Direct payments of the CAP – distribution across farm holdings in the EU and effects on farm household incomes in Austria

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Abstract

In 1992, the EU initiated the process of decoupling income transfers from agricultural production which has culminated in the 2003 reform of the common agricultural policy (CAP). In this reform 'single farm payments' have been introduced which are based on direct payments during the reference period 2000-2002. We use statistics of such payments to explore the distribution patterns across farm holdings in EU member states. The results show, that direct payments are skewed towards a small number of very large holdings in a few member states. To show their distributional consequences on farm household incomes, we use data from the Farm Accountancy Data network in Austria. The analysis shows that direct payments do not contribute towards a more equal income distribution of farm households.

Keywords: common agricultural policy, farm household income, income distribution, single farm payments, direct payments

1   Introduction

Until 1992, market price support and supply control policies were the major tools of the Common Agricultural Policy (CAP). The weaknesses of this policy conception to reach allocative and distributive policy objectives have been extensively criticized by economists during the last decades. A proposed solution was 'decoupling', which started with the MacSharry reform in 1992 and gained full momentum with the 2003 CAP-reform. Today, direct payments - paid according to individual entitlements obtained during the reference period 2000-2002 - are the most important policy tool. From a financial perspective, these "*single farm payments*" are either fully or at least partially decoupled and thus avoid many of the negative characteristics of both price policy and the payments based on historical areas and heads of livestock after 1992 (OECD 2006a and 2006b).

Fully decoupled payments are deemed to have minimal or no allocative effects and hence can be considered as pure income support. Thus, these payments are elements of a distributive policy. Such policies aim at correcting market outcomes according to politically determined objectives, usually through transferring money from richer to poorer households. If these CAP payments can be considered as a distributive policy tool in its very meaning, similar redistributive outcomes should be observable as well.

In this paper, we compare the distribution of direct payments for farm holdings across EU member states using Gini-coefficients and Lorenz curves. For Austria we show in detail how market incomes, social transfers, direct payments, and other CAP transfers are contributing to farm household incomes. Using the Austrian bookkeeping data we can show the consequences of direct payment on the distribution of market and farm household incomes.

Direct payments have become the most important fiscal policy tool in the EU in the last decade. Producers of certain crops (among them grains) and certain types of livestock (mainly ruminants) received premiums either based on the acreage planted or the number of raised or slaughtered animals. A number of restrictions (among them idling part of the land) were contingencies of the payments. The amount of premiums increased as domestic prices were lowered. Direct payments amounted to approximately 26 billions € in 2001, which was equivalent to one third of the EU budget and 21 % of factor income in the agricultural sector, or 4.000 € per AWU (annual working units) employed in farming (according to the EAA methodology).

The paper is structured as follows: in the next chapter we review the literature on distributive consequences of the CAP on farm household incomes. Then we present a methodology to derive distribution indicators from budgetary statistics which facilitate the comparison of transfers across countries. Presentations of data and comparisons of income and transfer indicators are provided in the result section. The paper addresses the need to establish better statistics to measure farm household incomes and ends with policy conclusions.

2   Evidence on the distribution of CAP transfers and farm household incomes

2.1   Data sources and their (ir)relevance for distributional analyses – an overview

Established information systems measuring the effects of CAP on farm incomes are hardly adequate for analyzing distributional outcomes, as recently maintained by the Court of Auditors (2004):

- The income indicator of the *farm accountancy data network* (FADN) – 'farm family income' – is tricky to interpret, because many agricultural holdings are organized as companies. In addition, the sample of farms providing the information is considered to be not representative.

- The *economic accounts for agriculture* (EAA) is a satellite account of the national accounts. Its main indicators are 'factor income' and 'net entrepreneurial income'. Besides the fact that the quality of data supplied by some Member States seems to be poor, these indicators are only provided at sector level. Using this source, distributional comparisons can therefore only be made across countries or with other sectors, but not among farm holdings within the farming sector of a country.

