Farm Household Income

ISSUES AND POLICY RESPONSES

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Foreword

Governments in OECD countries intervene in agriculture with a view to achieving a wide range of economic and social objectives, in particular the improvement of farm household incomes. The first part of this report provides a synthesis of available information and analysis on farm household income issues and draws on a number of studies including the one presented in Part II. The synthesis report describes the income objectives attributed to agricultural policies, reviews the levels, sources and distribution of farm household incomes in recent years, examines the extent to which policies contributed to the observed situation, assesses the effectiveness and cost-efficiency of policies in achieving their income objectives, and suggests policy instruments that would transfer income to farm households more effectively and more equitably.

The second part contains a study that investigates how efficient some of the most commonly used policy interventions are in transferring income to farmers. This notion is referred to as the transfer efficiency of support measures with respect to income.

The authors of the synthesis report in Part I are Catherine Moreddu and Bong Hwan Cho and the author of the study in Part II is Joe Dewbre, all from the OECD Directorate for Food, Agriculture and Fisheries. Part I was declassified by the Working Party on Agricultural Policies and Markets of the Committee for Agriculture in October 2002 and Part II was declassified by the Working Party on Agricultural Policies and Markets of the Committee for Agriculture in May 2002.

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Executive Summary

Governments in OECD countries intervene in agriculture with a view to achieving a wide range of economic and social objectives. One of the most cited reasons for intervention is to improve the income position of farm households. Although largely a legacy of concern with the economic plight of farm families in earlier times, the belief that government intervention is needed to ensure adequate income levels for farm families is wide-spread. References to the level, variability or distribution of farm household income can be found in framework documents, legislation and political speeches, but such references are usually quite imprecise concerning the target populations or the target levels of the variables mentioned. Although there is significant government intervention leading to high levels of support and protection in many countries, it is difficult to identify which policies are designed and put in place to address income problems specifically. This creates considerable difficulty in programme evaluation, difficulties that are compounded by a lack of appropriate data.

Part I of this report examines the income situation of farm households and the influence of agricultural and other (tax and social security) policies on the observed outcomes. It is recognised that support may be targeted to, and impact on, many other variables. These include the technologies used, production levels, the quality of the environment, the production of agriculture-related public goods and the role of the sector in the rural economy. This report does not cover the effects of policy on these or other aspects.

Based on available national information, in most OECD countries, farm households enjoy, on average, ***income levels*** that are close to those in the rest of society. In fact, farm households derive a significant share of income from off-farm sources, mainly other gainful activities but also social transfers and property income. In addition, they often possess significant wealth, in particular from farm assets. At the aggregate national level, farm household income does not appear to exhibit strong ***variability*** because government intervention and the diversification to off-farm sources of income have reduced annual variations. Income variability can, however, be a problem at the individual level. Although average income levels are often "comparable", there is a higher incidence of low income among farm households than among other households and the low-income gap (between low incomes and average incomes) is wider for farm households than for others. In fact, there are ***disparities*** in farm household income by farm size, type and region, but they are smaller than disparities in farm income.

In most OECD countries, large amounts of support are transferred to producers. This support has raised average farm household income to some extent, and has reduced income variability, but it has been at a very high cost to consumers and taxpayers and with significant leakage to unintended beneficiaries. The main problems relate to ***targeting*** – the great bulk of the measures used are generic in nature and go to farm households who do not need it, to ***equity*** – because the measures are still predominantly based on production

or factors of production they fail to change the income distribution in any significant way and to ***leakages*** – much of the support is transferred to unintended beneficiaries.

Part II of the report focuses on this latter issue and investigates how efficient some of the most commonly used policy interventions are in increasing the income of farm households. This concept is referred to as the transfer efficiency of support measures with respect to income.

Broadly speaking, governments help farmers earn more income than the market would otherwise provide them by either: *a)* imposing tariffs/granting export subsidies that drive up the prices consumers pay producers in the domestic market; or *b)* supplementing market receipts with payments drawn directly from budgetary funds. With perfect transfer efficiency (which exists only in theory) every dollar of the extra money consumers pay through higher prices and every dollar of the extra money taxpayers pay to fund direct payments would find its way directly into the income of the intended beneficiaries, *i.e.* farm households.

In reality, however, the greater share of that money ends up in the pockets of others. Farmers can capture only that part of the support that remunerates the factors of production they themselves own. This is typically a rather small share of the total consisting mainly of their land and family labour. Farmers buy most farm inputs from outside the farm and, as a result, input suppliers capture some, usually significant, share of the benefits of support. Similarly, if farmers rent rather than own the land, some of the benefits of support will accrue to the landowners. Moreover, a significant proportion of what consumers and taxpayers pay to support farmers disappears in "resource costs", the resource allocation distortions caused by the support.

The estimates of transfer efficiency reported here suggest that across the OECD area transfer efficiency is rather low. For the most commonly used measure – market price support – perhaps only 25% translates directly into a net income gain for the farm households producing the supported commodity. Even for the best performing of the agricultural support measures studied here – area payments – less than half of the original payment translates into net farm income.

Another phenomenon – the capitalisation of support into land values – means that income benefits accruing to those actually farming the land will be transitory. Land valued at prices inflated by farm support is eventually either sold or rented out. If it is sold, it will be at a "higher-than-otherwise" selling price; if it is rented, the renter will pay a higher-than-otherwise rental rate. These "higher-than-otherwise" selling prices or rental rates allow the sellers and landlords to capture the full economic benefits of support. However, those buying or renting that land to enter the sector or to expand will not reap any net economic benefit from the support because the prices they have to pay reflect the expected value of the support. In fact, this "second generation" of farm households inherits higher capital (or operating) costs and reduced farm profitability.

This study confirms results from earlier work that there is a strong inverse correlation between the extent to which a measure distorts production and trade, and its efficiency in transferring income benefits to those who farm. It also shows that even the best performing measures are relatively ineffective in income transfer efficiency terms and allow a large share of the support to go to unintended recipients.

The great bulk of support to agriculture in the OECD area is still delivered through mechanisms that distort production and trade and are inefficient in generating increased

net income for farmers. It is in fact difficult to envisage any specifically agricultural measure that could achieve farm income support and protection on a continuing basis without engendering significant waste and distortion.

In the light of this conclusion, budgetary payments that are decoupled from agricultural activity altogether would transfer income to selected farm households more efficiently. Such measures minimise economic distortions and distributive leakages because the effects on production decisions are minimal. In addition, they can be targeted and delivered to those households that are deemed to warrant assistance. In order to improve economic efficiency, it is important to make a correct assessment of the problems and needs of the sector. The order in which different remedies are applied is also important. Firstly, efforts should be made to develop and implement market-based solutions where these are feasible, including through investment to general services to the sector that improve the functioning of agricultural markets and allow farmers to increase their competitiveness. Targeted measures to correct market failures linked to the provision of public goods in the agricultural sector should then be applied, as they will affect income. Agricultural safety nets could then be envisaged to address risk management failures. Any outstanding income problem could finally be addressed; best through general tax and social systems that would ensure equal treatment *vis-à-vis* other households. In order to do so, income objectives should be clearly defined and comprehensive information on the economic situation of farm households should be collected in a flexible way to allow an assessment and monitoring of income deficiencies.

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Part I

Farm Household Income Issues in OECD Countries

In recent years, several OECD studies have looked at income issues in the agricultural sector. This synthesis combines and updates material from recently published reports[1] to produce a comprehensive study of farm household income issues in OECD countries. The background is one of significant government intervention in the agricultural sectors of many OECD countries that has led to high levels of support and protection, often justified in terms of a need to support the incomes of farmers and their families. This synthesis first presents income objectives in OECD countries and discusses measurement problems. Without attempting cross-country comparisons, it then reviews the income situation of farm households in OECD countries for which data are available, and examines the role which agricultural policies, whatever their objectives, have played in determining the observed outcomes. Finally, policy solutions are proposed that would improve farm household income more effectively and equitably.

I.1. What are the income objectives?

OECD countries have multiple and sometimes contradictory agricultural policy objectives. Incomes of farm households have traditionally featured prominently but in recent years objectives related to the environment, sustainability, rural development and food safety have also become important. Despite changing emphasis among the objectives, support to agriculture remains dominated by broad measures such as price support, output and input subsidies or area payments.[2] These measures for the most part are implemented in undifferentiated or untargeted ways. It is often difficult to associate a policy with a specific objective, and in particular, to identify the policies that are designed and put in place to address income problems.

While income objectives are relatively common in OECD countries, they are not often clearly expressed. Income concerns are sometimes reflected formally in contemporary policy statements, with various degrees of precision. In other cases, the declaration of an income objective goes back several decades, to when support programmes were initiated. More commonly, however, policy-makers make informal references to their concerns about the level and/or stability of farm incomes, or more broadly about the financial situation[3] or the welfare of farm families.[4] OECD member countries have typically framed income objectives in terms of distribution or equity (that is, farm household income levels relative to these of households in the economy as a whole).

In some countries, income objectives are or were explicitly stated. The guiding statement contained in the Treaty of Rome (1957), establishing the European Community, refers to the desire to "ensure a fair standard of living for the agricultural community". The Treaty has been amended several times but this statement has been retained. However, as the agricultural situation has developed the range of concerns has been expanded to cover new issues such as environment, sustainability and rural development, although measures specifically targeted to these objectives still only account for a relatively small share of total support. On the other hand, in the context of the reforms of the Common Agricultural

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Policy that took place in 1992 and in 2000, the budgetary payments introduced to compensate farmers for the reduction in intervention prices (so-called "compensation payments") clearly had the objective of offsetting the negative effects of the reform on agricultural incomes.

In some countries, income objectives have become less explicit in more recent policy statements, although concerns with regard to farm household income remain. In Sweden, up to the reform of 1990, the objective was that "farmers shall have a standard (of living) which is equal to that of other comparable groups". In Japan until recently the key policy statements described the main objective of agricultural policy as being to "enable farmers through increased farm income to enjoy equal standards of living with workers in other industries". However, there is no such statement in the text of the Basic Law adopted in 1999.

Some countries, such as Greece and Turkey, in which agriculture is relatively important in the economy, express income objectives more explicitly. The main element of interest for Greek agricultural policy is "farmers' income". The aim of rural development projects in Turkey is to "increase farmers' income". In some countries such as Poland, even though income objectives are not explicit in policy statements, it is pointed out that "very low and declining farmers' incomes" are one of the main agricultural problems.

Reflecting the joint objective of ensuring that farm incomes are "comparable" and "less volatile", Canadian policies emphasise the protection of the incomes of efficient producers from market price instability. This is in addition to the goal of providing farmers with a standard of living comparable to that in the rest of the economy. There are similar concerns in the United States. On the other hand, policy documents for Australia and New Zealand emphasise the competitiveness and efficiency of the sector through policy reform. The government role with respect to income issues is explicitly mentioned as being to protect incomes from sharp and unexpected decreases, as with disaster relief measures.

Despite their prominence, income objectives are seldom well defined, either in terms of the income variable being targeted, or the intended recipients. Some policy measures, such as income safety nets for income vulnerable groups or direct payments for disadvantaged areas suggest that at least in a few cases there has been a clarification of what income objectives mean, but there are rather few examples of such measures.

This synthesis report focuses on income issues and does not attempt to evaluate the effectiveness of agricultural support and protection in achieving other stated objectives. Governments justify their intervention in the agricultural sector both on equity grounds and on market failure grounds specifically with respect to risk management and to the provision of agriculture-related public goods. The risk management rationale assumes that, in the absence or incompleteness of contingency markets,[5] uncertainties affect producers' decisions regarding production and the use of resources, and lead them to produce below the level of output that would maximise profit in the absence of risk. Safety net measures that protect farmers against downside risks can thus be envisaged. Regarding equity concerns, sector-wide income support was introduced at a time when rural areas and farm households were lagging behind. Is there evidence that the income situation of farm households is currently systematically worse than that of other types of households? An attempt will be made to answer this question in Section I.3.

I.2. How can achievement of the different income objectives be measured?

The vagueness of policy statements, the different interpretations given by countries, and the ambiguities concerning just what is being targeted makes it difficult to measure the performance of policy relative to income objectives. Because it is rarely the case that clear criteria are given concerning the targeted households and the measure of income of interest, analysts have had to engage in a certain amount of interpretation of what is meant by the objective and to propose indicators to be used to gauge progress towards it.

Farm income provides only a very partial view of the income situation of a farm household. First, farm income, as reported in farm accounts, varies depending on the share of profit that is allocated to current income *versus* investment. Moreover, farm households derive a significant share of their income from sources other than farming. In order to reflect the income situation of farm households, all sources of income should be taken into account. For a full assessment of the economic situation of farm families, farm and household assets should also be considered in combination with income, but because of data and resource constraints, this study focuses only on the income situation of farm households (Box I.1 briefly discusses the issue of wealth).

Another problem concerns availability, quality and access to the relevant data. Do the data collected in OECD countries allow progress towards income objectives to be systematically and accurately measured? For many countries the answer is no. Sometimes the data are seriously out of date. Additional difficulties are created by the fact that in many countries the definitions adopted – of households, of income, etc. – are too narrow to allow the real income status of farm households to be evaluated. The number of farm households in economy-wide income surveys is often too small to be representative, which makes it difficult to compare the situation of farm households with that of other households. Finally, farm household income can be underestimated. Income in-kind is often not taken into account and there can be problems linked to confidentiality and asymmetric information with reporting income in surveys. Farm self-employment income, in particular, might not be fully captured. The types of data available to analyse the income situation of farm households are described in Box I.2 and some information on data sources and definitions is given in Annex I.1.

It is not surprising therefore that even greater difficulties are experienced in comparing the income situation of farm households across countries. First, the definition of farm households varies both with respect to who constitutes a household (which family members) and with respect to what constitutes a farm household (what level of sales, amount of land farmed, share of income from farming or other indicator qualifies a household as a farm household). There are enormous differences among countries with respect to these variables. Second, there are differences in the indicators of income that are reported although with detailed information on farm accounts a common definition of farm income can be adopted. The coverage of income sources often differs. In particular, there are still many countries in which off-farm sources of income of farm households are not reported. For these reasons, comparisons across countries have not been attempted in this study. For each country where data are available, income components are compared between farm and non-farm sectors and across various groups in the agricultural sector.

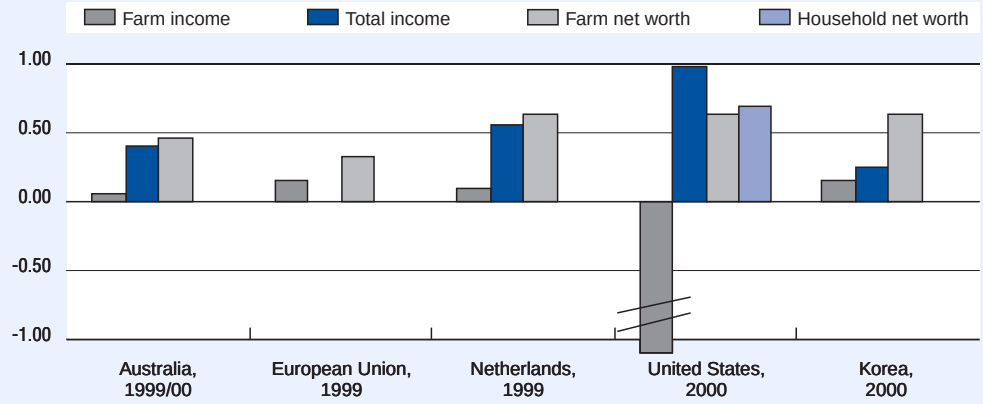
For the purposes of this study, the broadest definition of farm households and their income sources has been retained. Total household income includes all earned income both from farming and non-farm activities, property income from investments, and social

Box I.1. **Wealth and income**

In addition to total or disposable household income, it is important to consider wealth to assess the financial situation of a household, in particular in the case of farm families who own part or all of the factors of production farmed. The wealth of an individual can be defined as his total stock of tangible or intangible possessions which are capable of being exchanged for money or other goods (Hill, 1996). Not only does wealth give rise to income but it provides security and financial leverage. It therefore affects the ability to consume and, in the case of farms, the viability of the activity. Wealth is often measured by net worth, which is the difference between assets and liabilities.

Farm assets include current assets such as crop and livestock for sale and stocks of input, and long term assets such as farmland, buildings, machinery and equipment, breeding livestock, property rights and quotas. The value of farm assets and liabilities is reported in farm structural surveys. Low-income farm families often possess significant net worth and the net worth of farm households is usually more equally distributed than their total income (see graph below and Annex Graph AI.2.4). But farm assets and liabilities are an imperfect guide to the wealth or net worth of farm households, who often also own non-farm assets. Non-farm assets can be the result of a strategy to diversify sources of income (Section I.3). Only a US survey (Agricultural Resource Management Study, ARMS) reports the value of non-farm assets of farm households.

Average income and net worth of farms in the first quartile (25% smallest farms) as a ratio of the average of all farms



See Diagram I.1 for a definition of income indicators.
Source: OECD structural database.

transfers from pension, health, unemployment schemes and various social safety nets. Disposable income is the total income available to households after taxes have been deducted (see Diagram I.1 for a definition of the income indicators used in Part I).

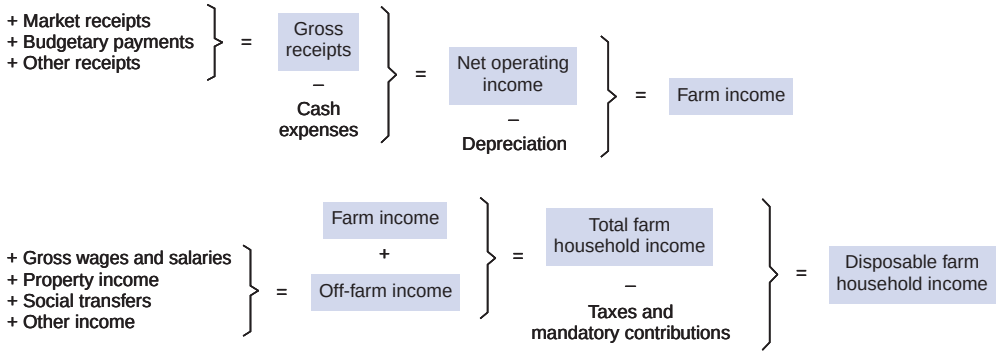
Finally, there are a number of statistical indicators to describe the level and distribution of income. Different benchmarks for comparison can be retained: all households, other (than farm) households, rural non-farm households, other similar households (self-employed workers, salaried workers' households, etc.), or urban *versus* rural households. Various indicators of dispersion such as the income gap, the Lorenz Curve, the Gini coefficient, the low-income rate, and the Sen index, have been used in the studies reported here.[6] To measure low income, the relative approach ("having less than

Box I.2. **Farm household data sources: macroeconomic *versus* microeconomic data**

Macroeconomic accounts of the agricultural sector provide an aggregate measure of farm income (OECD, 1999b). In most cases, these data do not include non-agricultural incomes. A EUROSTAT project collects macroeconomic data on the total income of agricultural households for European Union (EU) member countries (EUROSTAT, 1999) and these data are used here for some countries. However, they often refer to a narrow definition of farm households (main occupation farms of a minimum size for example). Consequently, whenever possible, national statistics that define farm households more broadly are used, in order to give a wider picture of the sector. With national account/ macroeconomic data, the level and composition of the total income of farm households can be examined and compared to that of other sectors.

To look at the distribution of income or the incidence of low income among farm households compared to other households, at the change in income over time, and the impact of agricultural, social and taxation policies, microeconomic data are necessary. They either come from specific surveys (farm, household expenditure, or income surveys), or from tax and social transfers files. Economy-wide surveys allow comparison between farm households and other households. In many cases, however, the sample of farm households proves to be too small to allow a detailed and representative distributional analysis. The LIS (Luxembourg Income Study), which contains micro data from national household surveys, allows such a comparison for at least some countries and has been used in the analysis of the incidence of low income in different categories of households reported in OECD (2001a) and summarised in this report. Specific farm surveys provide useful structural information on farm households, allowing the income situation to be related to structural characteristics, but they do not permit direct comparison with other households (unless linked with an economy-wide survey). The OECD structural database, which has been used to analyse the impact of support on the distribution of income, contains such data.

Diagram I.1. **Components of farm household income**



Source: OECD.

others" or under 50% of the median income), which is mostly used for comparative international studies, has been adopted (OECD, 2001a).

Issues related to farm household income data availability and quality are not just, or even primarily of interest to analysts. The principal beneficiaries of improved information would be policy makers and the public they serve. Until the coverage, timeliness and

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consistency of national microeconomic data is improved, policy measures, ostensibly aimed at improving the incomes of farm households, will be implemented without adequate knowledge of the nature, incidence or even existence of the problem that they are attempting to solve.

I.3. What is the income situation of farm households?

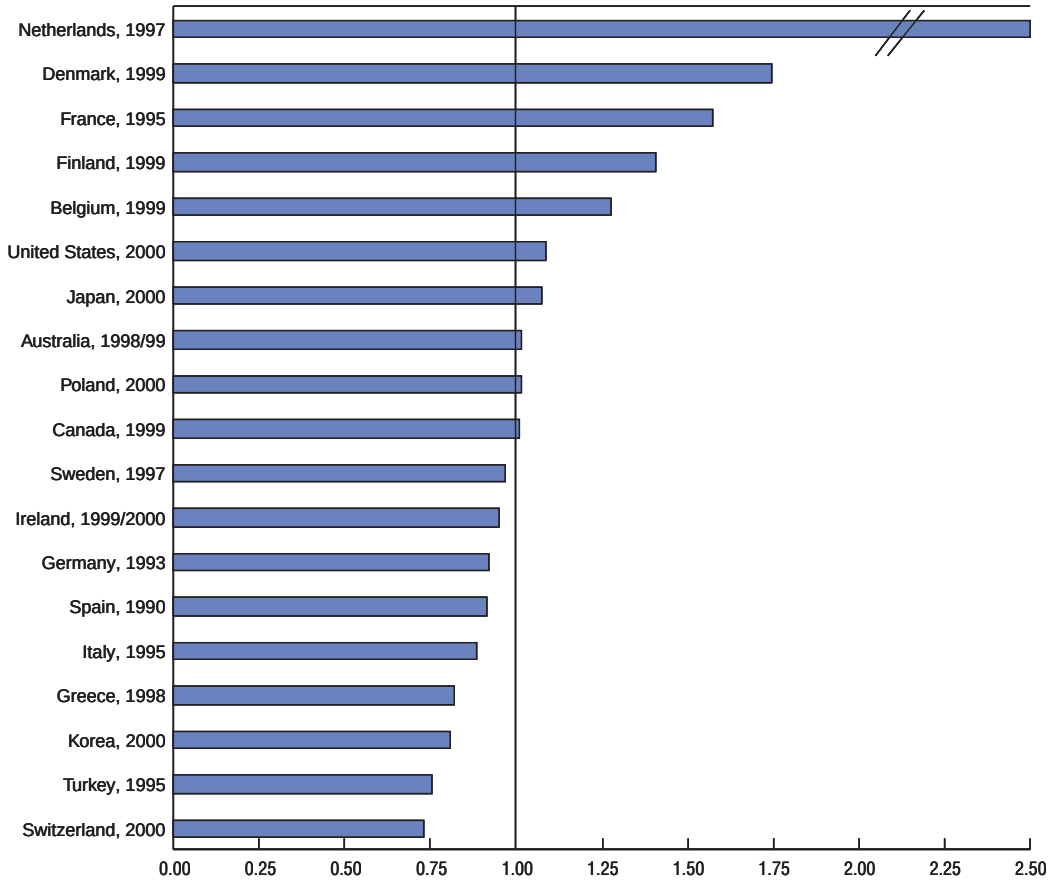
The picture that will be presented here is that emerging from national statistics. In this section, farm household income will be first compared to that of other households and the composition of farm household income will be examined. Disparities within the sector and the question of income variability will then be considered and finally, the incidence of low income will be reviewed.

How do the incomes of farm households compare on average with those in the rest of society?

In most OECD countries for which data are available, the average income of farm households is close to the economy-wide average (Graph I.1). For the average of the three most recent years (when available), farm household incomes are significantly higher (by

Graph I.1. **Total income of farm households as a ratio of that of all/other households**

Most recent year available

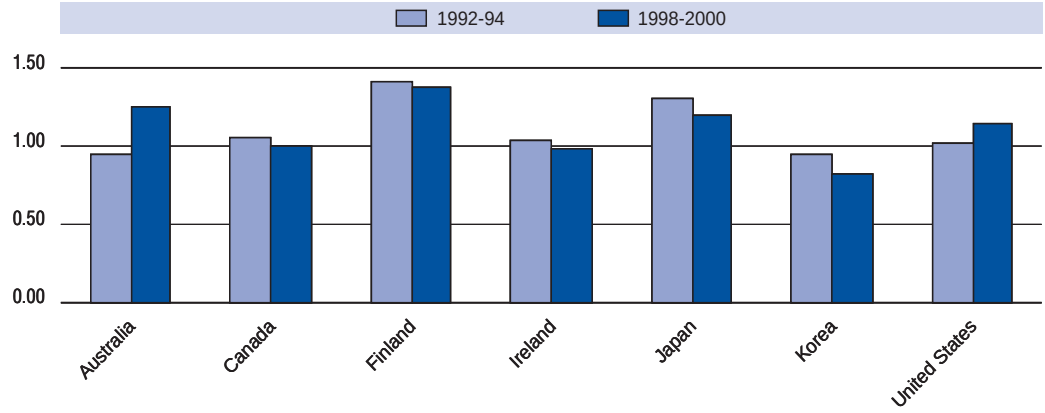


All households except for Japan, where it is workers' households and Korea, where it is urban households.
Source: Secretariat's calculation based on national statistics and EUROSTAT database (EUROSTAT, 1999 and 2002).

over 15%) in the Netherlands, Denmark, France, Finland and Belgium, and significantly lower (by over 15%) in Greece, Korea, Turkey and Switzerland.[7] In the few countries where the data were available to observe the longer-term trend, the relative income position of farm households often deteriorated in the late 1990s compared to the mid-1990s. However, except in the case of Korea, farm household income remained higher than that of other households (Graph I.2).

