument Relevance in Multivariate Linear Models: A Simple Measure", *Review of Economics and Statistics*, **79**(2), 348-352.

Tweeten, L. (1971). *Foundations of farm policy*. Lincoln: U. of Nebraska Press.

UNESCO. (1999). Classifying Educational Programs, Manual for ISCED-97, Implementation in OECD Countries 1999 Edition. Paris: UNESCO.

Wyhowski, D.J. (1994). "Estimation of a Panel-Data Model in the Presence of Correlation between Regressors and a 2-Way Error Component", *Econometric Theory*, **10**, 130-139.