- The same is true for the statistics on the *income of the agricultural households sectors* (IAHS; see Eurostat, 2002). The methodologies of the underlying concept are not harmonized which 'cast[s] doubt on the possibility of comparing data supplied by member states' (Court of Auditors, 2004). In principle, IAHS would allow to comparing non-farm household incomes with farm-household incomes, however it is not possible in all member states.

In preparing the 2003 CAP reform, EU Commissioner Franz Fischler infringed a hitherto off-limits information barrier. He released fairly detailed data about the distribution of direct payments to foster a political climate to limit the size of high-end CAP payments and thus to reduce the regressive nature of the CAP regime with the 2003 reform. A similar strategy is

followed by the European Commission in starting the "European Transparency Initiative" in 2005, which aims to "increase openness and accessibility of EU institutions, raise awareness over the use of the EU budget, and make the institutions of the EU more accountable to the public" (CEC, 2006). The most up-to-date figures on the distribution of direct payments across farm holdings were published by Eurostat in 2006. The data cover the period from 2000 to 2003. For Greece, only data on the two most recent years are available. For our quantitative analysis we use the dataset for 2001 which includes 14 EU member states.

2.2   Previous studies

Since decades, agricultural economists (e.g. Koester, Tangermann, 1976) have considered the introduction of direct payments as an important step to mitigate the negative effects of market price support, among them the strongly regressive distribution effects.

Over the last years, OECD has repeatedly looked at the various dimensions of the distribution of agricultural incomes. OECD (1999) analyses the distributional effects of agricultural policies in the mid-90s using own structural data and support estimates. In detail, the report compares the distribution of support in relation to output and income in OECD countries. The report concludes that the distribution of market price support is very similar to the one of output, differences in output, support, and income across regions are less than those across farm types or size classes, and distributions of output, support, and income in the countries reviewed has shown little change over the last ten years.

Kurashige and Hwan Cho (2001) examine the incidence of low income as well as the impact of social security policies of OECD countries in agriculture. Farm households are delineated according to farm self-employment income, 'low farm income' is defined as a certain fraction of a national median income. Based on six indicators, the degree of low income and inequality in income distribution, both for farm households and non-farm households, is scrutinized. Key results are that "low income" is higher among farm households than among non-farm households and that the income distribution shows a higher degree of inequality in farm households than in non-farm households, despite the fact that in many countries the farm sector receives significant benefits from the social security system.

Allanson (2003) explores the redistributive impact of Common Agricultural Policy reform with reference to the distribution of farming incomes in Scotland using a variant of the Gini-coefficient. The main result of this study is that the distribution of support through direct payments has exacerbated the inequality of farm incomes in Scotland in 1999/00. Also the

changes introduced by the 2003 CAP reform will have no effect on the given redistribution of farm incomes. Moreover, Allanson (2005) explores the redistributive effect of classical horizontal inequities induced by agricultural support policy. 'Horizontal inequity' within farm types, defined as the differences in the level of support received by farms of a given type and the level of pre-support income, is traced back to systematic differences in support levels between commodity regimes. The paper shows that for Scottish farms the overall redistributive effect of horizontal inequity is substantial and that current agricultural policy is not able to target support for farms with low levels of income.

At a different result arrives Keeney (2000) in a study of Irish agriculture based on individual farm records. Results are derived from a decomposition of the Gini-coefficient of family farm incomes into two components, direct payments and market-based income. Keeney demonstrates that the direct payment of the MacSharry reform induced a more equal distribution of family farm incomes in Ireland. In a similar study, Frawley and Keeney (2000) confirmed this result that suckler cow premiums and other headage payments were the most effective measures. Cross compliance schemes and the special beef premium had a more moderate effect in terms of equity and arable aid payments contributed least to farm income equity. The authors concluded that a high proportion of dairy farmers among those with high farm incomes may have influenced these results.