Graph I.2. **Evolution of the total income of farm households as a ratio of that of all/other households**

From the mid-1990s to the late 1990s



All households except for Japan, where it is workers' households and Korea, where it is urban households.
Source: Secretariat's calculation based on national statistics.

Reporting the same type of income comparison in the late-1980s and mid-1990s respectively, OECD (1995 and 1995a) and OECD (1998) already found that, in most countries for which data are available, farm household income was, on average, at the same level or higher than that of other households. The conclusion drawn at the time, that there was no widespread income problem in agriculture, still holds in view of the most recent data.

What are the sources of farm household income? How important is agricultural income?

Farm households derive a significant share of income from off-farm sources (Graphs I.3 and I.4), even when a very restrictive definition[8] of farm households is adopted. When a broad definition of farm households is adopted, farm income is not even the main source, reflecting the diversity of farm households, which include pluriactive, pension or hobby farm households.

Other income sources include salaries and wages from other activities, investment income such as interest, dividends or rents, and social transfers from health, pension, unemployment and/or child allowance schemes. Regardless of definition, in three-quarters of the countries examined, wages and salaries were the main source of off-farm income. Often, the farm operator himself is employed outside the farm but increasingly the spouse may also have off-farm employment. In countries where the household is defined more broadly than the nuclear family, *i.e.* includes more than one generation of adults and/or adult siblings, the share of labour income is higher than it would otherwise be (*e.g.* Japan). Cases where social transfers are higher than salaries and wages are found among countries restricting the definition of a farm household to the operator, whose

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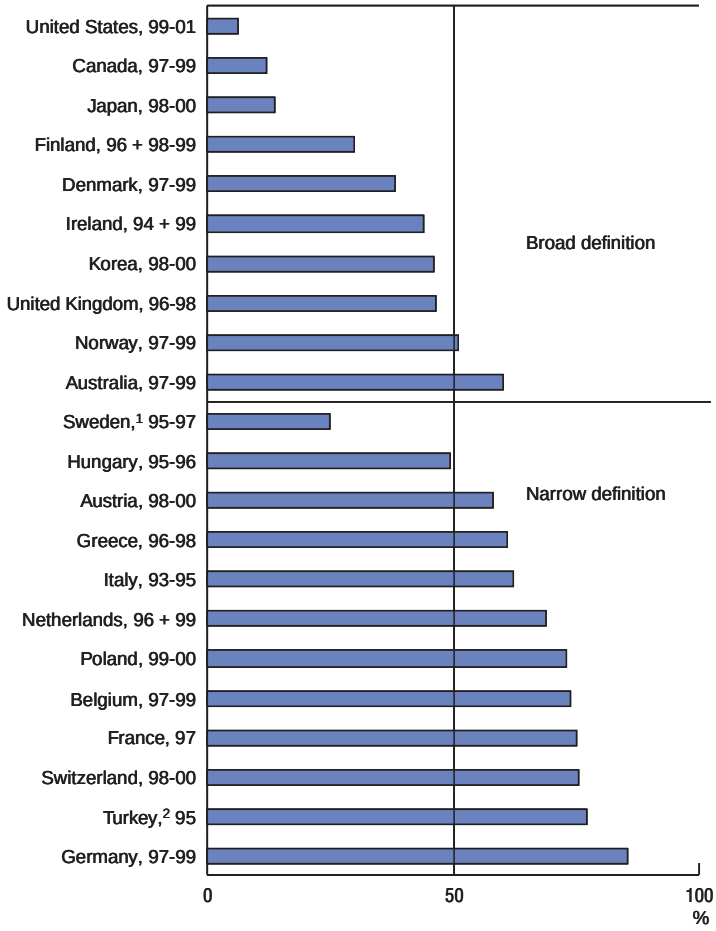
Graph I.3. **Percentage share of farm income in total income of farm households**

Average of the three most recent years available



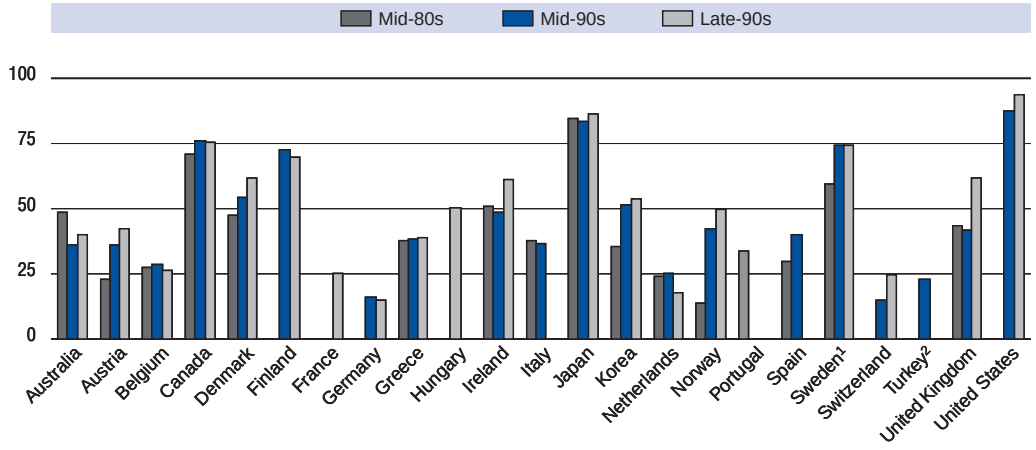
1. Income from independent activities.
2. Agricultural households in rural areas.

Source: Secretariat's calculation based on national statistics and EUROSTAT database (EUROSTAT, 1999 and 2002).

main occupation is farming, and the spouse. Finally, property income is the primary source of off-farm income in the United Kingdom only but comes next in importance in close to a third of the cases reviewed.

These results also confirm and reinforce the findings of OECD (1995) and OECD (1998). The share of off-farm income has increased in many countries for which data are available (Graph I.4), the most notable exceptions being Japan where the share of off-farm income has been constantly high over the period and some EU member countries where the definition of farm households is narrow. For these countries in particular it is not always possible to track the evolution of the share of off-farm income in total farm household income because once off-farm income reaches a certain share, those households are omitted from the data. Except for a small number of countries where farm income is variable, the broad picture of income composition does not depend on the year chosen. For example, the variation in the share of the different types of income did not exceed 10% when the most recent year was used rather than the three-year average of the most recent years.

Graph I.4. **Share of off-farm income in total income of farm households from the mid-1980s to the late-1990s**



Average of two or three years whenever possible.
1. Income from independent activities.
2. Agricultural households in rural areas.
Source: Secretariat's calculation based on national statistics and EUROSTAT database (EUROSTAT, 1999 and 2002).

How stable are farm household incomes? How did they evolve in the 1990s?

Agricultural activity is subject to different risks, some natural or biological in origin, others economic. These risks affect production volumes and prices and are thought to result in receipts and incomes that are more variable than in many other sectors. Farmers adopt strategies to reduce the variability of their total income.[9] A number of market-based tools are at their disposal, like diversification of income sources, capital and debt management, marketing techniques, hedging on futures markets and insurance. In most countries, agricultural policies, whatever their objective, also shield farm households against large losses of income (Section I.4). Social policies play a role in providing a safety net and fiscal arrangements can help to smooth annual income variations (OECD, 2000, Box 7). For example, some fiscal arrangements allow a farm household to defer a share of taxable income from a high-income year to a subsequent year when income is lower.

As a result of this combination of factors, aggregate farm income at the national level does not appear to exhibit strong variability. At the individual level, excessive farm income variability can, however, be a problem, in particular for farms that have not been able to adopt basic income risk strategies and, as a result, are too dependent on one source of income or do not have sufficient savings or capital raising capacity.

Farm household income is generally more stable than farm income as non-farm income, which accounts for a significant part of total farm household income, is often more stable than farm income (Table I.1).[10] As a result, the total income of farm households is generally not significantly more variable than that of other households, with the notable exception of Australia where natural conditions are very variable and farmers are not shielded from world price variability (Annex Graph AI.2.1).

In a number of countries, farm income was lower at the end of the 1990s than during the first half of the decade due to a decline in world commodity prices (Table I.2). However, the total income of farm households actually increased in most countries for which data are available. In Australia and some EU member countries for which data are available,

Table I.1. **Income variability in selected OECD countries**

In national currency, deflated by the GDP deflator, 1995 = 100

Coefficient of variation[1] over the period	Australia	Canada	Denmark	Japan	Norway	United Kingdom	United States
	1989-99	1989-97	1989-99	1990-2000	1989-99	1988-98	1991-99
Farm income	0.49	0.12	0.16	0.13	0.14	0.14	0.28
Total income of farm households	0.31	0.06	0.08	0.03	0.06	0.07	0.14
Total income of all households[2]	0.12	0.01	n.a.	0.04	n.a.	n.a.	0.08

n.a. Not available.
See Diagram I.1 for a definition of income indicators.
1. The coefficient of variation is the standard deviation divided by the average for the period.
2. Except for Japan, where it is workers' households.
Source: Secretariat's calculations based on national statistics; GDP deflator from OECD *National Accounts* database.

Table I.2. **Percentage change in average income per household between the first half of the 1990s and the end of the 1990s**

Deflated by the GDP deflator, 1995 = 100

	Period	Farm income	Total income of farm households	Total income of all households
Australia	1999-98/1992-94	44	35	–18
Austria	1998-2000/1993-94	0	4	n.a.
Belgium	1999-98/1991	–6	–6	n.a.
Denmark	1999-98/1992-94	7	5	6
Finland	1998-99/1994	19	5	8
Ireland	1999/2000/1987	12	41	45
Japan	1998-2000/1992-94	–20	–3	–6
Korea	1998-2000/1992-94	–8	1	17
Norway	1999-98/1992-94	–19	7	n.a.
United States	1998-2000/1992-94	–12	33	19

See Diagram I.1 for a definition of income indicators.
Source: Secretariat's calculations based on national statistics; GDP deflator from OECD *National Accounts* database.

farm income increased during the period, sometimes by a higher percentage than the total income of farm households. As pointed out in Frawley *et al.* (2000) reported in OECD (2001a) (see section on low income) farm income improvements in Ireland can be explained by changes in the agricultural policy mix and the long-term decline in the actual number of farm households. A report by the French Ministry of Agriculture (Blogowski and Pingault, 2002) on adjustments in the field crop sector in the 1990s finds that higher farm incomes were totally attributable to increases in farm size.

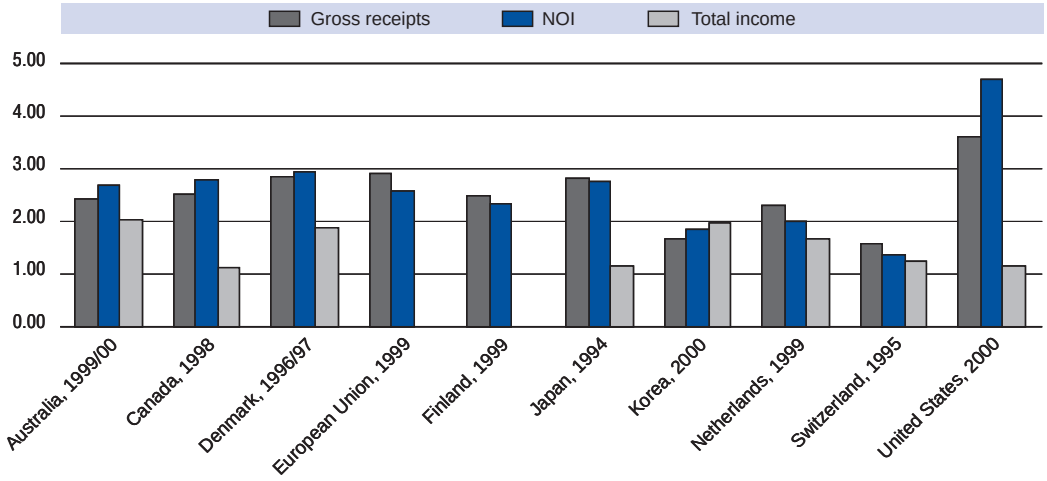
As shown in Annex Graph AI.2.1, in most countries for which time series are reported, the total income of farm households has been increasing since the mid-1980s. This is generally not the case for farm income, which generally fluctuates without following any clear trend. Norway is the only country where farm income is declining all through the period.

How large are income disparities?

Many factors such as region, the structural characteristics of the farm and the household, and the economic environment, in particular the opportunities for off-farm earnings, affect the total income of farm households. Differences in average income by

farm size and farm type in selected OECD countries are presented here, based on structural farm account data for selected countries.[11] In most countries reviewed, the average net operating income (NOI)[12] of farms in the top quartile[13] is two to three times bigger than that of all farms (Graph I.5). The exceptions are Switzerland where farm income inequalities are smaller and the United States where they are much larger. In all cases, the distribution of income reflects that of gross receipts, which, in part, depends on the definition of farms included in survey data. The distribution has been truncated when minimum limits on farmland, the value of commercial sales, or the share of income from farming or time spent on farming activities are placed on survey farms.

Graph I.5. **Average gross receipts, net operating farm income and total income of the top quartile (25% largest farms) as a ratio of the average of all farms**



NOI: Net operating income. See Diagram I.1 for a definition of income indicators.
Source: OECD structural database. Updated from OECD, 1999a.

In all countries where off-farm income is known, its inclusion narrows the dispersion of income by farm size and the total income of farm households is therefore more equally distributed than that of farm income.[14] Also the disposable income of main occupation[15] farm households, which are more dependent on farm income, is more unequally distributed than the disposable income of more broadly defined farm households[16] (OECD, 2001a).

Owing to differences in farm size, in productivity and in levels of support between commodities, there are also income disparities between farm types although they are not as large as between farms classified by gross sales. For example, in the European Union, the average farm income of dairy farms and pig/poultry farms, which account respectively for 12% and 2% of all farms, is respectively 50% and 30% higher than that of all farms, while in crop and cattle farms, average farm income is 20% lower than the average of all farms (Graph I.6). In Canada, the average farm income, before depreciation, of dairy farms (9% of all farms) is almost three times higher than that of all farms, while the average for grain and oilseed farms (40% of all farms) is the same as for all farms. Cattle farms (29% of all farms) report farm incomes less than half the overall average. Differences in farm income between farm types are relatively lower in Australia and much higher in the United States. In all cases where off-farm income is known, differences in total household income are lower than in farm income. This is particularly obvious when looking at US data, the

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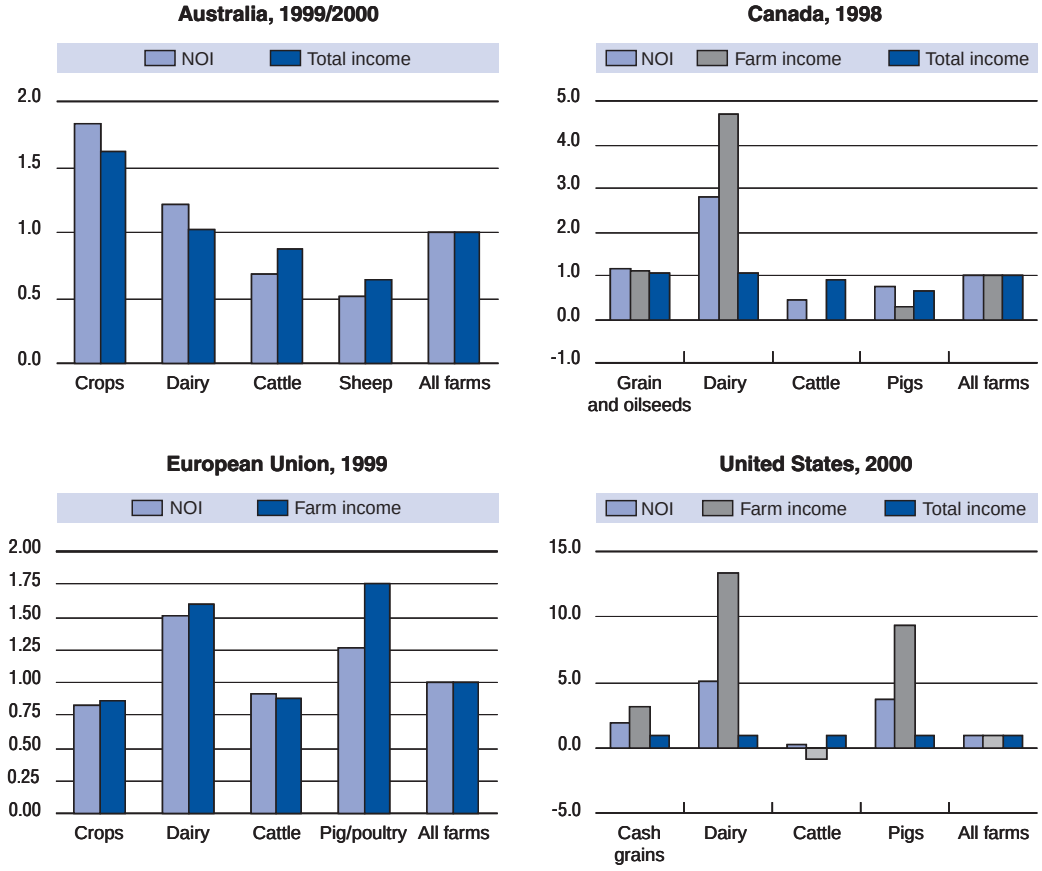
Graph I.6. **Comparison of income between farm types: average income of each farm type as a ratio of the average of all farms**



NOI: Net operating income. See Diagram I.1 for a definition of income indicators.
Source: OECD structural database. Updated from OECD, 1999a.

average farm income of cash grain farms and dairy farms is several times higher than that of all farms, but their total income is close to the average of all farms.

Similarly, we could look at income differences by region, as was done briefly in OECD (1999a). They stem from regional variations in the economic size of farms, type of farming and rate of support for each commodity, and depend on how widely regions are defined. For example, in Denmark differences in income across regions were less than across farm types or size classes. In the case of Switzerland, the average farm income in lowland areas was 11% higher than the average of all farms while that of mountain farms was 21% lower. As was the case across farms of different size and type, when non-agricultural incomes are taken into account, regional differences in income are reduced.

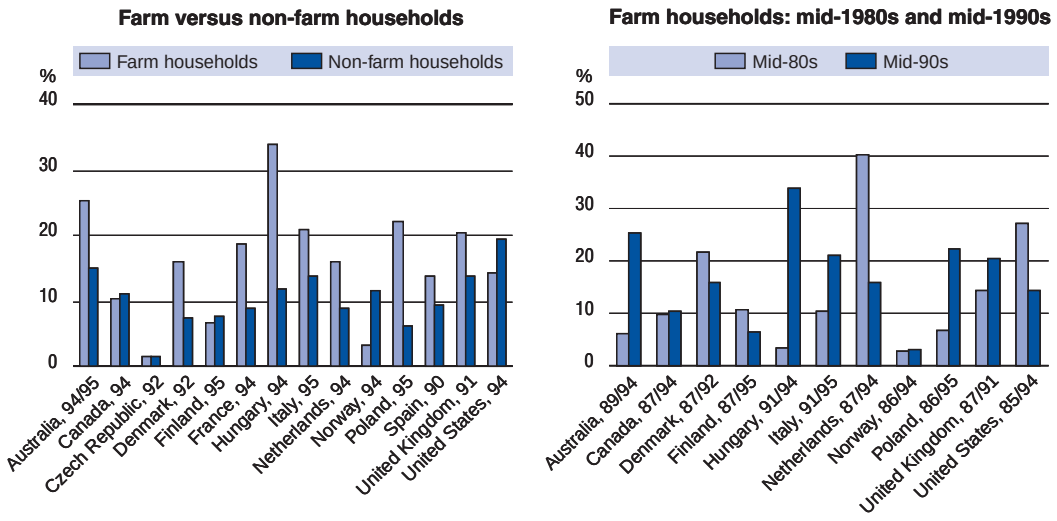
Is low income more pervasive among farm households than in the rest of society?

The incidence of low income[17] is examined here with three indicators: the low-income rate, the low-income gap and the Sen index,[18] as was done in OECD (2001a) using the LIS database. In many countries, all three indicators suggest that, in the mid-1990s, the incidence of low income was higher among farm households than among non-farm households. The low-income rate was higher for farm households than non-farm households in 9 out of 14 countries, slightly lower in three (Canada, the Czech Republic and

Finland) but significantly better in two (Norway and the United States) (Graph I.7). The low-income gap was bigger for farm than for non-farm households in all the examined countries (Graph I.8). When the analysis is repeated using a narrow definition of the farm household inequality is greater. In other words farm households who rely more on farm activities are more frequently included in the low-income category. This confirms the importance of off-farm activities. The results from the calculation of the Sen index also show that the incidence of low income is higher in agriculture than in other sectors for 8 out of 11 countries (Graph I.9).

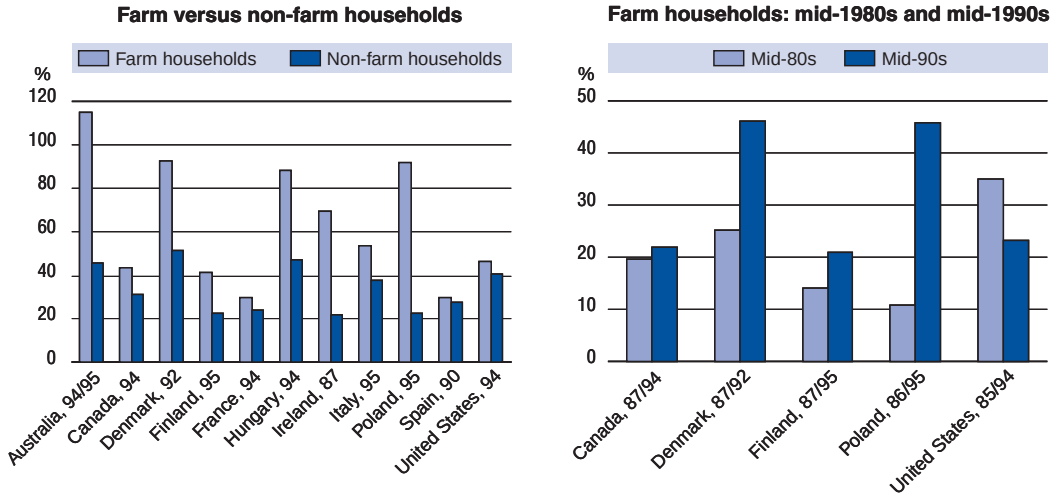
Moreover changes in the Sen index from the mid-1980s to the mid-1990s suggest that the low-income situation of farm households has not improved in many countries (Graphs I.7, I.8 and I.9). The low-income gap also widened during the same period (in four out of the five countries examined, with the notable exception of the United States).

Graph I.7. **Low-income rate**



Source: OECD, 2001a (LIS data).

Graph I.8. **Low-income gap**



Source: OECD, 2001a (LIS data).

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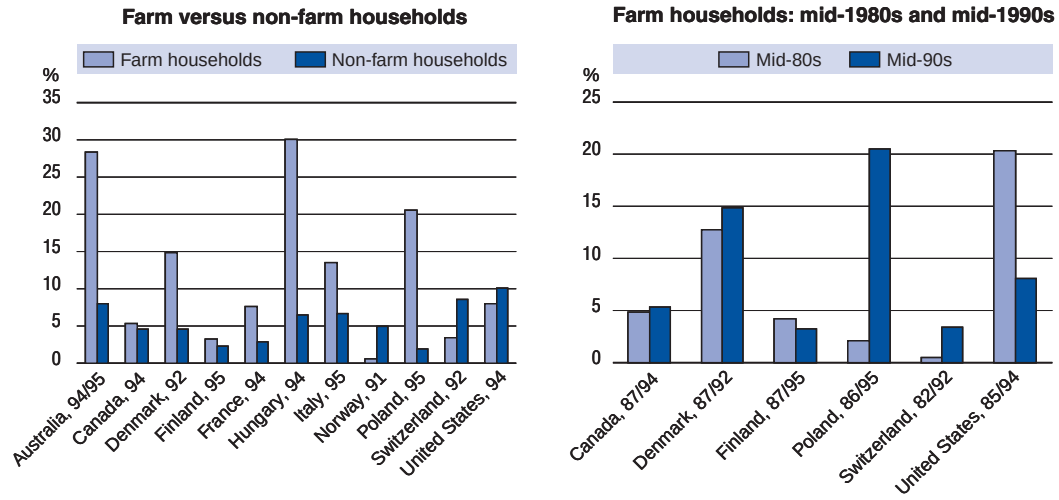
Graph I.9. **Sen index**



Source: OECD, 2001a (LIS data).

Compared with the low-income rate, income distribution, estimated by the Gini coefficient has not changed very much over time (OECD, 2001a).

Some countries have seen an improvement in the low-income situation of farm households over the review period. For example, according to an Irish study (Frawley *et al.*, 2000), data from 1997 indicate a decline in the incidence and risk of poverty for farmers in Ireland. While households headed by farmers made up 12% of all poor households in 1987, it was 4% in 1997. The study says that the decline in farm poverty in the late 1990s reflects partly improvements in basic levels of farm household income from both the current mix of farm support policies, and the long-term decline in the actual number of farm households. Similar conclusions would apply to other OECD countries.

Both farm and total income tend to increase in accordance with farm size. However, the smallest farms do not always have the smallest total incomes, reflecting the importance of off-farm incomes, in particular non-farm earnings. A higher incidence of low income in farm households suggests that opportunities for off-farm activity may be restricted for some farm households. In general, the opportunities for off-farm activities are relatively limited in remote rural areas, for persons with lower education levels, and for older people.

The share of households whose head did not receive post-secondary education is generally higher among farm households than among non-farm households. In most cases, this percentage is higher again among low-income households. Generally the older age groups have the lowest level of earnings. However, they receive the largest share of social transfers. The incidence of low income is also high for the younger age group (OECD, 2001a).

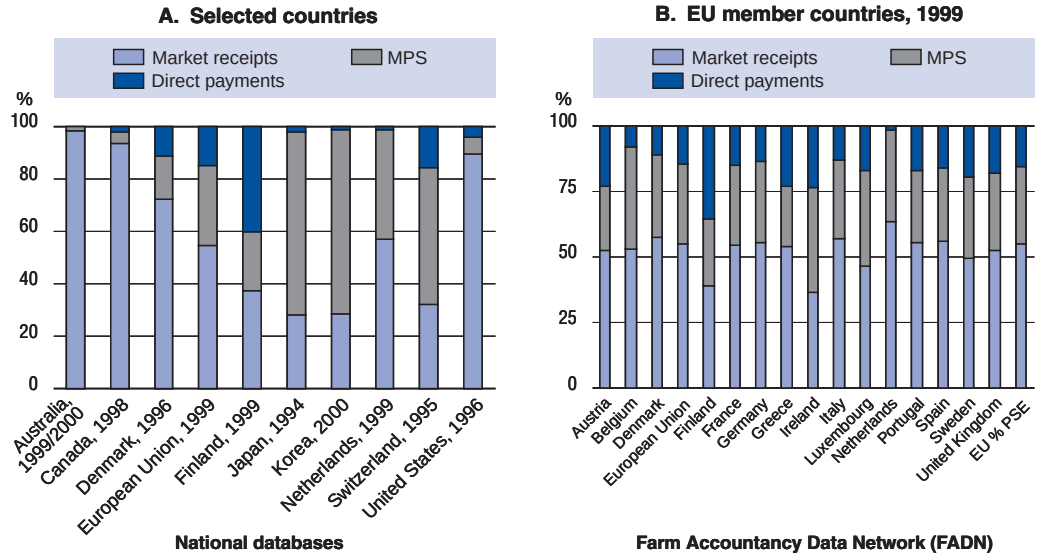
I.4. What is the impact of agricultural support policies, fiscal and social policies on farm household income?

The previous sections have briefly reviewed the income situation of farm households, but what can be said concerning the impact of policies, whether agricultural or non-sectoral, on the incomes of farm households and their distribution? These questions are asked irrespective of the implicit or explicit objectives associated with the policies in question.

How important is government support in farm income?

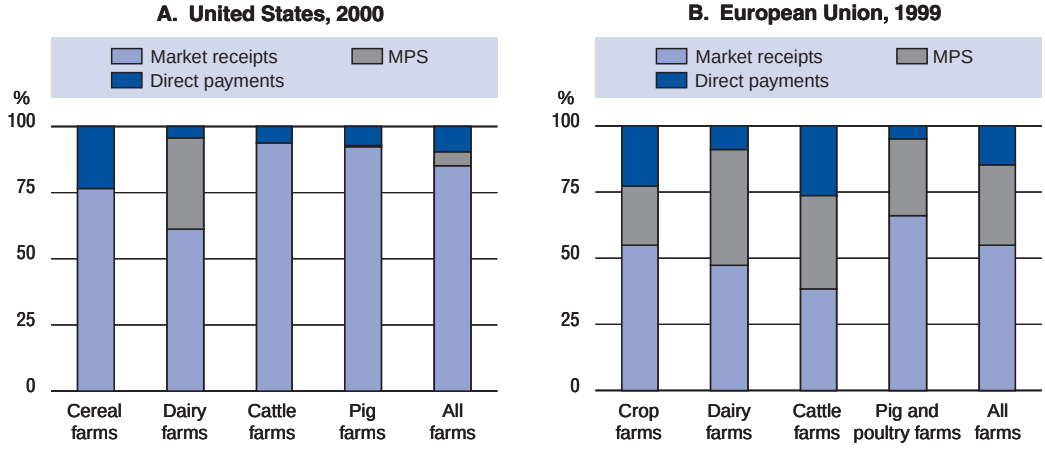
This question is rather difficult to answer, although in static terms, the share of support in total agricultural receipts can be estimated. The Producer Support Estimate (PSE) expressed as a percentage of gross receipts explains the share of gross receipts that comes from government support. For example, in the OECD area, one third of gross receipts resulted from support in 1999-2001, down from 38% in the mid-1980s (OECD, 2002a). Support levels vary by country and by commodity depending on policies in place and are summarised in Annex Graph AI.2.2. For selected OECD countries, Graphs I.10 and I.11 show the relative share of market receipts and different types of support in gross receipts, for the

Graph I.10. **Percentage share of support in gross receipts in selected OECD countries**



MPS: Market price support.
Support includes market price support and budgetary payments to producers.
Source: OECD structural database and PSE/CSE database.

Graph I.11. **Percentage share of support in gross receipts by farm type**



MPS: Market price support.
Support includes market price support and budgetary payments to producers.
Source: OECD structural database.

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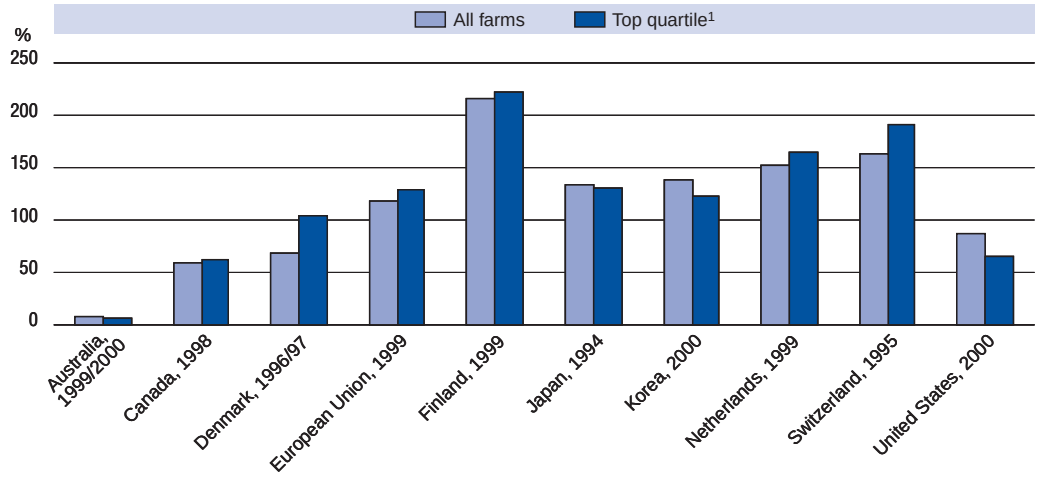
Graph I.12. **Support in relation to net operating income, all farms and top quartile**



Support includes market price support and budgetary payments to producers.
1. 25% largest farms, based on gross sales.
Source: OECD structural database and PSE/CSE database.

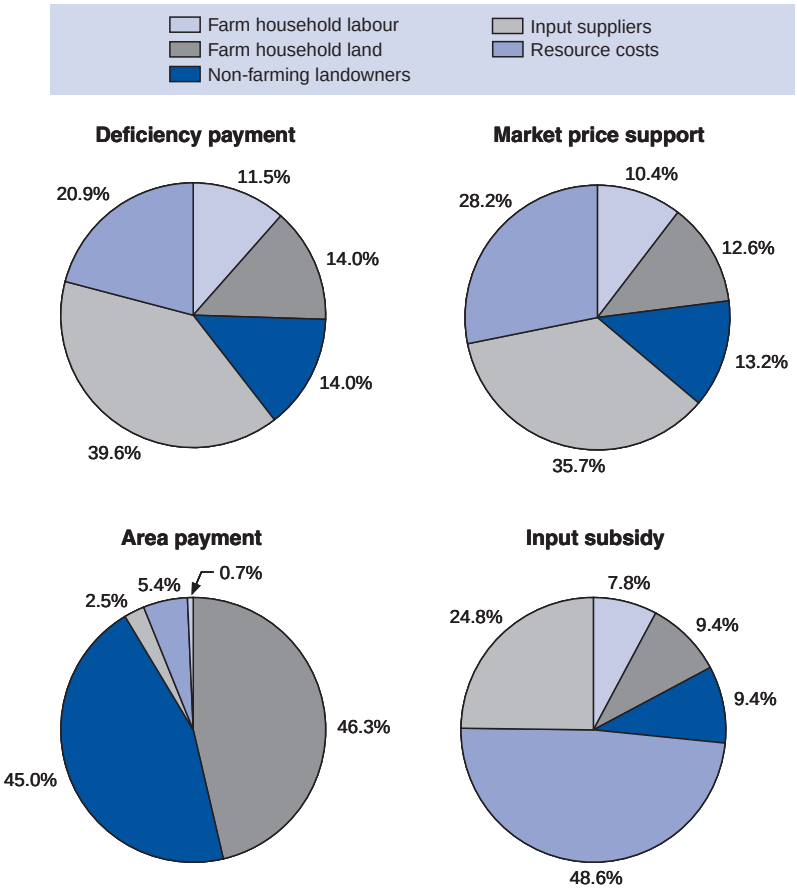
average of all farms, and by farm type in Canada and the European Union. In Graph I.12, support is compared to net operating income for all farms and for the top quartile (25% largest farms based on gross sales).

We cannot deduce from the PSE that farm household incomes would fall by an equivalent percentage if all government support were removed. The concept relates to gross receipts and is static by nature. In the absence of support, world prices would increase, domestic incentive prices would decrease in formerly supported countries in the short term, and farm households would adjust their farming practices and their off-farm activities to the new situation. However, a large share of the transfers generated by agricultural policy and included in the PSE does not necessarily translate into net income gains for farm households.

Part II presents a study on the efficiency of some of the most commonly used policy measures in transferring income to farmers. The income transfer efficiency ratio captures the share of support raised either from consumers or taxpayers, which actually raises the net income of farm households. There are two sources of transfer losses that limit the income transfer efficiency of policy measures. The first is economic costs, which result from distortions in the use of resources and its incidence on production and trade patterns. The second source of loss is distributive leakages, whereby some of the benefits of support accrue to groups other than the intended beneficiaries. This latter category includes the costs of administering farm programmes, the extra payments that farmers are required to make to input suppliers or downstream industries, additional payments to landlords and income transfers to (or from) other countries.

These losses can be compared across instruments. According to OECD estimates of income transfer efficiency, no support policy linked to agricultural activity succeeds in delivering more than half the monetary transfers from consumers and taxpayers as additional income to farm households. In the case of market price support and deficiency payments, the share is one fourth or less, for input subsidies it is less than one-fifth. Graph I.13 shows OECD estimates of where the money goes for each of these policy instruments.

Graph I.13. **Where does the money go?**
The income transfer efficiency of agricultural support



Source: OECD, 2002b, reported in Part II.

In the case of market price support and deficiency payments, the stimulus to output, and hence to input demand, means that much of the increase in receipts is paid back out to input suppliers or capitalised into land values. Not surprisingly, input suppliers reap most of the benefits of input subsidies. In the case of area payments, nearly all the benefits are absorbed in increased land values. This raises costs for farmers buying or leasing land. Farmers that own land do benefit, but this increase in wealth should not be interpreted as additional income, since it does not improve the long-term economic welfare of farm households as a whole.

What is the impact of agricultural policy on income risk and income variability?

Government intervention affects income risk for farm households at different levels (OECD, 2000). In addition to providing a stable economic environment and social safety nets for all households, governments in many OECD countries support their agricultural sector. Whatever their objective, many agricultural policy measures affect risk either by reducing farm income variability through stabilising input and output prices and quantities, or by raising income level and therefore modifying the attitude of farmers towards risk (the wealth effect increases the sense of security of risk averse farmers)

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(OECD, 2000 and 2001b). As a result, support affects the adoption of other risk management tools by farmers and could prevent the development of market solutions (OECD, 2000).

Support linked to output or input use encourages the use of inputs such as irrigation and pesticides that tend to make yields more stable. They may also lead farmers to produce in riskier conditions, *e.g.* on more fragile land or in drought prone areas. In many cases, support to producers contains devices to stabilise farm receipts (*e.g.* minimum guaranteed prices, deficiency payments or insurance schemes). Governments intervene to reduce risk faced by farmers more specifically by providing disaster payments, insurance programmes or agricultural safety nets. Governments also intervene to facilitate access by farmers to market-based mechanisms to reduce income risk such as futures markets or privately run insurance schemes, by providing information, training and by subsidising premiums and administrative costs.

The analysis reported in OECD (2003) shows the contribution of different categories of PSE measures to reducing the variability of farm receipts from crops over the period 1986-2000. In order to do so, it compares the variability of gross receipts from crops induced by each category of support measure included in the PSE to that of gross market receipts at world prices. Again, this analysis is static and does not consider adjustments that would take place if support were removed. For almost all the countries and crops considered, almost all PSE categories of support contribute to reducing the variability of farm receipts. The reduction in the variability of receipts due to support measures can be as high as 72% as in the case of wheat in the European Union. In countries with low levels of support, the impact is very small but there is, in general, no proportionality between the level of support and the reduction in receipt variability. In most countries and for most commodities, the total reduction in receipts variability is mainly explained by the impact of market price support, reflecting the lack of price transmission between the world markets and domestic markets, especially in countries using explicit border mechanisms to isolate domestic markets (*e.g.* European Union, Japan, Korea, Norway and Switzerland). In other countries, various types of budgetary payments also play a significant role in reducing farm receipts variability, either in addition to market price support (Norway and Switzerland), or alone (Canada and the United States).[19]

What is the distributional impact of support?

As explained in the previous section, there are leakages, sometimes very significant ones, which mean that much of the benefit of support is distributed to economic agents up and down the supply chain who were not necessarily the intended beneficiaries of the support. But what is the impact of the support on the distribution of income within the farm sector? This is an important question given income objectives generally and the observed higher incidence of low income among farm households more specifically. The static comparison between the distribution of support and that of gross receipts indicates the direction of the impact support has on the distribution of income.[20] Distributions by farm size, farm type and region have been examined for selected countries. Using the same methodology as in OECD (1999a), the distribution of gross receipts, support and income by farm size is compared graphically in Annex Graph AI.2.3 showing Lorenz curves for a number of OECD countries and numerically in Table I.3 showing Gini coefficients.[21]

The distribution of support by farm size is similar to the distribution of gross receipts. This is because a large share of support in the OECD area is linked to the level of production[22] or the level of input,[23] but also because in many cases support accounts for a

Table I.3. **Gini coefficients**

	Australia	Canada	Denmark	European Union	Finland	Japan	Korea	Netherlands	Switzerland	United States
	1999/2000	1998	1996/97	1999	1999	1994	1999	1999	1995	2000
Gross receipts[1]	0.59	0.61	0.74	0.73	0.64	0.70	0.32	0.54	0.27	0.91
Market price support (MPS)[2]	0.48	0.88	0.75	0.78	0.73	0.67	0.31	0.52	0.03	0.99
Direct payments (DP)[3]	n.a.	0.33	0.55	0.54	0.54	0.66	0.10	0.00	0.34	0.83
Total support (MPS + DP)	0.48	0.75	0.67	0.70	0.61	0.67	0.31	0.50	0.27	0.88
Net operating income	0.66	0.76	0.09	0.64	0.62	0.71	0.42	0.47	0.18	n.c.
Farm income	n.a.	n.c.	0.84	0.62	0.62	0.78	0.50	0.58	0.17	n.c.
Total income	0.44	0.02	0.33	n.a.	n.a.	0.07	0.46	0.32	0.13	0.03

n.a. Not available.
n.c. Not computable because of negative averages for some quartiles.
See Diagram I.1 for a definition of income indicators.
1. Gross receipts are the sum of receipts from sales of crop and livestock products, direct payments, receipts from agricultural activities off the farm and, in some countries, on-farm use.
2. Market price support is calculated by applying the ratio of market price support to the total value of gross receipts to receipts of each commodity for which an individual market price support is calculated in the PSE database and by applying an average ratio of all PSE commodities to remaining receipts.
3. Direct payments are budgetary transfers to farmers from agricultural policy. In the case of the European Union, subsidies for intermediate consumption are included.
Source: OECD structural database. Update from OECD, 1999a.

significant share of gross receipts. The largest farms, and often the most prosperous ones, are therefore the main beneficiaries.[24] In this sense, support is inequitable. On average, direct payments are more equally distributed than market price support and gross receipts but the difference is generally small. Among EU member countries, a notable exception is the Netherlands where direct payments are equally distributed because many of the larger farms are specialised in horticulture which receives little in the way of CAP payments. This also explains why the level of payments received by Dutch farmers is low. In Switzerland, direct payments are also relatively equally distributed as their attribution is subject to many constraints related to size and farming conditions. We can conclude overall that, in most countries, support has a rather small redistributional effect by farm size because it is only slightly less unequally distributed than gross receipts. Exceptions are Canada, where support is more unequally distributed than gross receipts because dairy farms, which on average, receive eight times more support than the average of all farms, are concentrated in the largest quartile; and Switzerland, where support has the same distribution as gross receipts (1995 data).

The impact of support on income disparities by farm type depends on how wide differences in support level are in the country and how narrowly farm types have been defined. In Canada, as shown in Graph I.14, support has accentuated inequality between dairy and cattle farms. In the European Union support has widened disparities between dairy and intensive livestock farms on the one hand and field crop and cattle farms on the other. In Denmark, support has increased the income gap between crop farms and intensive livestock (OECD, 1999a). There are, nonetheless a few cases where support narrows disparities, for example, between cereal and cattle farms in Finland or pig farms and all farms in the Netherlands, but the effect is relatively small. Overall, support increases income disparities between farm types (Graph I.14).

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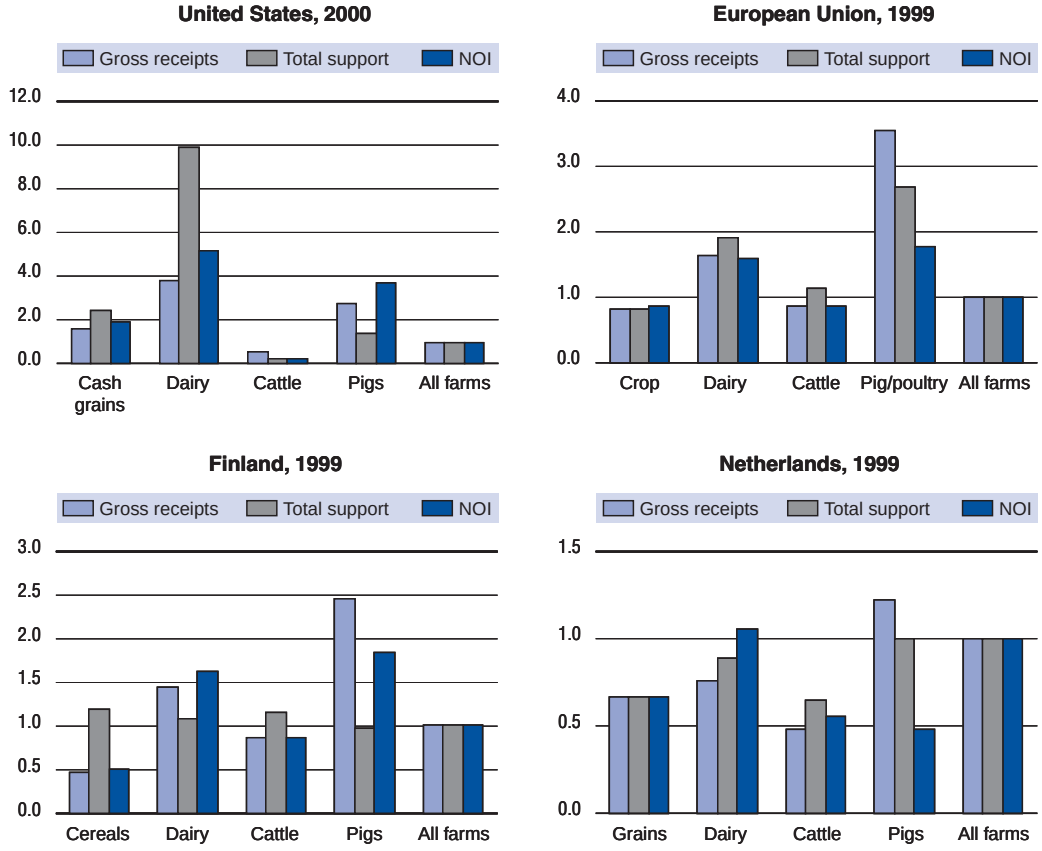
Graph I.14. **Gross receipts, support and farm income: average of each farm type as a ratio of the average of all farms**



NOI: Net operating income. See Diagram I.1 for a definition of income indicators.
Support includes market price support and budgetary payments to producers.
Source: OECD structural database and PSE/CSE database.

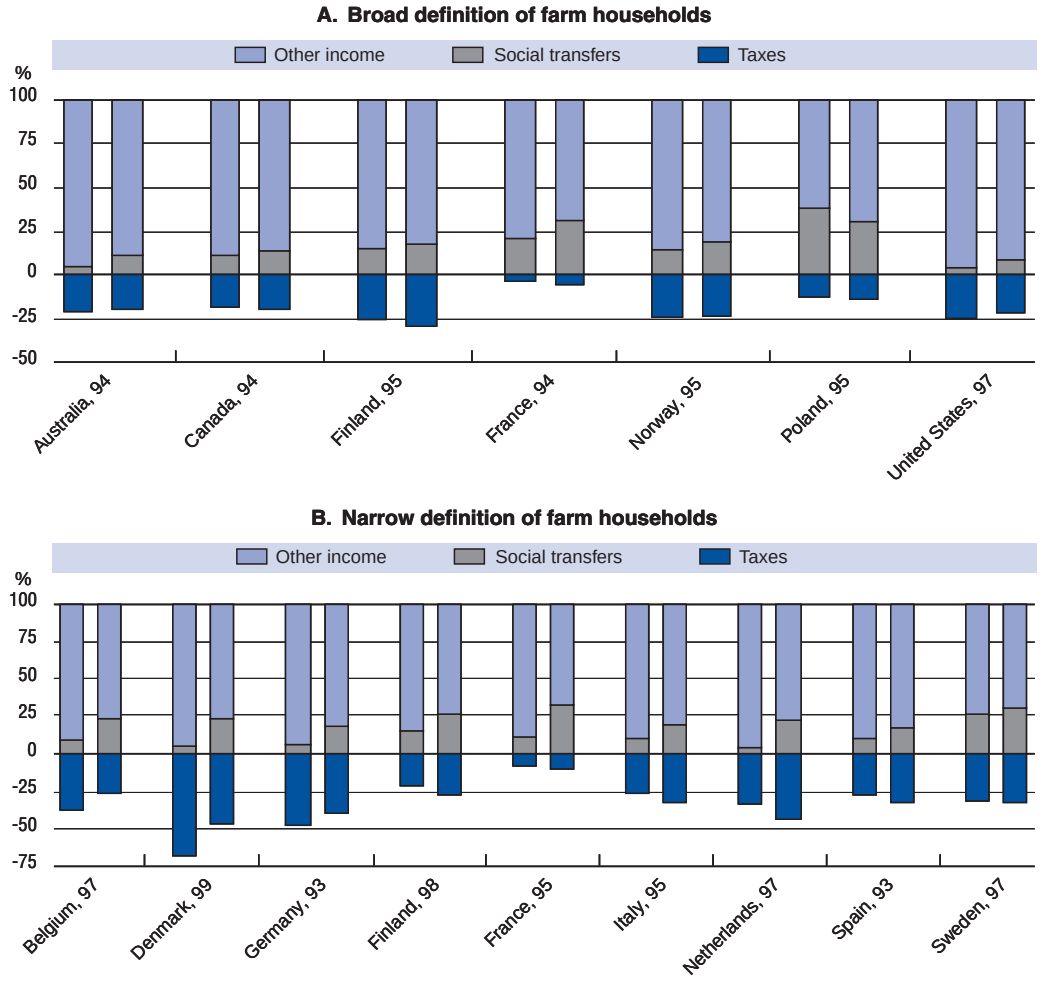
There are also regional differences in the distribution of support. While support linked to output automatically goes to larger farms, direct payments can be targeted to less favoured areas. This is done to some extent in Switzerland. Here some payments are higher in mountainous areas, and even though lowland farms receive more support in absolute terms the overall effect is to reduce income inequality between lowland and mountain farms. Inequality nonetheless persists (OECD, 1999a). In Denmark, off-farm income reduced income differences by region, but total support increased them despite a small redistributive impact of direct payments.