The territorial dimension of CAP expenditures has recently been analyzed by Shucksmith et al. (2005). Looking at the regional distribution of CAP payments and their contribution to cohesion objectives, the authors arrive at similarly disturbing results. They state that CAP payments in general do not support territorial cohesion, because more prosperous regions get higher levels of CAP transfers. Pillar 1 support, both per ha of agricultural land and per annual working unit (AWU) is concentrated in the prosperous northern areas of Europe. Pillar 2 support ('rural development'), while being somewhat more dispersed, still reaches primarily the richer regions of Europe. So, the territorial effects of the CAP are substantially uneven and in general run counter to the stated cohesion objectives. At a similar result with respect to the distribution of farm support between continental and Mediterranean agriculture arrive Mora and San Juan (2004). They present evidence that for widely acceptable definitions of equality, Mediterranean farming is discriminated compared to continental farming. This result is mainly due to the fact that smaller and more labor intensive farms are disadvantaged in the CAP framework.

Hence, with hardly any exceptions, most studies looking at distributional effects of the CAP come to the judgment that the current instruments of the CAP do not prevent a substantial part

of farmers from being among the poorest citizens of EU member states. At the same time, direct payments to high-income farm units clearly fuel vast income inequalities in this sector.

3. CAP direct payments – their distribution and effect on farm household incomes

3.1 Direct Payments across Farms in EU-15 Member States

In 2003, 5.2 million farm holdings in the EU-15 received direct payments amounting to 26.7 billion € (see Table 1). The distribution of direct payments is skewed towards larger units: 1,5% of the recipients get 27% of the transfers. On the other end of the distribution, farms receiving less than 5,000 € (76% of the holdings) get 16% of direct payments.
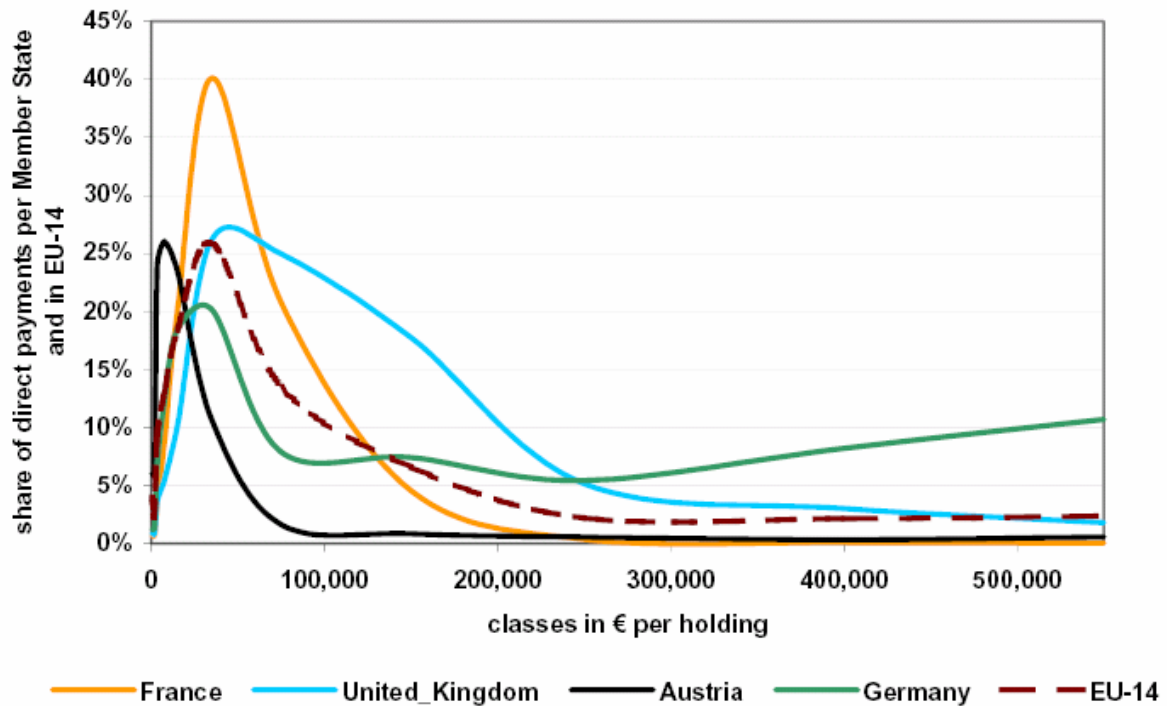
Table 1: Farm structure and direct payments in EU-15 member states