In all cases, the total income of farm households is less unequally distributed than farm income, although the extent of this effect varies greatly among countries. Significantly, the distributional impact of off-farm income is larger than that of support (Table I.3).

What is the impact of taxation and social policies on the relative income situation of farm households?

Many countries grant preferential tax arrangements to farmers (*e.g.* Australia, Czech Republic, Hungary, Mexico, Norway, Sweden and the United States).[25] In Australia and Sweden, for example, the purpose of the concession is to smooth income over a number of years and therefore help farmers deal with income risk.

Graph I.15. **Percentage share of social transfers and taxes in the disposable income of farm and non-farm households**



For each country, the first bar corresponds to farm households and the second bar to non-farm households.
Source: OECD (2001a), LIS database. EUROSTAT database.

Available evidence suggests that in many countries, the situation of farm households relative to other households improves after taxes are deducted, *i.e.* when disposable income is used for comparison rather than total income (OECD, 1995). Using more recent data, Graph I.15 confirms that in the majority of countries examined, the tax system is lighter on farm households than on other households. According to LIS data, it is even true for similar levels of income (OECD, 2001a). In most cases where farm households were taxed more than the average of all households, farm household income was higher than the total income of all households in the given year.

Social security systems usually aim to extend an adequate level of social protection to all members of society. They mainly include pension, health and unemployment schemes. Some countries offer special terms to farmers. This is the case in one third of the OECD member countries with respect to old age pensions. The government may contribute through an appropriation from general revenue, or pay a subsidy to make up any deficit in the insurance fund. In some countries, regulations allow farmers to contribute less, for the same coverage, than other citizens.

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As indicated in Section I.2, social transfers are often the second source of off-farm income for farm households after earnings from non-agricultural activities. In some countries, they are the most important source of non-farm income. In the mid-1990s they accounted for around 10% of all farm household income in countries where farm households are broadly defined and from 5% to 25% in countries were farm households are narrowly defined (OECD, 2000). The impact of social transfers on the disposable income (total income minus taxes) of farm households is significant (OECD, 2001a). Low-income rates for farm households of between 20% and 40% before tax and social transfers fall to 10%-20%. Social transfers have been effective in reducing the incidence of low income, especially for households with an older head. These households receive the highest benefits from social policies, mainly in the form of pensions.

Nonetheless, social transfers have a greater effect on the disposable income of non-farm households than on that of farm households (OECD, 2001a). In fact, in all the countries surveyed except Poland, the share of social transfers in total income is relatively smaller for farm households than for other households (Graph I.14). This could be explained by the fact that farmers are mostly self-employed. Unemployment benefits are therefore less important. However, with the increase of income from non-agricultural activities in total farm household income, unemployment benefits may begin to contribute more to the alleviation of low income among farm households in the future.

I.5. Are policy measures effectively achieving the set objectives in terms of the level, variability and distribution of farm household incomes?

Governments explain intervention to support the income of farm households both on equity grounds and on market failure grounds specifically with respect to risk management and the provision of agriculture-related public goods. The objectives of policies with regard to income in agriculture are not always explicitly stated but concerns are expressed in terms of adequate levels of income, income stability and equity, within the farm sector and compared to the rest of society.

When all sources of income are taken into account, farm households have, on average, incomes that are close to those of other households in most countries for which data are available and up to date. In some countries, agricultural support accounts for a large share of gross agricultural receipts and therefore is an important determinant of farm income. Nevertheless, it is increasingly other earned income, revenues from investments (property income) and social transfers that generate adequate levels of income for farm households.

Increasingly, farm households derive a significant share of their income, sometimes more than 50%, from off-farm sources, mainly other gainful activities but also significant social transfers. As a result, farm income is not an accurate measure of the income of farm households. Off-farm income not only raises the total level of income for farm households but also lowers its variability and partially offsets the inequality of the distribution of farm income. There are many complex factors behind the diversification that has taken place in farm household income. It seems, however, that despite heavy intervention from governments and significant support levels of all kinds, large numbers of farm households have not been able to earn adequate income from their farming activities alone.[26]

In most countries examined, the various tools and instruments available to farmers to reduce income risk, government intervention more generally and the diversification to off-farm sources of income, have reduced annual variations in farm household income at

the national level. In four out of five countries for which data were available, the total income of farm households was not significantly more variable than that of other households. In most OECD countries, market price support was found to have the biggest impact in reducing the variability of crop receipts reflecting partly the size of this type of support compared to other types of measures and partly the lack of price transmission in domestic markets.

Although in many countries farm households enjoy income levels that are, on average, close to those in the rest of society, there is a higher incidence of low income among farm households than among other households. In addition, the low-income gap (between low incomes and average incomes) is wider for farm households than for others. This would indicate that despite the complex array of agricultural policy measures there are still significant numbers of farm households that do not seem to have an adequate income. Clearly, the current set of agricultural policies is not sufficiently targeted to reach these households. The addition of social transfers alleviates the income inadequacy in many cases, especially for households where there are pensioners, but does not eliminate the problem.

In fact, the distribution of support is rather unequal. Because the distribution of support mirrors closely the distribution of gross receipts, most support goes to larger farms, often the richer ones. Support has only a very slight redistributive effect on income by farm size and, while some forms of direct payment are targeted to less favoured farms, they account for a small share of total support. In some cases, support has even increased income disparities, for example by farm type. Overall, large disparities in income remain in the farming sector, although here again, off-farm income has been effective in reducing them, in particular when farm households have had the opportunity to engage in other gainful activities.

Large amounts of support are transferred to agricultural producers (close to USD 250 billion in 1999-2001 for the OECD area). Is this support efficient in reaching the farm households who need it? Overall, in OECD countries, most support is linked to production levels or input use. It is therefore provided to all farmers, whatever their income situation. Moreover, much of the support leaks away to other economic agents such as absentee landowners and input suppliers. Even the support that remains in the sector is often capitalised into the value of land, quota or other fixed assets owned by the farm household. In this case, the benefits can only be realised when the assets are sold and do not alleviate current income deficiencies. It is therefore not surprising that support does not seem to address the specific needs of farm households with income problems.

Overall, support policies, whatever their objectives, have raised farm income to some extent, and have reduced income variability, but it has been at a very high cost to consumers and taxpayers and with significant leakage to unintended beneficiaries. Most of the support that reaches the sector goes to larger farm households, who do not usually need it. Income risk management programmes have often provided unnecessary and unintended support because of adverse selection, moral hazard[27] and rent seeking from producers whose objective is to maximise their benefits (Skees, 2000). Moreover, most of these risk reducing policy measures do not take account of all sources of income. Such programmes have probably discouraged the development of private mechanisms. In many cases, the continuation of high support level has slowed adjustment to more viable and sustainable types of farming, or to other activities.

Much of the support in OECD countries is linked to production or input use and therefore has significant international spillover effects. Production enhancing support raises domestic farm income but contributes to lower world prices, which in turn depress farm income in other parts of the world. Policies that reduce income risk faced by farmers also affect production decisions, often to the same extent as price support. In addition, by reducing adjustment in the domestic market, they transfer domestic instability to the world market and therefore switch the burden of adjustment to other countries (OECD, 2003).

The evidence presented here suggests that there are significant problems in delivering income support to farm households through the types of sector specific measures and policies that have been pursued to date. The main problems relate to ***targeting*** – the great bulk of the measures used are generic in nature – to ***equity*** – because the measures are still predominantly based on production or factors of production they fail to change the income distribution in any significant way – and to ***leakages*** – much of the support is transferred to unintended beneficiaries. The policies do raise farm income levels to some extent and reduce their variability, but this would seem to be achieved at probably significantly greater cost than necessary. The next section asks which measures would be more effective in meeting declared income objectives.

I.6. Which policy instruments would transfer income to farm households more effectively and more equitably?

To design and implement efficient policies, income objectives have to be clearly defined in the national policy process. In particular, some income criteria needs to be developed to define and identify the targeted households. All sources of income should be taken into account in identifying the households to be targeted, as well as household wealth. For example, criteria could be set concerning the aggregate level of income of the sector or the individual level and variability of individual farm household income that would trigger intervention, if indeed the prevailing policy concerns involve those criteria.

There are several possible policy responses to low-income problems among farm households. Government should first consider ways to develop market solutions. It is important to understand the cause of low income to find the most effective remedy. If governments are unwilling to see less efficient farmers leave the sector because they provide economic and social benefits that are not, and cannot be, rewarded by the market, the optimal policy would be to give farmers the appropriate incentive to provide for these benefits, using for example decoupled and targeted payments, rather than redistribute support only on the basis of lower incomes.

Similarly, regarding income risk management, government should encourage the development of contingency arrangements such as insurance and futures markets, for example through the collection and transmission of information to reduce problems created by information asymmetry; or training programmes in the use of futures markets to reduce income risk. Agricultural safety nets could then be envisaged to address any remaining risk management failure.

From an income transfer efficiency point of view, support that is decoupled from agricultural activity and targeted specifically to income would be much better as a way to transfer income to farm households. Such direct income payments minimise economic distortions and distributive leakages because their effects on production decisions are

minimal, and they can be targeted and delivered to those households that are deemed to warrant assistance.

More generally, government could invest in general services for the sector, such as expenditures on infrastructure, training, research and development, that improve the functioning of agricultural markets and allow farmers to increase their competitiveness. Low income may be experienced by farm households that are resource-poor and located in areas where there is also a problem of lack of viable economic alternatives. The solution in this type of situation is not necessarily a sector-specific income support scheme. Investment in infrastructure to make rural areas more attractive to investors and transitional assistance to more viable economic activities may be of greater benefit.

Sequencing is important. As policies to address market failures in the agricultural sector will have an impact on the income of farmers, there is a logical case for applying measures that first correct market failures and then address any outstanding concerns about incomes, using the types of measures indicated above. Finally, general tax and social security systems are in place in most, if not all, OECD countries. These structures are well placed to identify remaining low-income problems among agricultural households and ensure equal treatment *vis-à-vis* other classes of households.

It is important, in order to assess the problems and needs of the sector and to implement targeted measures, that comprehensive information on the economic situation of farm households be available. Such information should be collected in a flexible way to allow assessment and monitoring of income deficiencies. More detailed information on the sources of non-farm income would also help to understand the various strategies adopted by farm households and the relationships between agricultural, fiscal and social policies. Available statistics, however, show that in many countries, income support policies have been designed and implemented in the absence of adequate information on the income situation of farm households. This fact must, in part, explain their poor performance.

Notes

1. OECD, 1995, 1995a, 1999a, 2000, 2001a, 2002b and 2003.
2. They accounted for 90% of the Producer Support Estimate (PSE) in the OECD area in 1999-2001.
3. The financial situation of a farm family reflects a combination of its income and wealth. Little work has been undertaken at the OECD on this latter aspect. However, these questions are examined for the United States in USDA (2002).
4. Welfare is often measured in terms of consumption. However, this measure is not considered here, nor was it considered in the reports on which this report is based. This is because a main focus is on the efficiency and effectiveness of agricultural policy and not on farm household welfare *per se*, more broadly defined. Policy impacts are more directly captured by looking at income (and wealth if the data were available) than by looking at consumption.
5. Examples of contingency markets are futures markets, options, insurance markets, the bond market and the stock market.
6. A Lorenz (or concentration) curve represents the cumulative proportion of a variable as a function of the proportion of the population contributing to (accounting for) this variable. Axes vary between 0 and 1 and the equality line is the first diagonal. The distance between the Lorenz curve for the variable and the equality line indicates the degree of inequality of distribution for the variable. The further the distance, the more concentrated the variable and the more unequal the distribution. This distance can be measured by Gini coefficients (Table I.3). These are twice the

area between the Lorenz curve and the first diagonal. The greater the inequality, the higher the coefficient. The Gini coefficient (Ig) can be calculated as follows:

$$Ig = \frac{\sum_i \sum_j |x_i - x_j|}{2n(n-1)x_m} \quad \text{for } i = 1 \text{ to } n \text{ and } j = 1 \text{ to } n$$

where x_i and x_j are the average of group *i* and group *j* respectively, and
x_m is the average of the whole population.
When based on individual data and when all observations are positive, it ranges from 0 to 1. When there is a large number of negative observations, this formula does not apply.

7. It should be noted that some of the data in Graph I.1 are seriously out of date.
8. A more restrictive definition involves the exclusion of smaller farms (based on gross sales or area) and part-time farmers, for whom farm income is not the main source of income or agricultural activity is not the main activity.
9. These strategies are reviewed in OECD (2000).
10. Coefficients of variation calculated in Table I.1 measure variability around the average for the period without taking into account trends.
11. See OECD (1999a) for a description of the characteristics of national farm account data. Whenever possible, the analysis reported here has been updated to most recent data available.
12. See Diagram I.1 for a definition of income indicators.
13. The top quartile contains the 25% largest farms, based on gross sales.
14. Graphically, the Lorenz curve of the total income of farm households is closer to the equality line than the Lorenz curve of farm income.
15. Main occupation farm households are farm households, which derive more than half of their income from agriculture, or whose head is occupied by agricultural activities more than half his working time.
16. The Lorenz curve of the former is further from the equality line than the Lorenz curve of the latter.
17. In the analysis presented below, the term income refers to disposable household income (see Diagram I.1).
18. The low-income rate is the share of individual farm households with incomes falling below the low-income line (50% of median income of all households). The low-income gap is the difference between the average income of the low-income farm households and the low-income line (the average income gap). The Sen index combines the first two measures with an index of the dispersion of income (the Gini coefficient) among the low-income farm households. The smaller the Sen index, the better the income situation of households.
19. For more detailed explanations about the measurement method and a more detailed description of results, see OECD (2003).
20. It should be noted that support is included in the value of gross receipts.
21. See endnote 6 of Part I for a definition of Lorenz curves and Gini coefficients. It should be noted that when based on group averages, as here, the Gini coefficient is undervalued, especially since there are very few groups. The Gini coefficients used in this study and based on quartiles should therefore be viewed only in relative terms, between variables for the same country.
22. Seventy per cent of the PSE in the OECD area came from market price support measures and payments based on output in 1999-2001.
23. In 1999-2001, payments based on area planted or animal numbers and payments based on input use accounted respectively for 12 and 8% of the PSE for the OECD area.
24. As shown in Graph I.5, the average total income of farms in the top quartile (the largest farms based on gross sales) is higher than the average income of all farms (or, in fact, higher than the average income of farms in any of the other quartiles). However, there could be cases where smaller farms that derive most of their income from off-farm activities receive a higher total income than farms with larger gross sales.
25. Mainly from the PSE database. It should, however, be noted that there may be tax exemptions in other countries that are not covered in the database because the information is not available.

26. It should, however, be noted that in some cases, low farm incomes are not the result of a failure to earn adequate income from farming, but can be part of a strategy (for example, hobby farming). Recent analysis of farm households in Canada and the United States, for example, classify farms according to various criteria such as gross sales or revenue, age or main occupation of operator, business organisation, etc., to obtain more homogenous groups and better understand their behaviour and reaction to agricultural policy (AAFC, 2002; USDA, 2001).

27. Adverse selection and moral hazard occur when information is asymmetric. Moral hazard refers to the fact that farmers, who know more about their own risk than programme managers or subsidised insurance companies, are encouraged to adopt a riskier behaviour to obtain more indemnities. Adverse selection occurs because farmers are better able to judge whether they will benefit from a programme. As a result, the level of risk in the subscribing population is higher than in the total population.

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Annex I.1

Definition and Sources

OECD (1995), *A review of farm household incomes in OECD countries* [OCDE/GD(95)97] contains a description of available surveys and a detailed definition of income indicators published in national statistics. Annex 1 in OECD (1999a) describes the different sources and coverage of data in the OECD structural database. OECD (2001a) contains information on the Luxembourg Income Study (LIS) database. Data sources and definition used in this report are summarised in this annex and a detailed description can be found in the referenced original reports.

AI.1. Income indicators published in national statistics

Graphs I.1, I.2, I.3, I.4 and I.15B, Annex Graph AI.2.1, and Tables I.1 and I.2 mainly report data on household income from published national statistics. Data from EUROSTAT's "Income of the Agricultural Households Sector" are used for Belgium, Greece, Italy, Spain and Sweden, and for income comparison by socio-economic groups for Denmark and the Netherlands.

Australia: Data on farm household income are published in ABARE, *Australian Farm Surveys*. They come from the Australian agricultural and grazing industries survey described in Section AI.2, which uses a broad definition of farm household income. These data are compared to the average gross income of all households published in the *Statistical Yearbook of Australia* published by the Australian Bureau of Statistics.

Austria: *Grüne Bericht* contains data on the total income of main occupation farm households. *www.awi.bmlf.gv.at/gb/tabellen/Tab_6.1.01.xls*

Belgium: See EUROSTAT.

Canada: The average income of family units with one individual reporting some net farm income and the average income of all family units are provided by Statistics Canada from the Survey of Consumer Finances for long time series up to 1997 (Graph I.4, Annex Graph AI.2.1 and Table I.1). For most recent years (1997-99), the Survey of Labour and Income Dynamics (SLID) is used (Graphs I.1 and I.3) as the Survey of Consumer Finances was discontinued.

Denmark: See Section AI.2 below for a definition of farm household income (*www.sjfi.dk/*). See EUROSTAT for the income comparison between households.

Finland: Mean income of households by socio-economic group published in *Income Distribution Statistics* and *Statistical Yearbook of Finland* by Statistics Finland. From 1996, the income from agricultural activities is estimated based on the income from independent activities. A narrow definition of farm households is used.

France: The French Statistical Institute (INSEE) matched FADN data with taxation data to obtain the total income of agricultural households. Farm households are defined narrowly as main occupation farmers' households as in FADN. Income comparison between socio-economic groups comes from an INSEE document, *Compte de revenu par catégorie socio-professionnelle*.

Germany: *Agrarbericht* contains data on the total income of full-time farm married couples, published by the Federal Ministry of Consumer Protection, Food and Agriculture. Total incomes for main occupation farm households and all households were published by the Federal Office of Statistics up to 1993.

Greece: See EUROSTAT.

Ireland: Data come from the *Household Budget Survey 1999/2000*, published by the Central Statistics Office (CSO). *www.cso.ie/pressreleases/hbs.pdf*. Farm households are those identified in the National Farm Survey. A broad definition is therefore used.

Italy: See EUROSTAT.

Japan: See Section AI.2 below for a definition of farm household income. Workers' household income published in MAFF's Statistical Yearbook comes from the Monthly Report on the Family Income provided by the Management and Coordination Agency.

Korea: See Section AI.2 below for a definition of farm household income. Farm household income data published in *Major Statistics of Agriculture and Forestry* come from the Farm Household Economy Survey. Urban household income data come from the Household Income and Expenditure Survey. Both surveys are implemented by the Korea National Statistical Office.

Netherlands: See Section AI.2 below for a definition of farm household income. See EUROSTAT for the income comparison between households.

Norway: Data are reported in *Jordbrukstatistikk* (Agricultural Statistics) published by Statistics Norway based on data managed by the Norwegian Agricultural Economics Research Institute. They come from a survey of farmers' income and wealth based on taxation records and on an annual sample survey of agriculture. Farm households are broadly defined (low minimum farm size) but only pensionable income is taken into account thus capital income and pensions are excluded from income sources.

Poland: Data are published in the *Statistical Yearbook of the Republic of Poland* by the Central Statistical Office. They come from a sample survey of household budgets. The average income of self-employed farmers is compared to the income of all households. A farm household is a household where income from the use of a private farm is the exclusive or primary source of income. A narrow definition is thus adopted.

Spain: See EUROSTAT.

Sweden: See EUROSTAT.

Switzerland: Data were provided by the Swiss *Office fédéral de la Statistique*. They come from the Swiss Income and Consumption Survey. Farm households are narrowly defined by the main activity of the reference person.

Turkey: Data from a Social Accounting Matrix developed in the Agricultural Economics Research Institute (AERI) and published in Brooks, J. and Tanyeri, A. (1999), *Agricultural Policy Reform in Turkey: A Social Accounting Matrix Perspective*, Ankara. Income data come from the Income Distribution Survey of the State Institute of Statistics.

United Kingdom: DEFRA publishes farmers' total income assessed for tax in the United Kingdom. Data are derived from the Inland Revenue's Survey of Personal Incomes. A broad definition of farm *households is used*. *www.defra.gov.uk/esg/Work_htm/publications/cf/fiuk/current/Chapter2/c2t2.4_2.7.xls*

United States: See Section AI.2 below for a definition of farm household income. Data are published in USDA/ERS, *Agricultural Outlook*. Farm household income is compared to the US average household income from the CPS.

EUROSTAT: The IAHS statistics, formerly known as the Total Income of Agricultural Households, (TIAH) statistics, present an aggregate picture of the overall income situation of agricultural households. For the purpose of income comparisons, households are grouped according to the main income source of the household reference person, typically the head of household. An agricultural household ("narrow definition") is thus one where the reference person has farming as their main income.

Details of the methodology of IAHS statistics are contained in TIAH Manual of Methodology (Rev. 1). Three broad approaches ("models") to making estimates are encountered, representing points on a spectrum between microeconomic and macroeconomic methodology. In Model 1, estimates of the disposable income of the agricultural household sector can be obtained by grossing-up microeconomic data collected in household budget surveys, taxation records, farm account surveys, etc. Model 2 (macroeconomic approach) consists of subdividing the Distribution of Income Account for the households sector of the member State to separate sub-accounts for agricultural households. Model 3 combines a macroeconomic approach for deriving the income from agricultural activity of agricultural households with a microeconomic approach towards the other components of disposable income.

AI.2. OECD Structural Database

Graphs I.5, I.6, I.10, I.11, I.12 and I.14, Annex Graphs AI.2.3 and AI.2.4, and Table I.3 use data contained in the OECD structural database. This database includes data from the national surveys described below. The individual data are aggregated by quartiles based on gross sales.

Australia

Source: ABARE, Australian agricultural and grazing industries survey and Australian dairy industry survey.

Coverage: The first survey includes farms engaged mainly in growing cereal grains, coarse grains, oilseeds and/or pulses; farms engaged mainly in running sheep or beef cattle and growing cereal grains, coarse grains, oilseeds and/or pulses; farms engaged mainly in running sheep; farms engaged mainly in running beef cattle and farms engaged mainly in running both sheep and beef cattle. The second survey includes farms engaged mainly in dairying. Both surveys cover establishments with an estimated value of agricultural production of AUD 22 500 or more at the time of the 1996 census.

Sample: The sample consists of 1 600 farms representing 2% of the population. Sample weights are calculated so that sample estimates of numbers of farms, area of crops and number of livestock in various geographic regions and industries correspond as closely as possible to known Australian Bureau of Statistics data (Agricultural Census). A greater proportion of large, as opposed to small, farms is sampled.

Canada

Source: Agriculture and Agri-Food Canada, Taxation data.

Coverage: The data include only farms with total revenue of CAD 2 000 or more.

Sample: 235 000 farms are represented.

Definition of farm types:

- **Grain and oilseed farms:** Grain and oilseed farms are those on which more than 50% of gross agricultural revenue is from the sale of wheat, small grains, oilseeds, grain corn, dry field peas and beans, and field crop combinations.
- **Cattle farms:** Cattle farms are those on which more than 50% of the gross agricultural revenue is derived from the sale of cattle.
- **Dairy farms:** Dairy farms are those on which more than 50% of the gross agricultural revenue is derived from the sale of dairy products – milk and cream for example. This category includes farms with 40% or more of gross agricultural revenue derived from the sale of dairy products and 10% or more of the agricultural revenue from raising and selling dairy cattle.
- **Pig Farms:** Pig farms are those on which more than 50% of the gross agricultural revenue is derived from the sale of pigs and/or feedlot operations.

Denmark

Source: *Statens Jordbrugs-og Fiskeriokonomiske Institut, Landbrugsregnskabsstatistik* (Agricultural Account Statistics).

Coverage: All farms which according to the agricultural and horticultural census by the Danish Statistical Office have a standard gross margin (gross value of agricultural production minus main proportional specific costs) from agricultural production of 50% or more of the total standard gross margin originating from agricultural and horticultural production and which have a total cultivated area, excluding woods and gardens, of 5 ha or more. The population may, however, include holdings of less than 5 ha if their economic size is 4 ESU (European Size Unit = EUR 1 200) or more.

Sample: The total sample consists of approximately 2 000 farms representing 3% of the whole population. The rate of sampling varies according to groups.

European Union

Source: Commission of the European Communities, Farm Accountancy Data Network (FADN) database.

Coverage: This database covers commercial farms. The exact definition varies according to countries but the general definition of a commercial farm is a farm which is large enough to be the main activity of the farmer and to provide a level of income sufficient to support his or her family. In order to be classified as commercial, a farm must exceed a minimum economic size.

Sample: The sample consists of 57 000 farms representing 1.6% of the population. Weights applied to sampled farms to extrapolate to the total population are equal to the share of the group they represent in the total population. Groups are defined by region, specialisation and size.

Definition of farm types:

- **Field crop farms:**
  - ***Specialist cereals:*** More than 2/3 of the total SGM (Standard Gross Margin) from cereals.
  - ***General field cropping:*** More than 2/3 of the total SGM from general crops; cereals, oilseeds, pulses and fallow land subject to set-aside incentive schemes with no economic use no more than 2/3 of the total SGM.
  - ***Mixed cropping:*** More than 1/3 and not more than 2/3 of the total SGM from cropping; no other single production contributes more than 1/3 of the total SGM.
- **Cattle farms:**
  - ***Specialist cattle – rearing and fattening:*** More than 2/3 of the total SGM from cattle, but not more than 1/10 from milk cows.
  - ***Specialist cattle – dairying, rearing and fattening combined:*** More than 2/3 of the total SGM from cattle and more than 1/10 from milk cows; excluding specialist dairying (see below).
  - ***Sheep, goats and other grazing livestock:*** More than 2/3 of the total SGM from cattle, sheep and horses, but not more than 2/3 from cattle.
- **Dairy farms:**
  - ***Specialist dairying:*** More than 2/3 of the total SGM from dairy cattle and more than 2/3 of the dairy cattle's SGM from milk cows.
- **Pig and poultry farms:**
  - ***Specialist granivores:*** More than 2/3 of the total SGM from pigs and poultry.

Finland

Source: The Business and Income Statistics of Farming. Taxation data.

Coverage: Since 1993, forestry is no longer included. Holdings with two hectares or more of arable land under cultivation and which are subject to taxation under the income tax legislation on agriculture.

Sample: The Farm Register is used as the sampling frame. The sample consists of more than 10 000 farms representing around 12% of the farming population. The sample design is based on stratified simple random sampling. In 1998 and 1999 data gathered from tax forms have been supplemented using statistical forms sent direct to the farms.

Japan

Source: MAFF, *Agricultural Yearbook*, Farm Household Economy Survey.

Coverage: Commercial farms only. A commercial farm is a farm household with 0.3 ha or more, or with a smaller area but with sales of agricultural products exceeding 500 000 yen.

Sample: The number of households in the 1994 sample is 10 000 representing 0.35% of the population (2.8 million farms). The same rate of sampling is applied to each group by region, farm type and size.

Korea

Source: MAF, *Agricultural Yearbook and Major Statistics of Agriculture and Forestry*, Agricultural Statistic Survey and Farm Household Economy Survey.

Coverage: Farmers who cultivate farm land over 0.1 ha or engage in farming activities including livestock husbandry more than 90 days a year. Or farmers who have sales of agricultural products exceeding KRW 1 million.

Sample: The survey sample consists of 3 140 households from sampled farm household enumeration districts. It represents around 0.23% of the farming population (1.4 million).

Netherlands

Source: LEI, Dutch FADN.

Coverage: Main occupation farms. This definition covers 75% of all farms and 94% of total production.

Sample: Panel of more than 1 500 farms representing about 83 000 farms.

Switzerland

Source: Station fédérale de recherches en économie et technologie agricole (1997), *Rapport principal 1995 sur les exploitations-témoins*, Tänikon.

Coverage: Full-time farms fulfilling specific criteria concerning minimum size (0.25 ha or more, 1 UGB or more), maximum size (less than 50 ha), maximum share of non-agricultural income in total income depending on size, and minimum labour input. In addition, one member of the farm household must have followed an agricultural training programme. According to the 1990 Census, these farms represented 27% of the total, *i.e.* 29 500.

Sample: The survey contains 3 419 test farms representing 11% of the farming population. The share of farms surveyed among the total number of test-farms varies according to region, farm type and size.

United States

Source: USDA, ERS, Agricultural Resource Management Study (ARMS), Phase 3.

Coverage: Operators associated with farm businesses representing agricultural production in the United States (excluding Hawaii and Alaska). A farm is defined as an establishment that sold or normally would have sold at least USD 1 000 of agricultural products during the year. The farm operator is the person who runs the farm, making most of the day-to-day decisions about operating the farm.

Sample: The 2000 ARMS, Phase 3 is a multiple frame survey consisting of a list frame of known farm operations and a complimentary area frame to insure complete coverage of the target population. The list frame is stratified by farm size and type. The area frame consists of land segments stratified by land use characteristics. All farm operations within selected land segments are contacted for the survey. Simple random sampling is used to select sample farms within the individual strata. Each sample farm is assigned a weight reflecting its coverage of farms with similar characteristics in the farm population.

AI.3. Luxembourg Income Study (LIS) database

Graphs I.7, I.8, I.9 and I.15A report data from the LIS database.

The Luxembourg Income Study (LIS) project began in 1983 under the joint sponsorship of the government of Luxembourg and the Centre for Population, Poverty and Policy Studies (CEPS). It is mainly funded by the national science and social science research foundations of its member countries. The main objective of the LIS project is to create a

database containing social and economic data collected via household-based surveys in different countries. (See LIS web site, *www.lisproject.org*)

The LIS database contained information for 26 countries by the end of 2001, of which 23 are OECD countries. Participating countries mostly have provided data from the mid-1980s. The data are updated at four or five-year intervals. At the end of 2001, the most recent data referred to the mid-1990s.

The LIS database consists of micro data collected by member countries through household income surveys. At the household level, there are more than 100 socio-demographic and 50 income variables available for each household in each country. The demographic variables include information such as number and age of persons, of earners, and of children in the household.

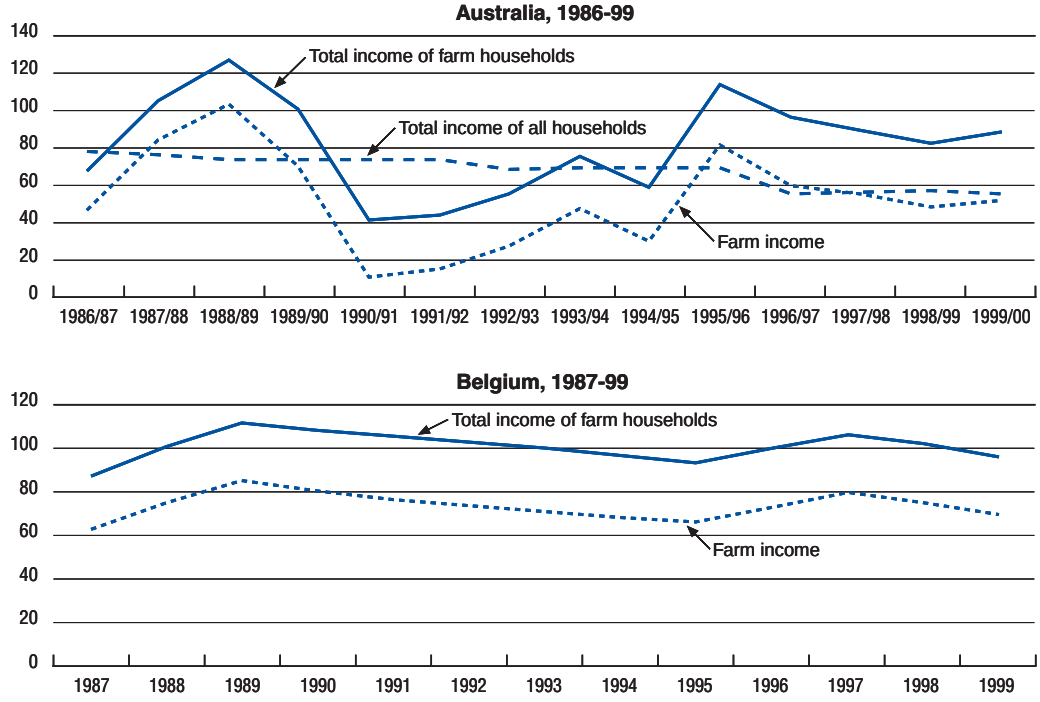
Three definitions can be used to identify farm-related households: households having farm self-employment income (definition 1), occupation of head is farm-related (definition 2) and industry of head is farm-related. In the study reported here the broad definition of definition 1 was selected, *i.e.* households whose farm self-employment income is not zero.

Annex I.2

Additional Graphs

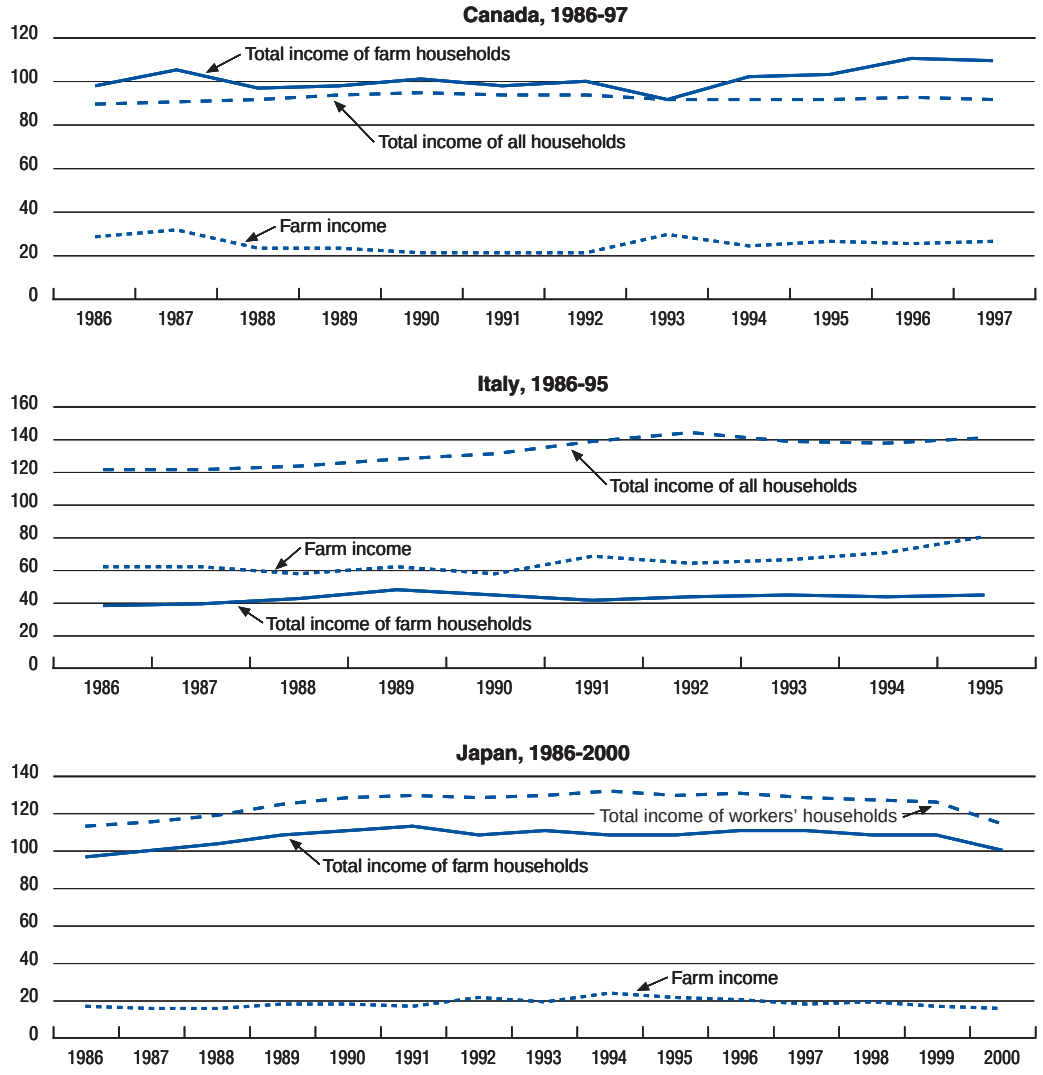
Graph AI.2.1. **Evolution of farm income, total income of farm households and total income of all households in selected countries in real terms**

As a % of the total income of farm households at the beginning of the period (average of the first three years)



Graph AI.2.1. **Evolution of farm income, total income of farm households and total income of all households in selected countries in real terms** *(cont.)*

As a % of the total income of farm households at the beginning of the period (average of the first three years)



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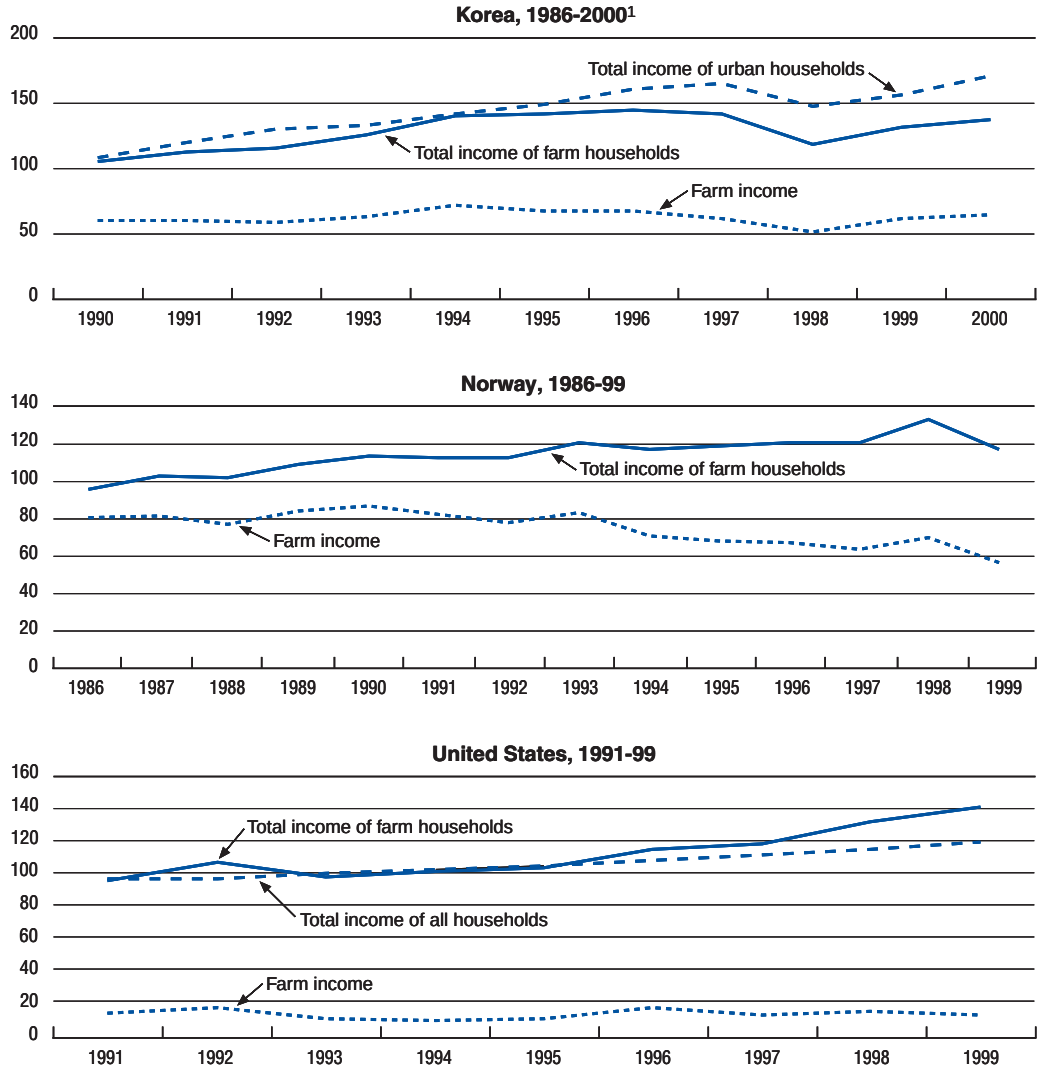
Graph AI.2.1. **Evolution of farm income, total income of farm households and total income of all households in selected countries in real terms** *(cont.)*

As a % of the total income of farm households at the beginning of the period (average of the first three years)

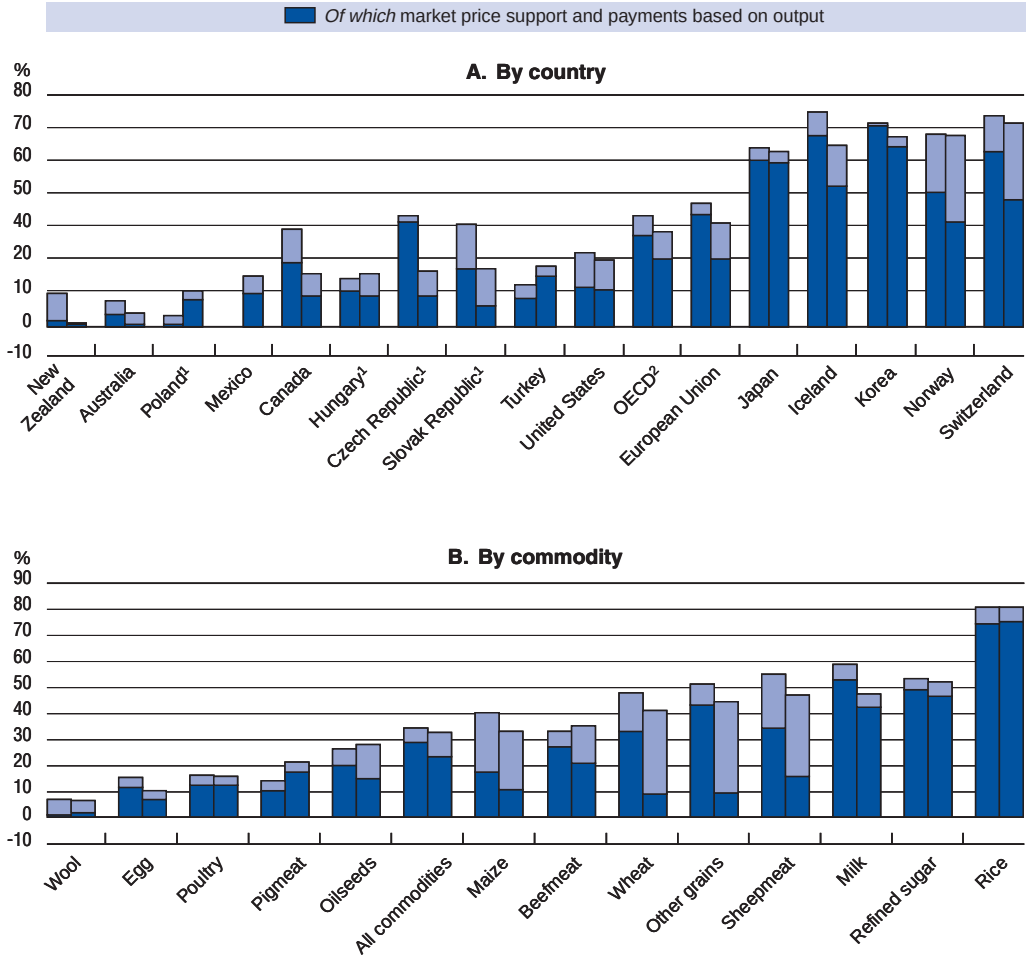


1. Incomes decreased in 1998 following the financial crisis that struck Korea at the end of 1997.

Source: National statistics; GDP deflator from OECD *National Accounts* database.

Graph AI.2.2. **Producer Support Estimate as a percentage of gross receipts, by country and by commodity, 1999-2001**

For each country and each commodity, the first bar corresponds to 1986-88 and the second to 1999-2001



1. For the Czech Republic, Hungary, Poland and Slovakia, 1986-88 is replaced by 1991-93.
2. For 1996-88, the Czech Republic, Hungary, Poland and Slovakia are excluded.

Source: OECD PSE/CSE database.

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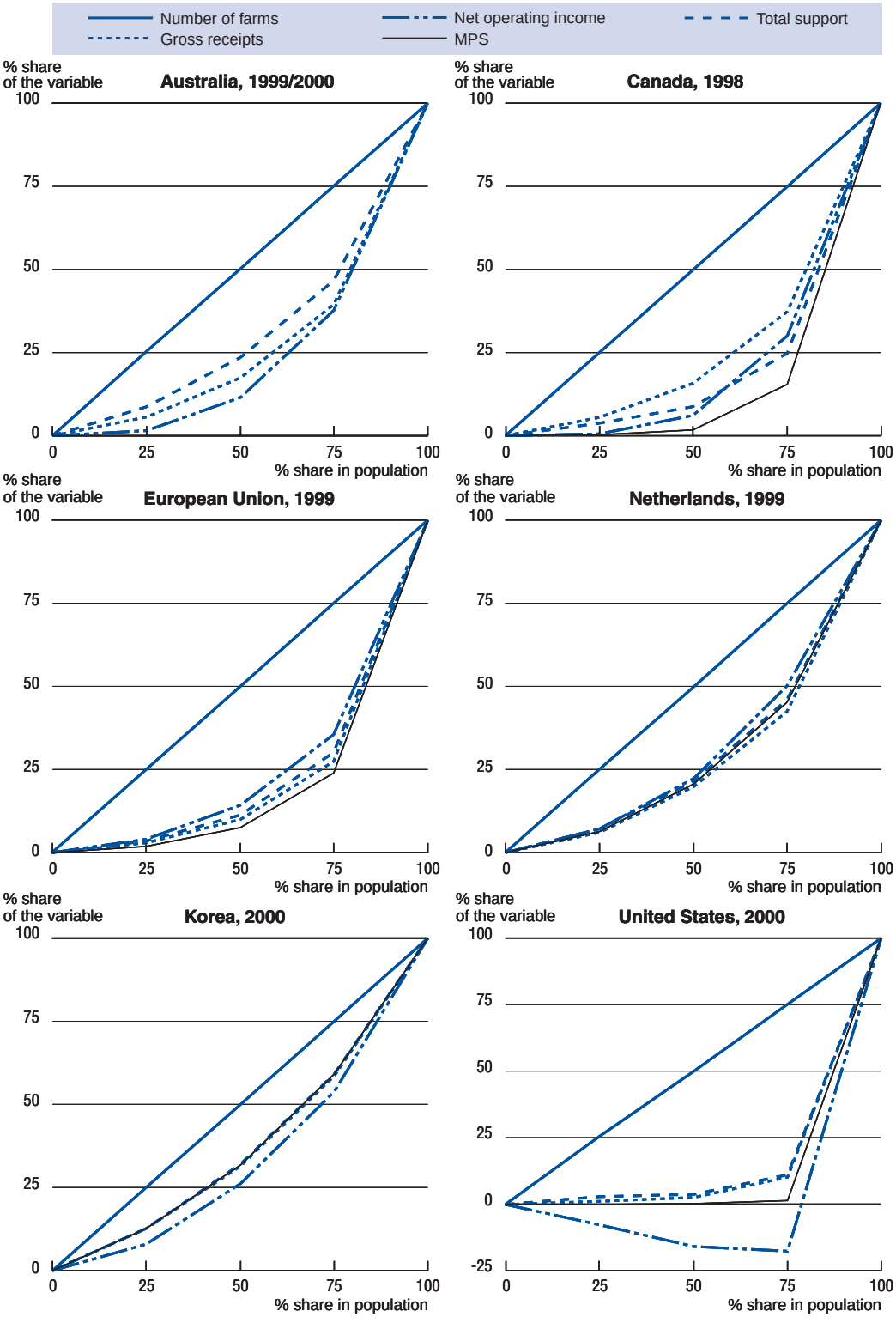
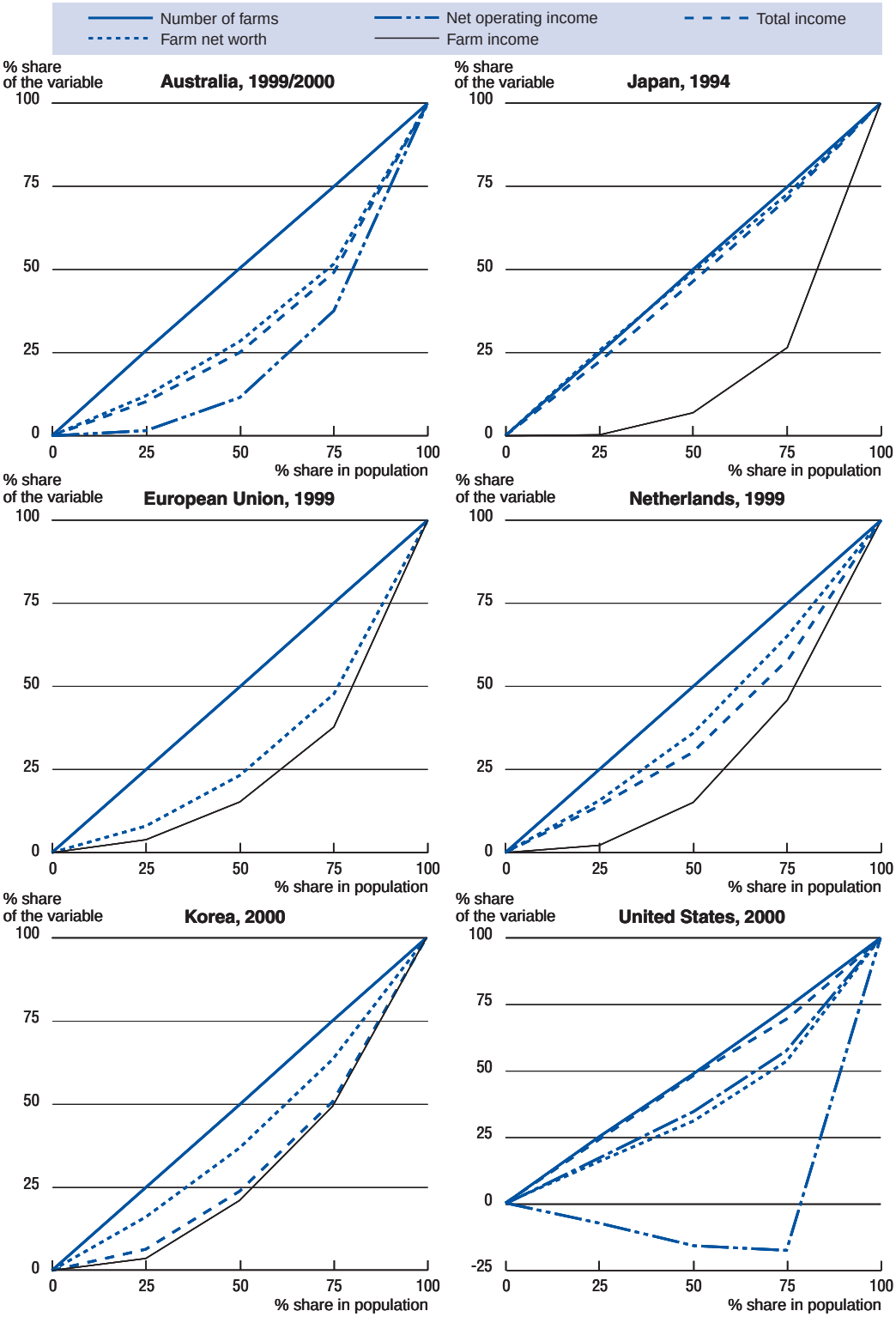
Graph AI.2.3. **The distribution of support, gross receipts and net operating income for selected OECD countries**



See Diagram I.1 for a definition of income indicators.
MPS: Market price support. Support includes market price support and budgetary payments to producers.
Source: OECD structural database and PSE/CSE database.