	holdings	UAA	AWU	DP 2001		DP 2003	
		2003		volume	holdings	volume	holdings
	1,000	1,000 ha	1,000	mil €	1,000	mil €	1,000
BE	55	1,394	73	315	48	414	48
DK	49	2,658	61	704	62	802	57
DE	412	16,982	689	3,986	362	3,902	344
GR	824	3,968	616	1,271	924	1,392	892
ES	1,141	25,175	998	3,987	929	4,279	900
FR	614	27,795	914	6,500	460	7,380	442
IE	135	4,372	160	854	135	1,102	129
IT	1,964	13,116	1,477	3,225	1,660	3,128	1,651
LU	2	128	4	19	2	26	2
NL	86	2,007	186	237	78	351	78
AT	174	3,257	175	520	146	601	137
PT	359	3,725	455	472	263	494	230
FI	75	2,245	98	392	72	436	69
SE	68	3,127	71	523	67	612	60
UK	281	16,106	352	3,161	211	3,123	149
EU14	5,341	122,088	5,711	24,891	4,496	26,652	4,298
EU15	6,159	126,055	6,327			28,044	5,190

Note: Recipients of direct payments are not necessarily classified as "holdings" according to the 2003 farm structure survey. BE = Belgium, DK = Denmark, DE = Germany, ES = Spain, FR = France, IE = Ireland, IT = Italy, LU = Luxemburg, NL = Netherlands, AT = Austria, PT = Portugal, FI = Finland, SE = Sweden, UK = United Kingdom, GR = Greece. UAA = utilized agricultural area, AWU = annual working unit.
Source: Eurostat (DP from Eurostat, 2005 and 2006; other data from Eurostat-Database, 2006).

Distributions of direct payments from the 2001 data for the composite of 14 EU member states (EU-15 without Greece) and for some selected countries is shown in Figure 1. Classified data with varying class sizes were used for the construction of the graphs, therefore the real, but unknown, distribution may look slightly different. The graphical representation of the data shows that the distribution of direct payments varies considerably across EU Member States.

Figure 1: Distribution of Direct Payments in Selected EU Member States and in EU-14 in 2001

Source: Eurostat, 2005; own calculations. Note: Figures are truncated at 550.000 €, the presented volume of payments is for the open class 500.000 €and above. The graph is based on classified data with varying class sizes, therefore the real, but unknown distribution may look slightly different.

In Austria, the largest share of direct payments (62%) is going to recipients receiving less than 10,000 €. Another country with a relatively small variation of payments among recipients is France, where 14% of the total volume is spent for recipients with less than 10,000 €. However, the average French farm gets considerable more direct payments (14,114 €) than the average Austrian farm (3,565 €). Countries like the United Kingdom and Germany have distributions with broad tails meaning that very few farms get a large share (the largest 2.5% recipients have got 53% and 40% of the total direct payments in 2001, respectively).

3.3 Concentration of direct payments in EU member states

Based on Eurostat data on the allocation of direct payments among farms in different classes, we have derived estimates on two measures of inequality: Lorenz curves and Concentration Ratios (CR) – see appendix for the details of the algebraic derivation. CR range between zero (absolute equality) and one (absolute inequality) of transfers, and we express them as percentages. Gini-coefficients and Concentration Ratios have the same interpretation, but are derived in a different manner. Lorenz curves are frequently used as graphical tools to show

the level of inequality of incomes (or transfers). We use the parameters of Lorenz curves to estimate the average values of transfers of the first and fifth quintile of recipients.

Table 2 summarizes major results of the estimations of CR and quintile averages for single member states and EU14. Some validation of the CR computation in equation 4 in the appendix is obtained by using micro-data on farm transfers (IACS data) from Austria and the computation method from Dixon et al. 1987, 1988 (equation 5). According to this computation method, the CR is 0.59, and therefore very close to 0.60 computed with the method described in equation (4).