Graph AI.2.4. **The distribution of income and net worth for selected OECD countries**



See Diagram I.1 for a definition of income indicators.
Source: OECD structural database and PSE/CSE database.

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Part II

The Incidence and Income Transfer Efficiency of Farm Support Measures

II.1. Introduction

The PSE indicates the gross value of monetary transfers from consumers and taxpayers to farmers resulting from agricultural policies. The PSE can be interpreted as the additional money farmers receive in a particular year because governments intervene in agriculture. How much of this extra money should be counted as net economic benefit for the intended beneficiaries? How much of it ends up in the pockets of unintended beneficiaries and how much of it is wasted?

The answers depend on who are designated as the "intended" beneficiaries and on how the associated agricultural policy works. Supporting and protecting the incomes of farm households remains a dominant goal of agricultural policy-makers in many OECD countries, despite the lack of any strong evidence that farm households have systematically lower incomes than other types of household. Consumers and taxpayers pay the costs. If farm household incomes went up by one dollar for each one-dollar increase in the combined consumer and taxpayer costs of supporting farmers, the "transfer efficiency" would be 100%. However, the characteristics of a policy and the market conditions necessary to achieve 100% transfer efficiency of farm support bear no resemblance to the real world. In the real world there are transfer efficiency losses because: *a)* all the different ways governments use to support farmers involve distortions to relative prices and the accompanying inefficiencies in resource use; and *b)* some of the economic benefits of farm support go to people who do not farm.

Policy interest in transfer efficiency arises not just out of a desire to improve policy targeting and reduce waste but also because of a close, inverse relationship between the trade effects and the transfer efficiency of farm support. Farm support measures with the highest degree of transfer efficiency generate the smallest trade effects, while the most trade distorting farm support measures provide little income benefit for farm households per dollar of taxpayer and consumer costs (Dewbre, Anton and Thompson, 2001; OECD, 2001a; Schmitz and Vercammen, 1995).

Transfer efficiency has featured frequently in past Programmes of Work of the OECD Committee for Agriculture (OECD, 1995 and OECD, 1996). Some of this work focused on *quantifying* transfer efficiency in order to estimate what percentage of consumer and taxpayer costs of farm support could be counted as income gain for farm households. It showed that output related support is an inefficient way of improving the income position of farm households. Part II extends the scope of quantitative analysis of transfer efficiency in two ways. First, in addition to output-related support, the coverage of support measures is extended to include support provided to individual factors of production. Second, there is a distinction made between that part of extra farm household income due to farm support in the form of higher returns to land and that part due to higher returns to farm household labour.

II.2. Some general considerations in analysing the benefits and costs of farm support

Benefits

The broad aim of estimating and comparing the transfer efficiency of different ways governments support farmers is to identify policy alternatives that could achieve the same improvement in farm household income at the lowest cost to consumers and taxpayers, and that distort trade as little as possible. The specific indicator of transfer efficiency employed here is the ratio of the absolute *change* in farm household income to the absolute *change* in the total of consumer and taxpayer costs caused by a small increase in a support measure.

Benefits are to be measured by changes in total incomes of farm households *in the aggregate*, making no distinctions amongst different kinds of farm households within that population.[1] The total income of farm households comprises income they earn from both on-farm and off-farm activities. In fact, in many OECD countries the largest share of the total income of households designated as farm households comes from off-farm sources (OECD, 1995; Gunderson *et al.*, 2001; USDA, 2001; and OECD, 2002). Government policies providing financial support to farmers lead to higher-than-otherwise earnings from farming activities and, thus, to higher-than-otherwise total income from on-farm and off-farm activities.

A given increase in financial support to farmers would cause an increase in the farm component of earnings of farm households and thereby an increase in their total earnings from all sources. However, some slippage would likely occur at both levels: *1)* the increase in *farm* income due to increased farm support could be less than dollar-for-dollar; and *2)* the increase in *total* income of farm households due to increased income from farming could also be less than dollar-for-dollar.

There are several reasons to expect a less than one-to-one relationship between extra money consumers and taxpayers spend to support farmers and the resulting extra total income of farm households. Some of the money consumers and taxpayers pay for farm support never reaches farmers at all, going instead towards paying the costs of administering the programme. Then, some of the money that farmers actually receive may be passed along immediately in the form of higher rents on land supplied by non-farming landlords.

Furthermore, farm support is rarely spread evenly amongst farm commodities competing for the same resources. Farmers respond to policy-induced changes in relative returns by shifting resources away from relatively unsupported crops and livestock towards those benefiting from support. The income gains they experience from an increase in returns to supported commodities may thus be partially offset by reductions in income earned from the lower production of unsupported commodities. Moreover, to fully maximise their benefits from support, farmers may expand production of supported commodities by increasing the intensity of purchased input use, expending some of the extra revenues they receive buying inputs supplied from off-farm suppliers.

Finally, even the additional income that farm households earn from their farming operations will not translate dollar-for-dollar into additional *total* income for the farm household if extra farm support encourages farm households to divert some of their work time, or other resources they own, from non-farm to farming activities. Such a reallocation would limit the gains in total income with a reduction in non-farm income partially offsetting the induced gains in income from farming.

Costs

The mix of consumer *versus* taxpayer contributions to the total costs of supporting farmers will differ depending on the form in which support is provided. The implications for farm household income, the transfer efficiency, will also vary depending upon the policy mechanism used. Thus, it is important to recognise the various avenues through which support is delivered from taxpayers and/or consumers.

One avenue is a policy of market intervention in order to force the market price to a government target price level. Domestic buyers of commodities under a regime of market price support pay a part, perhaps the largest part, of the costs in the form of higher domestic prices. Taxpayers must also pay if the supported commodity is exported: they pay the cost of subsidies to buyers in other countries plus the associated costs of government purchases and public stockholding. If the supported commodity is imported, however, taxpayers may benefit if the government collects and keeps tariffs on imports.

Various policies that deliver payments directly to farmers based on some criteria, such as the quantity of production or the use of a certain input (typically land), represent an alternative mechanism of support. Taxpayers pay the entire bill for agricultural policies that channel financial support to farmers in the form of direct budgetary payments. To the extent that these payments cause extra production and lower-than-otherwise market prices, consumers could become net beneficiaries of farm support. Taxpayer costs include not just the amount of money the government pays out in the form of payments to producers or as export subsidies, there are also administrative costs and so-called dead-weight costs of taxation that arise when citizens are taxed to collect revenues to fund the programs. These latter "transactions" costs are ignored here (an extended discussion of them is found in OECD, 1995).

Method, scope and limitations of analysis

In the following sections there is discussion and analysis of the benefits, costs and transfer efficiency of four categories of farm support measured and classified separately for the PSE: *1)* deficiency payments; *2)* market price support; *3)* area payments; and *4)* payments based on inputs. This analysis leads, for each category of support, to a pie chart showing numerical estimates of the income incidence of farm support on farm households, farm input suppliers and landlords.

The general procedure followed involved developing equations for the benefits and then the costs of marginal changes in support. This led to the development of equations expressing transfer efficiency, the ratio of benefits to costs, as functions of some familiar economic parameters: the elasticities of supply of land, labour and capital and their cost shares; the elasticities of commodity demand; the initial rates of support and trade ratios. These equations are then solved to obtain numerical estimates of transfer efficiency by introducing "reasonable" values for all these parameters.

This method was chosen to keep the exposition as simple and self-contained as possible. However, to the extent those goals were achieved, it was at the cost of simplifying assumptions that circumscribe the generality of the results. Numerical results must be viewed as approximations because the transfer efficiency formulas are derived using the calculus applying to differential changes in the various price and quantity variables. In addition, the specific numerical estimates of transfer efficiency obtained depend on the specific values assumed for the various supply and demand parameters in the formulas. In

making the illustrative calculations of transfer efficiency for this paper, a set of values thought to be generally representative of total agriculture in OECD countries was chosen. The sensitivity of results to some of the key assumptions is analysed in Annex II.1.

II.3. Transfer efficiency of deficiency payments

It is convenient to begin studying the transfer efficiency of farm support by comparing the costs and benefits of a simple deficiency payment. Under such a program, the government announces a target price for some farm commodity and then makes payments to producers to cover the difference between that price and the price the producer receives from the market.

This kind of support is classified as "payments based on output" under the new system for classifying PSE support measures. Although these payments do not account for a large share of total support provided to farmers in most OECD countries, it is interesting to analyse their transfer efficiency as they provide a simple starting point for introducing key parameters and formulas, as well as explaining most of the basic ideas.

Income benefits of deficiency payments

Deficiency payments increase farm household incomes because they increase earnings from the supply of owned factors to the production of the supported commodities. In the medium to longer term, the two most important categories of farm factors owned and supplied by farm households are land and farm household labour. To simplify the analysis, these two inputs are assumed to be the only farm-owned factors in the mix.

In estimating the income benefits of deficiency payments a three-step procedure, as suggested by Helmberger (1991), is followed. In the first step, the extent to which total producer revenues increase with an increase in the deficiency payment is estimated. Secondly, how much of that induced increase in total revenues is paid to each of the two farm-owned factors, *i.e.* how much do *gross* factor receipts increase, is then analysed. In the final step, an estimate is made of how much of those extra gross factor earnings can be counted as a *net* gain in farm household incomes.

Effects on total revenues

Total revenue earned by farmers from sales of a commodity supported through a deficiency payment comprise a $_s$] market component and a government component,

$$TR = [P_m * Q + [(P_p - P_m) * Q_s] \quad [1]$$

TR is total revenue from sales of the supported commodity,
P_m is market price,
P_p is the government target price and
Q_s is quantity produced.

The first bracketed term in Equation 1 measures what farmers earn from market sales and the second bracketed term measures what they earn as deficiency payments. If the government should increase the target price by a small amount, labelled ΔP_p,[2] this would increase the size of the per unit deficiency payment by ΔP_p and thereby the government component of total revenues. It can be expected that producers would respond to the higher effective prices by increasing production, the magnitude of which would depend on the size of the price increase the government decided to give farmers and on the price responsiveness of supply.

Can the extra production be sold without causing the market price P_m to go down? More importantly for present purposes, can such price dependence be safely ignored? Results of sensitivity analysis presented in Annex II.1 suggest that perhaps it can. When world market effects are taken into account, transfer efficiency is lowered in exporting countries or regions and is increased for importers. However, these differences are small unless the country or region in question is a "large" one.[3] Accordingly, constant world market prices are assumed for this analysis. This simplification means that the change in total revenue due to an increase in a deficiency payment can be expressed as:[4]

$$\Delta TR = [Q_s * \Delta P_p] + [\varepsilon_s * Q_s * \Delta P_p] = Q_s * (1 + \varepsilon_s) * \Delta P_p \quad [2]$$

ΔTR is the induced change in total revenue due to the change in the deficiency payment and ε_s is the elasticity of supply (the per cent change in output associated with a one-per cent change in the producer price). The first bracketed term in Equation 2 shows how much total revenue would increase if the quantity produced did not go up with the increase in support. The second one shows the increment to revenue earned on the induced increase in production.

Effects on gross farm factor returns

How much of the increase in total revenues shown in Equation 2 will be paid to land and to farm household labour? This question is much easier to answer by assuming constant factor shares.

Models embodying a constant factor share assumption feature frequently in analyses of agricultural production response and policy. Constant factor shares are a defining characteristic of the famous Cobb-Douglas production function, a common choice for analysing the benefits and costs of agricultural policies (Helmberger 1991, and Helmberger and Chavas, 1999). It is assumed that constant factor shares give a good approximation of changes in factor payments caused by changes in farm support measures, even if the underlying aggregate production function is not exactly of the Cobb-Douglas form.[5]

The two equations for measuring the gross increase in farm factor earnings caused by an increase in deficiency payments are thus,

$$\Delta GFE_n = s_n * n_r * \Delta TR \quad [3]$$

$$\Delta GFE_l = s_l * l_r * \Delta TR \quad [4]$$

ΔGFE_n and ΔGFE_l are, respectively, the change in gross factor earnings of farm household land and labour caused by a change in farm support. The symbol s_n stands for the share of total costs of production attributable to land – the total of that supplied by farm households and that supplied by landlords who do not farm. The symbol s_l corresponds to the share of total costs of production attributable to labour, the total of that labour supplied by farm households and that supplied by hired labourers. Finally, n_r is the proportion of the total land farmed that is owned by farm households and l_r is the proportion of total labour used in farming supplied by farm households. It is shown below that the four parameters s_n, n_r, s_l and l_r are key determinants of the transfer efficiency of the various support measures studied. This is further illuminated in the sensitivity analysis reported in Annex I.1.

Effects on net farm factor earnings

How much of the increase in gross factor earnings caused by the increase in deficiency payments can be counted as gain in net factor earnings, and thus as a net gain in farm

household income? One way of clarifying this question is to consider under what circumstances all of the increase in farm-owned factor payments could be counted as an increase in farm household income. This would occur only in the special circumstance where the two farm-owned factors were completely fixed in the production of the farm commodity or commodities benefiting from the extra support.

To assume that the farm household labour and land used in the production of a farm commodity receiving deficiency payments are completely fixed in that use may be realistic in the very short term. It is questionable when applied to the medium or long term. Conceptually, there are two ways farm households can adjust the number of hectares and the amount of work time they devote to production of farm commodities. These are: *1)* by changing the total quantities of those factors employed on-farm *versus* off-farm; and *2)* by reallocating amongst on-farm uses.

The possibilities for adjusting the total amount of land used on-farm *versus* off-farm are undoubtedly limited in most OECD countries in the short to medium run, but shifting land among competing on-farm uses can and does occur frequently in response to short to medium run changes in relative returns. Both channels of adjustment are open for farm household labour, and especially so if the adjustment horizon is medium to longer term. Typically, farm households earn a significant share of total farm household income working off the farm. Improvements over time in the education and job skills of farmers and their families have led to increased flexibility in shifting work time between on-farm and off-farm employment in response to changes in relative earnings potential.

The earnings farm households forego when they divert their land and labour from other uses to the production of farm commodities benefiting from support are the opportunity costs of those factors. These costs have to be subtracted from the increased earnings farm households get from producing supported commodities in calculating the net gain in farm household income. Consider, as a concrete example, the effects of introducing a deficiency payment for wheat. Let us suppose that farm households responded by increasing the quantity of wheat they produce. This might mean that some portion of a farm household's available work time formerly spent working off the farm might now be spent seeding, weeding and reaping wheat. It might also mean that some pastureland gets ploughed and planted to wheat. The consequent reduction in off-farm income and in livestock enterprise returns would have to be subtracted from the extra wheat earnings to arrive at the *net* gain in farm household income.

The ease with which farm households can adjust the quantities of land and labour they supply to farming activities will be reflected in the elasticity of factor supply for those two factors. The higher the elasticity of factor supply, the greater is the adjustment in factor use in response to a policy-induced change in factor returns, and the less the net gain in farm household income for a given change in support. Helmberger proposes a simple formula for using the elasticity of factor supply in calculating the net gain in factor returns due to a policy-induced increase in factor payments. The general version of the formula is:

$$\Delta NFE = 1/(1 + e) * \Delta GFE \qquad [5]$$

ΔNFE is the net gain in factor earnings due to a policy-induced increase in gross factor earnings and e is the elasticity of supply of a factor.

A zero elasticity of supply for a factor corresponds to that situation where the factor is completely fixed in production. In Equation 5 is the only situation in which all the gains in

factor payments induced by an increase in support can be counted as net gain in factor earnings. In all other circumstances, the elasticity of factor supply (which is always positive) serves to regulate what fraction of the gross gain in factor earnings gets counted as net gain.[6]

The net gain in farm household income due to a change in support is equal to the sum of the induced net gains in factor earnings on the land and labour they supply. Accordingly, the relationship shown in Equation 5 can be used to derive the following equation for calculating the net gain in farm household income due to an increase in deficiency payments

$$\Delta FHI = \Delta GFE_n/(1 + e_n) + \Delta GFE_l/(1 + e_l) \quad [6]$$

ΔFHI is the change in farm household income due to the change in deficiency payments. The symbol e_n refers to the elasticity of supply of land (whether owned by farm households or by others) and e_l is the elasticity of the supply of farm household labour.

Combining Equations 5 and 6 and simplifying the result gives the following formula for estimating the gain in farm household income associated with a given increase in total farm revenues.

$$\Delta FHI = [s_n * n_r/(1 + e_n) + s_l * l_r/(1 + e_l)] * \Delta TR \quad [7]$$

Note from Equation 7 that, all other things being equal, the increase in farm household income due to an increase in total revenues will be smaller: *a)* the smaller the cost shares of farm household land and labour; and *b)* the larger is the elasticity of supply of those factors.

Leakages and length of run

Results presented below show that one reason the income transfer efficiency of farm support turns out to be so low is that a significant proportion of the economic benefits go to suppliers of inputs purchased by farmers. This can be demonstrated by following the same analytical approach as used above to measure income impacts for farm households.

Assuming constant factor cost shares for the land and labour used in agricultural production implies a factor cost share for all other factors combined that is constant as well. In this analysis we label this aggregated factor "purchased inputs". Multiplying this share by the induced increase in total returns analogously to the calculation of gross farm factor earnings using Equations [3] and [4] above gives the extra amount that will be spent on input purchases.

In turn, net factor earnings (called input supplier profits later on) can be calculated using an equation similar to [5]. That equation expresses the net increase in factor earnings as the ratio of the gross increase in factor earnings ΔGFE to $(1 + e)$, where e is the elasticity of supply of the factor in question. It was noted that if that elasticity is zero, the associated factor is completely *inelastic* in supply and the entirety of the gross increase in factor payments can be counted as a net increase. However, what if e is very large indicating that the quantity of the associated factor is completely *elastic* in supply, *i.e.* that the quantity supplied can easily be increased in response to increases in its price? If that elasticity is large enough then none of the increased expenditures on the factor can be counted as net gain in factor returns.

Assuming the supply of a factor is completely inelastic means the price, but not the quantity, of that factor varies with changes in demand. Assuming the supply of a factor is infinitely elastic means the quantity, but not the price, varies with changes in quantity

demanded. In measuring income distributional effects of agricultural policy analysts frequently combine these two assumptions applying the first to land, the second to all non-land inputs (including farm household labour) used in agricultural production. (See, for example, Abler and Salhofer in OECD, 2001a; Chapter 3 in Helmberger, 1991; and Chapter 4 in Gardner, 1987.) As Gardner notes, these assumptions lie behind the widely accepted belief that the benefits of farm price support accrue predominantly to landowners.

The elasticity of supply of non-land inputs might reasonably be regarded as infinite if the "run" is long enough. For the medium run context in which farm policy analysis is politically relevant, it seems doubtful. Filling total farm sector demand for the raw materials: natural gas, crude oil, steel and so on used to manufacture farm inputs probably puts little strain on the world prices of them, even in the short run. However, to manufacture farm inputs and then make them available to and usable by farmers requires more than raw materials. Input suppliers must add processing, transportation, distribution and marketing services. Providing these services requires investment in capital, both physical and human, that is specific to those services and which may not be as easily adjustable in the short to medium term as that of the underlying raw materials. Examples are farm machinery and equipment merchants; garages, workshops and mechanics that specialise in repairing and maintaining farm machinery and equipment; fertiliser mixing plants and the specialised equipment used to transport and distribute fertiliser; livestock feed processing plants, animal health facilities and veterinarian services.

Accordingly, in the analysis that follows it is assumed that no factor used in farm production is completely fixed in supply, though the supply of land is assumed less elastic than that of non-land factors. Likewise, no factor is assumed to be in completely elastic supply, though the supplies of purchased inputs and farm household labour are each assumed more elastic than that of land. Naturally, the longer the length of run assumed, the less the net gains overall and the greater is the share of that diminished total going to landowners. In other words, the longer the period of adjustment to an increase in support the lower the income transfer efficiency, a result which will hold regardless of the particular support measure used in delivering that support.

Taxpayer costs of deficiency payments

The taxpayer cost for a deficiency payment is,

$$TC = (P_p - P_m) * Q_s \qquad [8]$$

A small change in the government target price and the associated deficiency payment rate would cause total taxpayer costs to rise by,

$$\Delta TC = [Q_s * \Delta P_p] + [Q_s * \varepsilon_s * op * \Delta P_p] = Q_s * (1 + \varepsilon_s * op) * \Delta P_p \qquad [9]$$

ΔTC is the change in taxpayer costs associated with a small change in deficiency payments and *op* is the initial payment ratio *(op = (Pp – Pm)/Pp)*, the ratio of the initial rate of deficiency payment to the producer price. (It is given the symbol op to accord with the label "payments based on output" applied to this category of support measures in the PSE.)

The initial support ratio, *op* has a familiar interpretation in the special circumstance where the deficiency payment is the only source of farm support provided. In this special case, the support ratio (converted to a percentage) would be the per cent PSE. The higher this initial ratio, the higher the costs of further increasing support. To understand why this is so, and therefore why the initial support ratio ends up in the equation, it is helpful to think of the increase in taxpayer costs as comprising two parts.

First, there is the extra cost due to having to pay the marginal increase in deficiency payment ΔP_p on the pre-existing level of production Q_s. This is shown in the first set of brackets in Equation 9. Second, there are the extra costs due to having to pay *both* the marginal increase in the deficiency payment *and* the pre-existing rate on all new production. This is measured by the second bracketed term in Equation 9.

Estimated results

The equation needed to estimate the transfer efficiency of a deficiency payment for farm household income is[7]

$$TE\ (fhi) = \Delta FHI/\Delta TC = [s_n * n_r/(1 + e_n) + s_l * l_r/(1 + e_l)] * [(1 + \varepsilon_s)/(1 + \varepsilon_s * op)] \quad [10]$$

This equation contains eight parameters. Table II.1 shows the relationship between transfer efficiency and each of these eight parameters as well as some indicative numerical values for them. Parameter values are to be viewed as indicative since they will be different for different circumstances: countries, commodities and term (medium or long). The elasticities of factor supply in Table II.1 are meant to reflect factor adjustment occurring over a medium run adjustment horizon of, for example, three to five years.

The estimates of factor cost shares chosen for Table II.1 were inferred from data presented in two OECD reports (OECD, 2001a and OECD, 1999). The first of these reports, *Market Effects of Crop Support Measures*, synthesises results of analysis using the PEM crop

Table II.1. **Parameter values used and estimated results from transfer efficiency calculations**

Parameter	Description	Relationship to TE	Representative value
Factor cost shares			
s_n	Land	Positive	0.20
s_l	Labour	Positive	0.20
s_o	Purchased inputs	Negative	0.60
Farm household supplied shares			
n_r	Land	Positive	0.50
l_r	Labour	Positive	0.75
Factor supply elasticities			
e_n	Land	Negative	0.10
e_l	Farm household labour	Negative	1.00
e_o	Purchased factors	Positive	1.50
ε_s	Output supply elasticity	Positive	1.00
Initial support ratios			
op	Output payment	Negative	0.30
mps	Market price support	Negative	0.30
ap	Area payment	Negative	0.30
is	Purchased input subsidy	Negative	0.30
Estimated transfer efficiency:			
Deficiency payment			**0.25**
Market price support			**0.24**
Area payment			**0.48**
Input subsidy			**0.17**

Source: OECD Secretariat.

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model. It contains estimates of factor cost shares for crops in Canada, Japan, Mexico, the European Union (treated as one country), Switzerland and the United States. The second, *Economic Accounts for Agriculture*, reports estimates of costs of production for the entire sector.

In general, total land (that supplied by farm households plus that supplied by non-farming landlords) usually accounts for approximately 20% of total costs of crop production in the countries studied for the PEM crop analysis. Annex II.2 contains estimates of the shares of owned farmland for a selection of OECD countries. These estimates average around 50%, the same Graph used for the calculations on transfer efficiency. A recent study of the effects of government payments on land values in the United States (Barnard *et al.*, 2001) found that of the land receiving the most benefits from government payments a significantly higher proportion was rented than was the case for all land.

Assuming that one half the cropland is rented gives a cost share for owned land supplied by farm households of 10%. The cost share for hired labour used in crop production in the countries studied for the *Market Effects* report was around 5%, leaving a cost share of 15% for that labour supplied by farm households. Let us suppose for present purposes that this is representative for the sector as a whole.