The overview shows that there are two types of member states: Portugal, United Kingdom, Spain, Italy and Germany have high levels of concentration. Based on the estimates of Lorenz-curve parameters (see appendix), quintile ratios can be obtained: The 20% of holdings getting the largest amounts of direct payments receive 90% (Portugal), 79% (Italy), 78% (United Kingdom and Spain) and 75% (Germany) of the total of direct payments in their country. At the EU14 level, 20% of the holdings got 80% of the direct payments in 2001.

Table 2: Distribution of direct payments, agricultural land (UAA) and livestock units (LU)

	direct payments 2001					LU 2003	UAA 2003
	CR	1st quintile	4th quintile	average	median	CR	
	%	Euro	Euro	Euro	Euro	%	%
BE	59.28	466	20,115	6,537	3,834	70.52	56.78
DK	58.15	692	33,877	11,343	6,586	79.76	56.14
DE	71.66	608	41,092	11,003	4,202	76.51	68.24
GR	-	-	-	-	-	91.31	65.95
ES	75.25	52	16,730	4,294	1,167	94.22	80.77
FR	59.61	550	42,878	14,117	7,980	77.75	60.7
IE	57.96	462	18,953	6,310	3,811	58.01	46.48
IT	76.29	31	7,675	1,942	867	97.27	77.77
LU	49.78	993	22,659	8,591	6,758	57.61	51.66
NL	57.71	241	9,146	3,048	1,746	74.76	57.29
AT	60.11	225	11,105	3,569	1,856	70.29	60.99
PT	87.09	3	8,109	1,793	756	90.78	83.01
FI	49.54	750	14,254	5,415	3,897	79.86	46.2
SE	64.00	311	25,688	7,788	3,831	79.47	58.42
UK	75.47	56	58,637	14,988	3,632	80.79	72.99
EU14	77.30	38	22,201	5,537	1,207	89.35	78.09
EU15	-	-	-	-	-	90.12	78.99

Note: CR = concentration ratio. DP = direct payment, UAA = utilized agricultural area, LU = livestock units.
Source: average direct payments are from Eurostat (2005), all other figures are own estimates based on observations in classes published by Eurostat (2005) and the Eurostat-Database (2006).

The Lorenz-curve parameter estimates were used to derive the direct payments for the first and forth quintile of recipients. About 84% of holdings in Portugal, and 73% of holdings in Italy received 1.250 Euro of payments or less in 2001. The skewness of the distribution can also be seen when (estimated) medians and (calculated) averages of direct payment per holding are compared (see 5th and 6t^{h} column in Table 2).

In the last two columns of Table 2 we compare the CR estimates of the distribution of direct payments with the distribution of livestock units (LU) and the acreage of utilized agricultural land (UAA). The CRs shows that the distributions of direct payments and agricultural land are very similar in most member states, with Ireland being a notable exception.

3.4   Farm household incomes and direct payments in Austria

Direct payments are only one source of income for farm households and therefore an overall assessment of the distributional consequences of these instruments must include the other sources of income as well. To measure the distributional consequences of direct payments, we use MAD (mean absolute difference – see Appendix for the algebraic definition), a measure which is robust even if negative incomes are involved (for Gini-coefficients, a modified version would be needed; see e.g. Allanson, 2004). This measure is invariant to equal absolute changes in all incomes. For instance, if all farms have got the same amount of payments (flat-payment per farm) then they receive the same level of support regardless of their current resource endowments (e.g. land, labour), production decisions, or income situation. Such a transfer would not change the MAD measure and may be judged as distributional neutral, because it has no effect on absolute inequality.