Combining the shares for farm household land and farm household labour would thus yield a total of 25% for all farm household factors used in crop production. The sector-wide aggregates reported in the *Economic Accounts for Agriculture* suggest a total factor share for farm household supplied factors in this same neighbourhood. Although the *Economic Accounts* data do not allow calculation of factor cost shares separately for farm household supplied labour and land, estimates of net farm income reported can be used to estimate a cost share for their total. Net farm income as a percentage of total value of output is typically less than 30% in individual OECD countries, frequently below 20%.[8]

The elasticities of factor supply for land, labour and purchased inputs in Table II.1 were chosen based on data presented in reviews of past studies of agricultural supply response in North America (Abler, 2001) and in Europe (Salhofer, 2001) that were undertaken in developing the PEM crop model (OECD, 2001a). The authors were asked to make recommendations of "plausible ranges" of parameter values to use in policy simulation analysis.

A total land-supply elasticity of 0.10 for modelling sector-wide supply response fits comfortably within their recommended ranges. In the following analysis, that elasticity is applied equally to land owned by farm households and by others. The supply of farm household labour in the medium to long term is generally assumed to be more responsive than the supply of land to changes in relative returns; a difference which widens the longer the run being considered. This elasticity will reflect the ease with which farm household members can shift between on-farm and off-farm work as well as household preferences for work *versus* non-work (including leisure) activities.

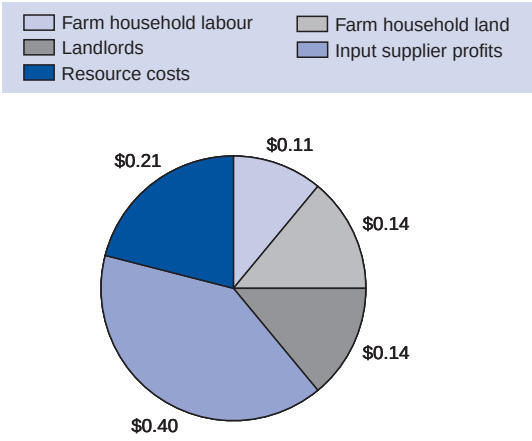
Mathematically, the elasticity of output supply ε_s is itself a function of values assigned the factor cost shares and the elasticities of factor supply. However, to calculate this elasticity (as was done to obtain the value 1.0 for the table) the list of factors must be extended to include all productive factors, not just land and farm labour. The factor share and the elasticity of supply characterising those inputs purchased by farmers must also be considered. A combined cost share of 0.40 for *total* land and *total* labour implies a cost share of 0.60 for all purchased inputs combined. An elasticity of purchased inputs of 1.5 is also well within the range of plausible values recommended by the PEM consultants.

As discussed above, one would be looking at substantially higher numbers for the elasticities of purchased factors if the adjustment horizon were long run. If it were only this supply elasticity, *i.e.* that for purchased factors, that would be higher in the long run, one might conclude from results shown in the table that transfer efficiency would also be higher in the long run. However, the elasticity of the supply of farm factors, especially that of farm household labour, is also likely to be greater in the longer run. In calculating transfer efficiency, the positive effect of higher purchased factor elasticities will be offset by the negative effect of higher farm factor elasticities.

The estimate of transfer efficiency for deficiency payments of 0.25 in Table II.1 was obtained by introducing the listed parameter values into the transfer efficiency formula, Equation 10. This result would imply that for each extra dollar of support provided to farmers in the form of deficiency payments, only twenty-five cents translates into a gain in net earnings for the land and labour supplied by farm households. In other words, for each one-dollar gain in factor earnings, taxpayers must pay around four dollars in deficiency payments.

If farm households receive just twenty-five cents of each extra dollar taxpayers pay in deficiency payments, what happens to the other seventy-five cents? Graph II.1 shows how the entire one-dollar of extra taxpayer costs for deficiency payments is divided up. The largest portion, forty cents, goes as extra profits to suppliers of farm inputs. Another fourteen cents goes out as extra rents for non-farming landlords. Resource costs, that is the money needed to offset the combined opportunity costs of diverting resources from other productive uses to the production of the supported commodity, account for the remaining twenty-one cents. These costs include the economic efficiency losses for the domestic economy as a whole – the economy-wide costs of the production distortions caused by the deficiency payment.

Graph II.1. **The incidence of deficiency payments**



Source: OECD Secretariat.

The entire distribution of leakages and efficiency losses revealed in Graph II.1 will be different for different assumptions concerning values of the parameters shown in the Table II.1. Results presented in Annex II.1 show the sensitivity of transfer efficiency estimates to alternative model and parameter assumptions, and reveal that the most important assumptions concern the factor shares applying to the farmland and farm

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household labour supplied by farm households. The higher those shares, the higher are estimated transfer efficiencies.

Note from Graph II.1 that the twenty-five cents of net gain in farm household income is itself split: fourteen cents to farm household supplied land and eleven cents to farm household supplied labour. However, those fourteen cents going to farm household supplied land should be seen as transitory, applying only in the medium-run context of the present analysis. Economic theory implies that those extra land rents, appropriately discounted to reflect the time value of money and uncertainty about the permanence of government support, will be capitalised into the price of the land (Barnard et al., 1997). Eventually, that land will be sold at those higher prices when farmers leave the sector or retire. The new owner may continue to receive the government payments, but their value to him/her will be just offset by the extra cost of owning that higher-priced land (either as interest expense on the loan taken out to buy the land or as foregone earnings on owner equity).

II.4. Transfer efficiency of market price support

Let us suppose now that the government rather than using a deficiency payment to increase the effective producer price, does so by a program of market price support. Market price support continues to account for the largest share of the total estimated monetary transfers to farmers attributable to agricultural policy in OECD countries (OECD, 2001b). A stylised version of a program of market price support under which the government sets a price to apply equally to all domestic sellers and buyers of a farm commodity will be analysed here. The government will enforce that price by imposing a tariff high enough to ensure that no imports can be sold at a lower price and, if necessary, by subsidising exports of surplus product.

Taxpayer costs of market price support

For the same effective producer price, the income benefits of market price support will be the same as for a deficiency payment. It is only the differences in their respective costs that need concern us here. The taxpayer costs of a program of market price support depend critically on whether a country is an exporter or an importer of the supported commodity. If domestic production exceeds domestic consumption, the country in question is an exporter and the government must pay subsidies to buyers in world markets to make up the difference between the supported price and the prevailing world price.

If domestic consumption exceeds domestic production, the country in question is an importer and *may* receive tariff revenues on imports. However, not all programs of market price support generate tariff revenues for governments of importing countries. Voluntary export restraints and tariff rate quotas are examples in which the rents from restricting imports may not accrue to the importing country government.

The formula for measuring the taxpayer costs of export subsidies or, if negative, the tariff revenues earned, for a program of market price support is

$$TC_x = (P_d - P_w) * (Q_s - Q_d) \qquad [11]$$

TC_x is the taxpayer costs (benefits) of export subsidies (import tariffs), P_d is the domestic price in the presence of market price support, P_w is the world price and Q_d is domestic consumption.

A small change in the guaranteed price and thus in the associated market price support rate would cause total taxpayer costs to change by

$$\Delta TC_x = [(1 + mps * \varepsilon_s) - cr * (1 + mps * \varepsilon_d)] * \Delta P_d * Q_s \quad [12]$$

The symbol *cr* stands for the ratio of domestic consumption to domestic production (if less than one, the country in question is an exporter, if greater than one, an importer). The proportional rate of market price support is denoted by *mps* and ε_d is the elasticity of domestic demand for the supported commodity.

Consumer costs of market price support

One way of measuring the consumer costs of market price support is to simply multiply the quantity they consume – Q_d by the price gap ($P_d - P_w$), the difference between the domestic and the world price. However, that covers only part of the additional costs imposed on consumers when domestic prices are increased by market price support measures. This is because the amount consumed at supported domestic prices is probably less than would be observed at the lower world market prices. When consumers reduce their consumption in response to policy-induced price increases there are additional costs to be accounted for. These costs are sometimes called the real income losses associated with the higher consumer prices. These can be measured by calculating, for a given policy-induced change in consumer prices, not the change in the consumer expenditures but the change in consumer surplus (see OECD, 1995 for a fuller discussion and graphical exposition).

An equation to approximate the change in consumer surplus when the domestic price is increased by the small increment ΔP_d is

$$\Delta CS = (-\Delta P_d * Q_d + 0.5 * \Delta P_d * \Delta Q_d) = (-1 + 0.5 * \varepsilon_d * \Delta P_d/P_d) * Q_d * \Delta P_d \quad [13]$$

ΔCS is the reduction in consumer surplus (the negative of the change in consumer costs) due to market price support.[9]

A cost-version of this equation that is more convenient for the following total cost calculations can be obtained by multiplying and dividing the last expression in Equation 13 by $-Q_s$. This accomplishes two things. First, it changes the sign of the measured change in consumer surplus from negative to positive allowing us to add it to the induced change in taxpayer costs, which we have so far measured with a positive sign. Second, it eliminates Q_d from the equation.

$$-\Delta CS = cr * (1 - 0.5 * \varepsilon_d * \Delta P_d/P_d) * Q_s * \Delta P_d \quad [14]$$

An equation for the change in the total of taxpayer and consumer costs induced by the small change in market price support can now be obtained by combining results from Equations 12 and 14, giving

$$\Delta TC = [(1 + mps * \varepsilon_s) - cr * (1 + mps * \varepsilon_d)] + [cr * (1 - 0.5 * \varepsilon_d * \Delta P_d/P_d)] * Q_s * \Delta P_d \quad [15]$$

Estimated results

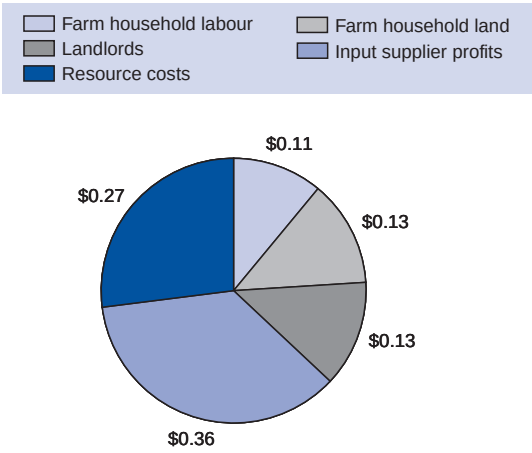
Equation 15 gives the needed measure of costs for the cost side of the transfer efficiency ratio for market price support. The benefit side of that ratio is obtained in the analysis of the transfer efficiency of deficiency payments in Equation 7. Combining these, and making the required substitutions and simplifications, leads to the following equation for measuring the transfer efficiency of market price support.

$$TE\ (fhi) = \Delta FHI/\Delta TC = [s_n * n_r/(1 + e_n) + s_l * l_r/(1 + e_l)] * (1 + \varepsilon_s)/[cr * (1 - 0.5 * \varepsilon_d * \Delta P_d/P_d) + (1 + mps * \varepsilon_s) - cr * (1 + mps * \varepsilon_d)] \quad [16]$$

Equation 16 contains all of the same parameters found in Equation 10, the equation derived above for estimating the transfer efficiency of a deficiency payment, plus two new ones: ε_d the price elasticity of domestic demand and *cr* the ratio of domestic consumption to domestic production. A value of –0.20 for the price elasticity of demand for aggregated agricultural output and a ratio of domestic consumption to production of 0.90 is assumed. The latter corresponds roughly to the average relative value of total agricultural consumption and production in OECD countries. Annex II.1 contains some results showing the sensitivity of transfer efficiency estimates to the trading status of a country.

Introducing these values, and those for all other parameters from Table II.1, into Equation 16 yields an estimate of the transfer efficiency of market price support of 0.24, a figure slightly less than the result of 0.25 obtained for the transfer efficiency of a deficiency payment. In other words, farm households would experience a gain of only twenty-four cents for each one-dollar of additional taxpayer plus consumer costs for market price support. Put the other way round, taxpayers and consumers together pay more than four dollars for each one-dollar gain in farm household income due to market price support. Graph II.2 shows this breakdown.

Graph II.2. **The incidence of market price support**



Source: OECD Secretariat.

The biggest difference between the transfer efficiency results obtained when analysing a deficiency payment, shown in Graph II.1, and the results for market price support, shown in Graph II.2, is the extra resource costs of market price support. Resource costs are higher for market price support because domestic economic losses resulting from induced reductions in consumption must be included.

II.5. Transfer efficiency of factor subsidies

The objective of the two stylised support measures analysed above, whether implemented using a deficiency payment or a tariff, is to increase the effective price farmers receive for their *output*. Another way of supporting farm incomes is to provide payments per unit of factor use. In terms of the estimated amount of money OECD governments spend each year, the most important category of factor subsidies is area payments.

The transfer efficiency of area payments is also interesting to study because it is virtually the only kind of support targeted directly to a factor of farm production owned and supplied by farm households. In principle, governments could devise policy measures aimed directly at increasing returns to farm household labour, via the income tax system for example. Surprisingly, these forms of targeted support do not account for very much of the money governments spend (or, equivalently, the tax revenues they forego) subsidising agriculture.

Accordingly, this section begins with an analysis of the benefits, costs and transfer efficiency of area payments. The only other broad category of factor subsidies accounting for a noticeable share of the PSE is payments based on inputs. An analysis of the transfer efficiency characteristics of one stylised variety of such payments – subsidies to purchased inputs concludes this section.

Income benefits of an area payment

Consider that instead of providing budgetary support to farmers via a deficiency payment the same amount of support is provided in the form of a payment to land. Suppose further that this is a per-hectare or per-acre payment made conditional on planting a crop or otherwise using the designated land in some specified agricultural use. Assume as well that this payment is made to the owner of the eligible land regardless of whether he or she is a farmer. This is actually the way the program works in some countries whereas in others the law requires that the payments be made to whoever is farming the land. However, under the usual assumptions about land markets, rental rates will eventually be driven up by the amount of the payment and the estimated transfer efficiency will come out the same regardless of who actually *first* receives the payment.

Area payments implemented in this way constitute a stylised version of an area payment program that does not correspond exactly to any one of the many area payment programs operating in member countries. Nevertheless, by analysing this stylised version most of the really important differences in the economic effects that distinguish this general category of support measures from deficiency payments and market price support are captured. Area payments are often restricted to only a certain amount of land, either based on past uses or in total – although these restrictions may be questioned in terms of enforcement – so the elasticity of the factor supply relevant for net benefit calculations may be reduced closer to zero.

In general, as for a deficiency payment, a factor subsidy may increase incomes of farm households by increasing the returns to both the factors they supply to agriculture. It should be expected that a subsidy targeted to one of those factors, an area payment in the present case, would affect the returns to land more than the returns to household labour. The equations for calculating gross factor earnings for the land and labour supplied by farm households when farmers receive an area payment are

$$GFE_n = [s_n * n_r * TR] + [n_r * (AP * X_n)] \quad [17]$$

$$GFE_l = s_l * l_r * TR \quad [18]$$

AP is the per-hectare area payment and X_n is the total number of hectares of land benefiting from the payment.

The first bracketed expression in Equation 17 measures that part of the total revenues earned from sales that go as factor payments to the land supplied by farm households. The second bracketed expression, absent in Equation 18, measures the extra returns

attributable to the area payment. In Equation 17, the symbol X_n refers to the total land supplied by both farm households and by non-farming landlords. The presence of the parameter n_r, the proportion of land that is owned by farm households, in that part of the equation serves to emphasise the point further that only a portion of the area payments is made on land supplied by farm households.

Imagine increasing the per-hectare area payment *AP* by a small amount ΔAP. The equations for calculating the impact of this on the gross factor earnings for farm household land and labour are

$$\Delta GFE_n = [s_n * n_r * e_n * \Delta AP * X_n] + n_r * [(1 + ap * e_n) * \Delta AP * X_n] \quad [19]$$

$$\Delta GFE_l = [s_l * l_r * e_n * \Delta AP * X_n] \quad [20]$$

In Equation 18, *ap* is the initial area payment rate expressed as a ratio to the initial rental rate of land.

Consider the first bracketed expression in Equation 19 and then the corresponding expression in Equation 20. These two formulas measure the gains in factor earnings attributable to the increase in total receipts from sales of the supported crop that might follow an increase in the area payment. (Under our assumptions about the nature of the payment and the elasticity of supply of land, the area payment stimulates additional plantings leading, ultimately, to an increase in production.)

The second bracketed expression in Equation 19 measures the portion of extra area payments that farm households get on the land they supply. There is no second term in Equation 20, reflecting the fact that farm household labour will benefit from area payments only to the extent that such payments lead to additional production. This will not amount to much if, as would be expected, the supply of land is highly price inelastic. This provides the first glimpse of an important finding about area payments that will be illustrated in the transfer efficiency calculations to follow. It is that the lion's share of the economic benefit of such payments goes to land.

The final equation for estimating the income benefits of area payments for farm households is

$$\begin{aligned}\Delta FHI &= \Delta GFE_n/(1 + e_n) + \Delta GFE_l/(1 + e_l) \quad [21]\\ &= [s_n * n_r * e_n * \Delta AP * X_n]/(1 + e_n) + n_r * [(1 + ap * e_n) * \Delta AP * X_n]/(1 + e_n)\\ &\quad + [s_l * l_r * e_n * \Delta AP * X_n]/(1 + e_l)\\ &= [(s_n * n_r * e_n + n_r * (1 + ap * e_n))/(1 + e_n) + (s_l * l_r * e_n)/(1 + e_l)] * \Delta AP * X_n\end{aligned}$$

Taxpayer costs of area payments

The taxpayer cost for an area payment is,

$$TC = AP * X_n \quad [22]$$

A small change in the area payment rate would cause total taxpayer costs to rise by

$$\Delta TC = [X_n * \Delta AP] + [X_n * e_n * ap * \Delta AP] \quad [23]$$

The role of the variable *ap* in determining the cost of increasing an area payment is analogous to that of the support ratio *op* in determining the cost of an increase in a deficiency payment or *mps* in determining the costs of market price support.

Estimated results

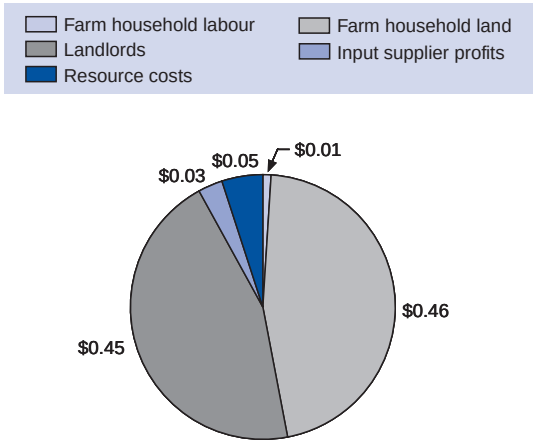
The equation needed to estimate the transfer efficiency of an area payment for farm household income can now be derived. It is, after simplifying,

$$TE\ (fhi) = \Delta FHI/\Delta TC = [(s_n * n_r * e_n + n_r * (1 + ap * e_n))/(1 + e_n) + (s_l * l_r * e_n)/(1 + e_l)]/(1 + e_n * ap) \quad [24]$$

The only new parameter in Equation 24 is the initial support ratio *ap* applying to area payments. To calculate an indicative numerical estimate of the transfer efficiency of an area payment let us assume a value of 0.30 for this parameter. Introducing this value and those for factor shares and supply elasticities from Table II.1 into Equation 24 yields an estimate of the transfer efficiency of an area payment of 0.47, more than double that of either the deficiency payment or market price support.

According to this result farm households would experience a gain of forty-seven cents for each one-dollar of additional taxpayer costs for an area payment. In other words, taxpayers pay a little over two dollars for each one-dollar gain in farm household income due to an area payment Graph II.3 shows the complete breakdown.

Graph II.3. **The incidence of area payments**



Source: OECD Secretariat.

The division of the taxpayer dollar for area payments is considerably different than was the case for deficiency payments. Input suppliers capture almost none of the benefits and the resource costs are considerably lower. On the other hand, a much bigger share of the benefits of area payments, 46%, as compared to 14% for deficiency payments, goes to landlords. Moreover, farm households themselves gain almost exclusively from the increase in returns to the land they themselves supply, forty-six cents. Very little, less than one cent, of farm households' gains come in the form of increased returns to farm household supplied labour.

Income benefits of subsidies to purchased inputs

The category of the PSE called "Payments based on use of inputs" contains a wide variety of government subsidies to farmers not otherwise classified. In this final section, we will analyse the transfer efficiency of just one stylised sub-category in that group of support measures – subsidies to purchased inputs. Real life examples include unit price

subsidies applying to fertiliser, fuel, interest and insurance, as well as the subsidy-equivalent of, for example, tax incentives the government provides to encourage farmer investment in machinery and equipment.

Imagine simultaneously increasing the per-unit price subsidy, or subsidy equivalent, applying to all of the inputs purchased by farmers. The equations for calculating the impact of this on the gross factor earnings for farm household supplied labour and land are,

$$\Delta GFE_n = s_n * n_r * e_o * \Delta IS * X_o \quad [25]$$

$$\Delta GFE_l = s_l * l_r * e_o * \Delta IS * X_o \quad [26]$$

The symbol e_o stands for the elasticity of supply of purchased inputs, considered as an aggregate, ΔIS is the unit input subsidy and X_o is the quantity used of the subsidised inputs.

The corresponding equation for estimating the change in farm household income, derived following the same procedure as for all the other kinds of support above gives

$$\begin{aligned}\Delta FHI &= \Delta GFE_n/(1 + e_n) + \Delta GFE_l / (1 + e_l) \quad [27]\\ &= [(s_n * n_r * e_o * \Delta IS) * X_o]/(1 + e_n) + [(s_l * l_r * e_o * \Delta IS) * X_o]/(1 + e_l)\\ &= [(s_n * n_r * e_o) / (1 + e_n) + (s_l * l_r * e_o)/(1 + e_l)] * \Delta IS * X_o\end{aligned}$$

Taxpayer costs of input subsidies

The taxpayer cost for an input subsidy is,

$$TC = IS * X_o \quad [28]$$

A small change in the input subsidy rate would cause total taxpayer costs to rise by

$$\Delta TC = [X_o * \Delta IS] + [X_o * e_o * is * \Delta IS] \quad [29]$$

The symbol *is* stands for the initial input subsidy rate, expressed as a ratio to the initial price of the input, which has a role in estimating the costs of increasing an input subsidy analogous to that of *op, mps* and *ap* in earlier cost equations.

Estimated results

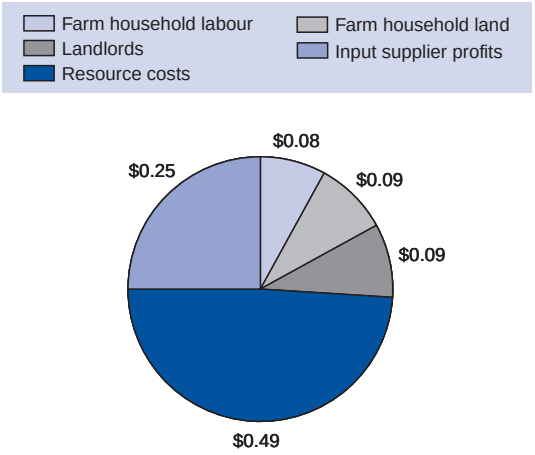
The equation for estimating the transfer efficiency of an input subsidy is thus:

$$TE\ (fhi) = \Delta FHI/\Delta TC = [(s_n * n_r * e_o)/(1 + e_n) + (s_l * l_r * e_o)/(1 + e_l)]/(1 + e_o * is) \quad [30]$$

Comparing this equation to the earlier equations used to make transfer efficiency calculations, there are only two new parameters: e_o the elasticity of supply for the subsidised input and *is* the ratio of the initial subsidy to the initial price of the input. A value of 1.50 for the first of these was assumed. Similarly, in keeping with earlier assumptions about support ratios, let us assume a value of 0.30 for the "is" parameter. Introducing this value and those for factor shares and supply elasticities from Table II.1 into Equation 30 yields an estimate of the transfer efficiency of an input subsidy of only 0.17.

According to this result, farm households would experience a gain of only seventeen cents for each one-dollar of additional taxpayer costs for a subsidy to inputs they purchase. Put the other way round, taxpayers pay almost six dollars for each one-dollar gain in farm household income due to such a subsidy. Graph II.4 shows the breakdown. The seventeen cents that farm households gain splits nearly evenly between farm household supplied labour and farm household supplied land.

Graph II.4. **The incidence of an input subsidy**



Source: OECD Secretariat.

II.6. Conclusions and policy implications

Part II began by asking how much of the gross monetary transfers from taxpayers and consumers to farmers attributable to agricultural policies can be counted as net gain in the income of farm households? The answer is that, measured in terms of changes in benefits and costs "at the margin", probably less than one-half even for the most efficient of support measures. For market price support the answer is less than one-fourth, and for input subsidies less than one-fifth. Although some measures are less inefficient than others none of the support measures studied would seem to provide long term income benefits for farm households efficiently.

Area payments deliver greater income benefit per dollar of taxpayer (or consumer) costs than the other forms of support studied. However, nearly 100% of those gains take the form of increased land rents. Furthermore, increased land rent accounts for the greatest share of the income gain farm households enjoy from farm support, regardless of the policy mechanism used to deliver that support. Those gains cannot be viewed, however, as a source of continuing improvement in the long-term economic well being of people who farm. Those extra land rents will be capitalised into the selling price of land and that land will eventually be sold or leased at those inflated prices leaving little net economic benefit from farm support for farmers who subsequently buy or lease it. In fact, those farmers will face higher capital and associated debt servicing costs (or higher leasing expenses), and ultimately reduced farm profitability.