As outlined in section 2.1 there are no data sources available at EU level which would allow us to explore the distributional consequences of direct payments for household incomes at EU level. But we can use Austrian FADN data which are detailed enough to allow such an analysis, even if they are not perfect for such an analysis either. Austria is among the EU member states with relatively low concentration ratios of direct payments (together with Finland, The Netherlands, Belgium, Luxembourg, and Denmark). Our findings therefore seem to be representative for this group of small countries, at least. Data for the analysis of farm household income structure and distribution are from the Austrian FADN (LBG, 2001, 2002, and 2003).

The dataset contains records of 2,350 farms in the year 2000, 2,276 farms in 2001, and 2,288 farms in 2002. In this analysis, average figures for 2,572 different farms are calculated from

the three-year panel record to offset annual anomalies[1]. The bookkeeping data of these farms do not exclude incomes from other sources than agriculture, as is the case in many other countries which collect FADN data. Therefore a large share of total income of the farm household – including social transfers and pension, and non-farm activities – are recorded.

The data are from FADN and therefore not representative for all farm households, because the smallest and largest holdings are not represented in this sample. This can be seen when the statistics of direct payments of the sample (Table 3) are compared to those of all Austrian farms (Table 2). Nevertheless, the FADN data are useful to show the distributional consequences for the sample when we compare the MAD before and after direct payments have been accounted for.

Table 3: Mean, standard deviation (Std), minimum (Min), maximum (Max), Mean Absolute Difference (MAD) of income components from FADN-farms (average of 2000 - 2002) and average incomes per quintile

	Mean	Std	Min	Max	MAD	1st quintile	4th quintile
	1,000 €						
direct payments	6.6	7.1	0.0	76.4	6.7	2.0	8.9
agricultural market income	10.8	21.2	-51.5	262.4	20.5	-3.2	21.2
market income + direct payments	17.5	22.5	-49.2	265.1	22.2	1.4	29.9
market income + all CAP transfers	26.5	24.3	-27.3	274.9	24.9	7.7	41.3
farm household income	40.9	24.3	23.2	278.2	24.9	22.4	56.1

Source: own calculation, based on LBG.

The average agricultural market income (defined as revenues net of expenses, investments and depreciation) is 10.8 thousand € of the whole FADN sample and negative in the first quintile of farms. Without any additional sources of income, these farms would go out of business. The MAD of the agricultural market income is 20.5 thousand € which is used as a benchmark.

When we add direct payments to the agricultural market income (6.7 thousand € on average) the MAD increases from 20.5 to 22.2 thousand € A higher MAD indicates that the direct payments favor those farmers more that have higher agricultural market incomes in the first place. When all other CAP transfers are taken into consideration (the sum of direct payments, less favored areas payments and agri-environmental payments) the MAD increases further, reaching 24.9 thousand € Thus CAP payments taken all together, and direct payments in particular, increase the level of inequality in the sample of Austrian FADN farms. Other sources of income (most notably social transfers and pensions) neither contribute to inequality

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[1] The number of 2,572 farms results because some farms have left LBG and others have been included. Consequently, not for all farms are 3-year average figures available, but are still included in this analysis.

nor do they make incomes more equal, the MAD remains at the level of agricultural market income plus CAP transfers which is 24.9 thousand €

4   Conclusions and Discussion

In this analysis we used data on the allocation of direct payments in EU member states to calculate indicators for a comparison of their distributional effects between and within countries. Lorenz-curve parameters and Gini-coefficients, which are widely used measures of inequality, were estimated for data of 14 EU member states from 2001. The distribution of direct payments varies significantly within the EU. The inequality measures show that some countries (among them Finland, The Netherlands, Denmark) have comparable low levels of concentration, while Portugal, United Kingdom, and Germany have very high ones. At the average of 14 EU members, 80% of direct payments have received only 20% of holdings in 2001.

Due to a lack of adequate statistics, the consequences of direct payments on the distribution of farm household incomes cannot be evaluated at an EU wide scale. For Austria, data on farm household incomes (including social transfers and off-farm incomes) are available. We used these data to explore the distributional consequences on household incomes. Agricultural market incomes (farm revenues minus operating expenses and depreciation) are negative in many Austrian farms, therefore we use mean absolute difference (MAD), a concentration measure which can be used in a straight forward manner if incomes are negative. We find that direct payments, do not decrease the inequality of agricultural market incomes. On the contrary, farms with higher market incomes, benefit more from them. The same is true for other CAP payments (among them agri-environmental payments).