Area payments, especially if implemented in conjunction with planting restrictions or other provisions mitigating their effects on production, have often been recommended by economists as a better alternative than, for example, market price support for supporting farm incomes. When viewed in terms of their associated resource costs and induced distortions to trade, a well-packaged program of area payments might well be considered a preferable alternative. Limiting the time horizon and reducing the level of payments would check the adverse effects of support inevitably being reflected in land prices. Linking payments to a fixed historical period and eliminating the requirement to plant/produce would further curb unwanted production increases. Nevertheless, because a significant share of the benefits of area payments are captured by landlords who do not farm, even

this category of support fails to deliver income benefits for farm households constituting a high proportion of total costs.

It is clear that widely prevailing approaches to support are not efficient in improving farm household income, and even have the opposite effect of raising costs and reducing farm profitability over the longer term. No farm support policy seems to transfer income to farm households efficiently, although some measures are more efficient than others are. None seem to provide long term income benefits for farm households: all create some degree of distortion in resource use that ultimately shows up as distortion in international trade.

Are there better ways of providing income support for farm households that would not result in the capitalisation of benefits into land? Some of the alternatives would merely change the nature of the asset into which such benefits become capitalised, a marketable production quota or other entitlement to produce, for example. One proposal calls for governments to issue bonds to replace existing programs of price and income support (Swinbank and Tangermann, 2000). These bonds, whose value could be made equal to the net economic benefits provided by a given package of current support measures, would be given to farmers to compensate them for the removal of those measures. Eligibility would be based on the characteristic of the individual, *i.e.* that he/she is a farmer, rather than on a characteristic of the associated farm business, *e.g.* quantity of production or land area. This would allow the current generation of farmers to extract the full expected value of future program benefits and would facilitate a transition to more efficient and effective policies.

It is also possible that at least part of the solution for governments who may wish to ensure "reasonable" income levels for farm households lies outside of agricultural policy entirely. Even then the appropriate policy response depends importantly on the explicit goal and intended beneficiary of support. Many farm households already have income levels equivalent to or in excess of those of non-farm households. The public policy interest in these cases would seem to be poorly served with any income related policy instrument, though provision of necessary public services to rural and remote areas, so that they are not disadvantaged relative to urban areas, might be considered. A number of farm households, however, are characterised by relatively low-income levels. While the nature and causes of lower incomes would warrant further study, broader social policies, such as those available to others in society, seem appropriate to consider in some cases. Temporary income support, training and skills upgrading, re-employment assistance, etc., could prove to be more efficient and cost-effective than the current policy set.

Notes

1. In a recent USDA-ERS paper, Gunderson *et al.* (2000) showed that the distribution of government direct payments in the United States strongly favours those households with above average household incomes and wealth. Relatively poor farm households receive very little from these payments.
2. In the formulas for estimating transfer efficiency presented subsequently this small increase is set at 1% of the initial price.
3. This can be understood by assuming a hypothetical increase in deficiency payments which leads to extra production, which in turn would lead to lower world market prices. It is further assumed that these lower prices are passed back to both domestic producers and to consumers in the country under study.
   The implications of lower world market prices for producer returns, and thereby the taxpayer costs of deficiency payments, will be considered first. Note that under a deficiency payment program, the government must cover the difference between the target price and the world price, revealing that the taxpayer costs of the deficiency payment will be higher than if world market prices had remained the same. In so far as the effects on consumer costs are concerned, given the

assumption that the lower world market prices are passed back to the domestic market, domestic buyers of the supported commodity pay less.
Therefore, lower world market prices mean that the cost to taxpayers for deficiency payments would increase, but that for consumers the cost would decrease. The final combined total will depend on the relative magnitudes of production and consumption. If production is greater than consumption, *i.e.* if the country is a net exporter, lower world prices will lead to a net increase in combined costs and lower transfer efficiency. If consumption is greater than production, *i.e.* if the country is a net importer, lower world prices will lead to a net reduction in combined costs and higher transfer efficiency. If levels of production and consumption are similar, as is the case for total agriculture in most OECD countries, estimated transfer efficiency should be about the same whether world market price effects are accounted for or not. The analysis reported in Annex II.1 confirms this.

4. Using partial derivatives, the change in total revenue ΔTR caused by a small change in producer price ΔPp is approximated by

$$\Delta TR = \partial TR / \partial P_p * \Delta P_p = \partial (Q_s * P_p) / \partial P_p * \Delta P_p ,$$

$$\Delta TR = (\partial Q_s / \partial P_p * P_p + Q_s) * \Delta P_p .$$

If we multiply and divide this last equation by Qs, the following is obtained

$$\Delta TR = Q_s * \Delta P_p + (\partial Q_s / \partial P_p * P_p / Q_s) * Q_s * \Delta P_p$$

which, noting that the elasticity of supply is,

$$\varepsilon_s = (\partial Q_s / \partial P_p * P_p / Q_s)$$

gives the result in the text. There are several more of these elasticity-based formulas used in the paper, all developed using this same general procedure.

5. Support for this assumption can be found in the results reported in Annex II.1. Transfer efficiency estimates are obtained using a Cobb-Douglas version of the production function and are compared with those obtained using a less-restrictive Constant-Elasticity-of-Substitution (CES) model. There are no substantial differences between the two sets of results.

6. The formula applies only if the factor supply function is of the constant elasticity, log-linear form. However, it is probably safe to assume that a log-linear equation can provide a good approximation for the present purpose.

7. This is obtained through a three-step process: replace ΔTR in Equation 7 with the last result in Equation 2, take the ratio of that result to the last result in Equation 9, then simplify by eliminating the variables ΔQ_s and ΔP_p.

8. Net farm income as a percentage of value of production overstates somewhat the true factor cost share for factors supplied by farm households. This is because: *a)* no account is taken of the fact that estimated net farm income in the Economic Accounts includes "subsidies"; and *b)* those estimates include land rents, some of which are paid to non-farming landlords.

9. The last expression in the equation is obtained by exploiting the definition of the demand elasticity, $\varepsilon_d = \Delta Q_d / \Delta P_d * P_d / Q_d$, so that $\Delta Q_d = \varepsilon_d * \Delta P_d / P_d * Q_d$.

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Annex II.1

Sensitivity of Transfer Efficiency Estimates to Selected Assumptions

The transfer efficiency estimates reported in the main body of this paper are specific to the assumptions made about the country under study: its relative importance in the world agricultural market (small) and its trading status (exporter), as well as the particular numerical values of key economic parameters. Analysis presented in this annex addresses the sensitivity of estimated transfer efficiency results to these assumptions.

The sensitivity of results to assumptions is easy to see for the parameter values appearing in the various transfer efficiency formulas. If any of those numbers are changed, the results will also change. The sensitivity of results to changing assumptions about the size and trading status of the country is less obvious. Undertaking that kind of sensitivity analysis requires a model in which the limiting assumptions can be relaxed.

A two-region model of agricultural trade

The simplest model that permits the assumptions to be relaxed is a partial equilibrium trade model representing market-clearing interaction of supply and demand for output and inputs. The model used here is a two-region version (a home country and a rest-of-world) of a multi-country model described in Gunter *et al.* (1996). It is the same basic model on which the OECD's PEM analysis was developed (OECD, 2001). In keeping with the simplifications adopted for the analysis reported in the main text, the agricultural sector of a country is considered as producing a single tradable output using three non-tradable aggregated factors of production: land, labour and purchased inputs.

Producers and consumers in the home country face market prices which government can make higher or lower than the corresponding world price through the use of export subsidies or taxes. It is assumed that producers and consumers in the rest of the world face the world market price. Likewise, producers in the home country may benefit from government payments based on output or on input use. These policy interventions are introduced as price wedges in the same way as was done for the analysis reported in the main text.

Table AII.1.1 contains variable and parameter definitions and the equations of the model. All behavioural relationships in the model are approximated with equations linear in elasticities and percentage changes in the variables. Lower case versions of the symbols used to denote price and quantity variables in the main text here denote percentage changes in them.

Most of the variables and parameters in Table AII.1.1 were introduced in the main text. The most important of the new parameters are the elasticities of factor substitution – the $\sigma_{i,j}$. These parameters are necessary because the model documented in Table AII.1.1 is

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Table AII.1.1. **Variables, parameters and equations of the transfer efficiency model**

Variables	Definition
Endogenous variables	
$q_s^h, q_d^h, q_s^r, q_d^r$	Quantities supplied and demanded of total agricultural output in a home country, denoted with the superscript *h*, and a rest of world, denoted with the superscript *r*.
p_s^h, p_d^h, p^w	Output supply and demand prices in the home country and on the world market, the latter designated with the superscript *w*.
$x_{ns}^h, x_{ls}^h, x_{os}^h, x_{nd}^h, x_{ld}^h, x_{od}^h$	Supply of and demand for land, labour and purchased inputs in the home country.
$x_{ns}^r, x_{ls}^r, x_{os}^r, x_{nd}^r, x_{ld}^r, x_{od}^r$	Supply of and demand for land, labour and purchased inputs in the rest of world.
$w_{ns}^h, w_{ls}^h, w_{os}^h, w_{nd}^h, w_{ld}^h, w_{od}^h$	Supply and demand prices of land, labour and purchased inputs in the home country.
$w_{ns}^r, w_{ls}^r, w_{os}^r, w_{nd}^r, w_{ld}^r, w_{od}^r$	Supply and demand prices of land, labour and purchased inputs in the rest of world.
$x_{ns}^h, x_{ls}^h, x_{os}^h, x_{nd}^h, x_{ld}^h, x_{od}^h$	Quantities supplied and demanded of land, labour and purchased inputs in the home country.
$x_{ns}^r, x_{ls}^r, x_{os}^r, x_{nd}^r, x_{ld}^r, x_{od}^r$	Quantities of land, labour and purchased inputs in the rest of world.
Policy variables	
mps, op, ap, is	Proportional rates of market price support, output price support, area payments, input subsidies.
Parameters and elasticities	
$\varepsilon_d^h, \varepsilon_d^r$	Elasticities of domestic demand in the home country and rest of world.
$s_n^h, s_l^h, s_o^h, s_n^r, s_l^r, s_o^r$	Factor cost shares for land, labour and purchased inputs in the home country and rest of world.
$e_n^h, e_l^h, e_o^h, e_n^r, e_l^r, e_o^r$	Factor supply elasticities for land, labour and purchased inputs in the home country and rest of world.
$\sigma_{n,l}^h, \sigma_{n,o}^h, \sigma_{l,o}^h, \sigma_{n,l}^r, \sigma_{n,o}^r, \sigma_{l,o}^r$	Allen elasticities of factor substitution for the home country and rest of world. Notice these are symmetric so that $\sigma_{i,j} = \sigma_{j,i}$ for all combinations of land, labour and purchased inputs for both the home country and rest of world. Moreover, $\sigma_{i,i} = -\sum_j s_j \sigma_{j,i} / s_i$.

based on a Constant-Elasticity-of-Substitution (CES) production function. The Cobb-Douglas function, on which the analysis in the main text was based, is usefully viewed as a special case of the CES function in which all the elasticities of factor substitution are equal to 1.0.

Another special case is the linear production function in which all the elasticities of substitution are zero. Known variously as an "input-output", "Leontif" production function, the linear production function is one in which the factors are combined, as in a recipe, in fixed proportions: just so much land, this many tons of fertiliser, this many hours of labour, etc. Fixed proportions assumptions characterise the way agricultural production is modelled in all linear programming models and in many of the partial equilibrium and general equilibrium models used in agricultural policy analysis. In the Aglink model, for example, crop production is modelled by assuming that yields are determined independently of land area planted. In the GTAP model, there are explicit production functions for a long list of outputs but intermediate inputs, fertiliser for example, are combined with land in fixed proportions.

Table AII.1.1. **Equations of the transfer efficiency model** *(cont.)*

Equations	Definition
1. $q_d^h = \varepsilon_d^h p_d^h$	Output demands.
2. $q_d^r = \varepsilon_d^r p^w$	
3. $x_{i,d}^h = \sum_{j=1}^{3} s_j^h \sigma_{i,j}^h w_{j,d}^h + q_s^h$	Input demands. The subscripts *j* and *i* each run from 1 to 3 for: land, farm household labour and purchased inputs respectively.
4. $x_{i,d}^r = \sum_{j=1}^{3} s_j^r \sigma_{i,j}^r w_{j,d}^r + q_s^r$	
5. $p_s^h = \sum_{i=1}^{3} s_i^h w_{i,d}^h$	Zero profit conditions ensuring that total market receipts are fully exhausted in payments to factors and reflecting an implicit assumption that the production function exhibits constant returns to scale.
6. $p^w = \sum_{i=1}^{3} s_i^r w_{i,d}^r$	
7. $x_{i,s}^h = e_{i,s}^h w_{i,s}^h$	Input supplies.
8. $x_{i,s}^r = e_{i,s}^r w_{i,s}^r$	
9. $X_{i,d}^h = X_{i,s}^h$	Input market clearing.
10. $X_{i,d}^r = X_{i,s}^r$	
11. $W_{n,s}^h = W_{n,d}^h * (1 + ap)$	Input supply prices.
12. $W_{o,s}^h = W_{o,d}^h * (1 + is)$	
13. $p_d^h = p^w + mps$	Home country output demand price.
14. $p_s^h = p^w + op + mps$	Home country (effective) output supply price.
15. $Q_s^h + Q_s^r = Q_d^h + Q_d^r$	World market clearing.

Source: OECD Secretariat.

The assumption of unitary elasticities of factor substitution highlights the limiting nature of the Cobb-Douglas representation of a production technology. Alternatives to that function are usually described and justified in terms of their less restrictive assumptions about factor substitution. The CES function maintains the assumption of constancy of the substitution parameters but allows for different degrees of substitutability among different factors. In this version, land and labour substitute less well – elasticity of substitution of 0.3, than labour and purchased inputs – elasticity of substitution of 0.8.

Table AII.1.2 below contains estimates of "base" and "alternative" values for all those parameters featuring in the sensitivity analysis. For other parameters in the model, the same values were used as reported in Table II.1. Most of these parameters come from, or were adapted directly from "best-guess" estimates published in the earlier cited report of results of PEM analyses. In general, sensitivity analysis may be undertaken either just to show how results depend on parameter values or to obtain ranges of "plausible" values for

Table AII.1.2. **Model parameters used in sensitivity analysis**

Market parameters			
	Base	Large (exporting) country	Importer
Home country share of world production	0.20	0.50	0.20
Consumption ratio	0.50	0.20	2.00
Farm factor shares			
	Base	High	Low
Land	0.20	0.30	0.10
… % owned by farm household	50%	100%	50%
Farm household labour	0.15	0.20	0.10
Elasticities of factor supply			
	Base	High	Low
Land	0.10	0.30	0.00
Farm household labour	1.00	3.00	0.10
Purchased inputs	1.50	4.50	0.50
Elasticities of factor substitution			
	Base (CD)	CES	Linear
Land – labour	1.00	0.30	0.00
Land – purchased	1.00	0.50	0.00
Labour – purchased	1.00	0.80	0.00

Source: OECD Secretariat.

result variables. The analysis reported here was motivated by the first of these objectives. Accordingly, the parameter values used for the "alternative" simulations should not be interpreted as "equally plausible" as those used for the "base" simulations. Some of these parameters represent unlikely extremes.

In order to do policy simulation experiments the model is calibrated to replicate a given set of initial conditions – the actual prices and quantities in some base period for example. (It does not matter which base period is chosen since all the functional relationships in the model are approximated with equations linear in per cent changes in the variables.) A small change in the value of one of the policy parameters is introduced and the model re-solved to calculate a new set of equilibrium values for all endogenous prices and quantities.[1]

Seven different kinds of simulation experiments were undertaken with the model. The aim of these experiments was to measure differences in transfer efficiency results depending on whether we assume:

- Different market structures:
  1. Endogenous or exogenous world market prices.
  2. Country in question is large or small.
  3. Country in question is an exporter or an importer.
- Different production structure/parameter values:
  4. Production function is Cobb-Douglas, CES or linear.

5. Farm household factor shares are high or low.
6. Elasticities of factor supply are high or low.
7. Initial support levels are high *versus* low.

Results

Table AII.1.3 contains estimates of transfer efficiency from the sensitivity analyses. These estimates were obtained by solving the model documented in Table AII.1.1 as a single system of simultaneous equations. Base results in the first row of the table embody exactly the same assumptions as those invoked in doing the analysis for the main text – constant world market prices, Cobb-Douglas production technology and base parameter values.[2] All the results presented in the remaining rows were obtained under endogenous world market price assumptions, but with different assumed values for key parameters as shown in Table AII.1.2.

Table AII.1.3. **Sensitivity of transfer efficiency to alternative assumptions**

	Deficiency payment	Market price support	Area payment	Input subsidy
Base	**0.26**	**0.25**	**0.48**	**0.15**
Endogenous world prices	0.24	0.24	0.48	0.11
Large (exporting) country	0.18	0.19	0.46	0.03
Importing country	0.27	0.26	0.48	0.12
CES production function	0.27	0.27	0.47	0.13
Linear production function	0.39	0.38	0.42	0.40
High farm factor shares	0.35	0.34	0.96	0.11
Low farm factor shares	0.15	0.15	0.47	0.07
High factor elasticities	0.28	0.28	0.45	0.16
Low factor elasticities	0.27	0.26	0.50	0.04
Zero initial support	0.28	0.28	0.48	0.12

Source: OECD Secretariat.

Effect of size and trading status of the home country

Extra producer support, regardless of whether given in the form of market price support or as direct payments based on output, area or input use, leads to some increase in production and a corresponding decline in world market prices. If passed through to the domestic market, a decline in market prices diminishes the income gain that would otherwise be attributable to higher support levels (or, equivalently, increases the costs of providing the same amount of support). However, lower market prices also result in lower-than-otherwise consumer costs. The combined total of taxpayer and consumer costs will be unambiguously higher for a given increase in support in an exporting country but could be lower for an importing country.

In terms of the transfer efficiency calculations, the reduction in income gain associated with lower world market prices will always be greater for an exporting country than any associated induced reduction in the combined total of consumer and taxpayer costs. This means estimated transfer efficiency should be lower where world market prices are accounted for than when not, a result confirmed by the second row of Table AII.1.3 and illuminated further in the "large-country" case reported in the third row.

The "large-country" results in the third row of the table are associated with an assumed home-country share of world agricultural production of 50%. Although no country in the OECD accounts for nearly that high a proportion of production of any one of the PSE commodities, much less for agriculture in total, these results highlight the fact that, if sufficiently widespread, tit-for-tat increases in farm subsidies by governments of "large-enough" countries are likely to lead to highly inefficient transfers. Or, put the other way round, co-ordinated *reductions* in agricultural subsidies would likely lead to less income loss among farmers in all countries than would unilateral reductions.

Generally speaking, the transfer efficiency of support measures providing direct price or payment benefits to farmers (all categories studied except input subsidies) is higher for an importing country than for an exporting country. Consumption being larger than production means that the induced gains in consumer surplus are *relatively* more important for the importing country. Recall in this connection that in doing the analysis to estimate the transfer efficiency of market price support it was assumed that trade intervention is one under which the government collects tariff revenues. Transfer efficiency of market price support might be lower under regimes, such as voluntary export restraints or tariff-rate quotas, where the tariff rents are allocated to suppliers.

The most notable differences between the results that were reported in the main text and those reported in Table AII.1.3 are the much lower transfer efficiency estimates applying to input subsidies, in particular the estimate of 0.03 for the large country case. Indeed, one cannot rule out the logical possibility that an increase in input subsidies could lead to an actual fall in farm household incomes. That is to say, there are combinations of still-reasonable parameter values such that a given increase in subsidies to purchased inputs would cause a subsidy-induced fall in world market price and an associated negative impact on income sufficiently great to swamp the positive income effect of lower purchased input prices. This further explains the relative unimportance of subsidies to purchased inputs in the mix of support measures actually used by OECD governments.

Parameter sensitivity

Compare the estimates of transfer efficiency in the row labelled "base" with those in the two rows labelled "CES production function" and "Linear production function". There is less difference between the base (Cobb-Douglas) and CES assumptions than between either of these sets of results and those obtained with the linear production function. The qualitative ranking across the four support measures is the same for the linear production function as for the Cobb-Douglas and CES versions. However, with the linear function the transfer efficiencies of the various support measures are all about the same. This is because the linear production function gives simulated *production* effects for each of four support measures (for the same change in support level) that are roughly the same.

More generally, there might be less need to distinguish among various kinds of support measures in discussing the production, trade and welfare effects of support if one could be confident that the aggregate agricultural production function could be represented by a linear function in the context of this study. The conclusions from reviews of past studies of agricultural production done for the PEM crop analysis, published as annexes in the final report (OECD, 2001), are not friendly to such an assumption. Those reviews may not provide consensus estimates of elasticities of factor substitution sufficiently definitive to choose between the Cobb-Douglas and CES alternatives. On the other hand, they do provide a strong basis for rejecting zero values and thus the linear production function as a useful representation for research that focuses on the effects of farm support based on inputs.

Results in the seventh and eighth rows of Table AII.1.3 reveal the importance of factor share assumptions to estimated transfer efficiency. The logic of the results is simple: the higher the share of total market receipts going to pay for factors supplied by farm households, the higher is transfer efficiency. It does not matter whether those shares are higher because the underlying factor shares for total land and labour are higher or because the proportions of those two factors supplied by farm households are higher. The most flagrant difference in the estimates of transfer efficiency presented in these two rows and those in the rest of the table is that for area payments. Clearly, when all farmland is owned by farming households, area payments constitute a highly efficient means of supporting farm household incomes.

The ninth and tenth rows of Table AII.1.3 indicates the importance of factor mobility for transfer efficiency. The noteworthy result here is, once again, one relating to subsidies to purchased inputs. It is the 0.04 estimate obtained under assumptions of low elasticities of factor supply. Generally speaking the lower the elasticity of factor supply the higher the economic efficiency of financial transfers. At the limit, subsidising a factor in completely inelastic supply should rank on an efficiency scale (but not usually on an equity scale) alongside the theoretical "pure" lump sum transfer. However, this analysis is not of economic efficiency in the pure sense of the term but of transfer efficiency. In the present context, subsidies to purchased inputs that are inelastically supplied may lead to highly inefficient transfers to farm households.

The final row in Table AII.1.3 shows results obtained under zero initial levels of support. All the other transfer efficiency results in that and previous tables were obtained assuming a 30% initial rate of support applying to the category of support under study.[3] Comparing these results with those in the base row gives the expected result – the transfer efficiency of a support measure declines with the level of support provided by that measure. The decreasing marginal returns to support follows from the need to apply the full level of support to any new production which occurs as a consequence of the marginal increase in the incentives relating to output or input use.

Summary

The estimated transfer efficiency of deficiency payments, of market price support, of area payments and, especially, of subsidies to purchased inputs depends on whether the country in question is large or small, an exporter or an importer and on the particular parameter values assumed. However, taking account of those additional considerations, as was done in this annex, leaves unaltered the essential conclusions reached from the analysis reported in the main text.

Notes

1. A version of the model in EXCEL was created using the SOLVER software.
2. Numerical results differ slightly from those reported in the main text. There are two main reasons for this: *1)* the consumption ratios that were parameters in some of the transfer efficiency formulas are, in effect, endogenous variables in the model; and *2)* numerical results were obtained simulating "discrete" rather than "differential" changes in the various policy measures.
3. Italics applied to the latter part of the sentence serve to emphasise that there are many different aspects to the notion of pre-existing levels of support. The very real-world phenomenon of pre-existing levels of support in all categories was not acknowledged. These also have implications for the estimated transfer efficiency of any one category of support. Those possibilities were ignored because of the very large number of permutations and combinations of policy simulation experiments needed to fully address the issue.

Annex II.2

Table AII.2.1. **Share of farmed land owned by the farmer**

	1990	1993	1995	1997	2000
	Percentage				
Belgium	33.0	32.8	32.3	31.9	
Denmark	80.9	78.9	77.5	75.1	74.8
Germany	43.3	39.9	38.1	37.0	
Greece	76.4	75.2	73.7	73.8	
Spain	72.3	72.7	72.3	72.3	
France	43.3	39.3	36.8	34.9	
Ireland	87.6	88.1	87.6	86.7	
Italy	80.9	77.8	78.1	78.1	
Luxembourg	50.4	47.6	47.1	46.5	46.1
The Netherlands	66.9	64.6	69.7	71.7	
Austria			78.0	77.2	
Portugal	69.0	69.6	69.6	69.6	
Finland			77.9	80.2	
Sweden			54.8	54.4	
United Kingdom	61.6	61.9	63.7	65.2	
EU 15			59.4	59.0	
United States	58.0			61.4	
Canada					82.1

Notes: **European Union:** total agricultural area (AA) is split between three categories: AA owner farmed + AA tenant farmed + AA share farmed or in other modes of tenure.
United States: Total land operated defined as owned land plus land rented or leased from others (including AUM land) less land rented out.
Canada: area owned in percentage of total area of farms.
Source: **European Union** (region and countries): EUROSTAT, Structure of agricultural holdings.
United States Farm Costs and Returns Survey (USDA). Farm Operating and Financial Characteristics, 1990 and 1997 Census of Agriculture, USDA.
Canada: Statistics Canada, Statistical profile highlights.

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