We use the evidence on the distribution of direct payment of the CAP to draw three major conclusions concerning 'single farm payments' which have been introduced in 2005 based on the level of transfers during the reference period 2000-2002:

- 'single farm payments' are constructed in a manner to minimize production incentives, the most important instrument of the CAP (from a financial perspective) has therefore (almost) no allocative effects;

- the largest share of 'single farm payments' reaches a small number of holdings, in some EU member states, the number of privileged units is very small;

- evidence from Austria suggests that direct payments (and most likely 'single farm payments') are not contributing to more equal farm household incomes.

We use measures of inequality in this analysis but we do not advocate that direct payments (or the 'single farm payment') should be equally distributed among farmers who qualified for them through historical coincidence at a given date. Such a claim would neither contribute to the objectives of the CAP, nor would an equal distribution be more socially acceptable than the observed ones. However, our findings shall contribute to a discussion on the long term perspectives of the EU common agricultural policy which seriously takes into consideration distributive consequences of CAP payments. Such a discussion will prevail in the EU because the peculiar distributive consequences of CAP payments have attracted concerns among non agricultural economics researchers (e.g. Sapir et. al., 2003) and the general public (see e.g. Baldwin, 2005).

The fundamental changes in the instrumentation of the CAP, with moving from price support to fully decoupled direct payments, raises questions concerning the distributional consequences of CAP transfers. As the 2001 data show, direct payments – and consequently the single farm payments established in 2003 – are biased towards bigger farms all over the EU and benefit very large holdings over-proportionally in a number of EU member states. Such a situation raises equity concerns because frequently larger farms also benefit from economies of scale.

A couple of suggestions have been discussed how to mitigate this situation. One suggestion concentrates on the size of holdings in curtailing direct payments for larger ones. This suggestion has already found its way into practical policy making in the EU (this regulation is called 'modulation'). Yet, the obvious weakness of such an approach is that farmers are able to respond quite easily, e.g. by formally dividing a farm into different legal entities. From an economic perspective, such an approach is likely to have negative allocative effects by influencing the performance of farms according to their size. So, at best, this approach can be seen as a temporary solution.

Another suggestion, which tries to overcome some of the drawbacks of the modulation approach focuses on the labor input of farms. The basic intention is that transfers in farming in the end should support people, not products or owners of land. But also in that case, direct payments related to labor input will induce reactions in the form of incentives to artificially increase officially counted farm labor. Farmers could include family members, but also by engaging employees for service activities which then can be sold to non-agricultural firms. One solution could be to replace actual labor inputs by a transparently calculated representative values. This, however, would be seen as a direct link between production and

support and may thus cause problems with respect to the WTO green box status of such payments.

Single farm payments (the substitutes of direct payments from 2005 on) are only paid if farmers abide by a set of production standards ('cross compliance'). These rules have been tied with environmental, food safety and animal welfare standards. Thereby, such payments overcome the status of a simple income transfer and thus get fortified in political discussions. Yet, scientific evidence points out that this way of securing public goods is highly inefficient and should be replaced by better profiled specific programs within the "second pillar" of CAP.

In a nutshell, the current direct payments in the first pillar (the 'single farm payments') provide income support, while there are hardly any public goods effects. These payments are decoupled and therefore by definition do not have any allocative effects. The purpose of them is therefore distributive. Given that most other distributive policies outside agriculture make those better-off whose primary incomes are lower than average, in this sense direct payments do not qualify to be a 'typical' distributive tool. As the data and distribution indicators show, direct payments favor the largest holding.

So, from an economic point of view, the key question is whether and under what circumstances the EU should continue such a specific, sectoral income policy in the long run. The general opinion among agricultural economists is that direct payments which originate in compensations for historic price cuts etc. should be granted only temporarily. Direct payments, which focus on the provision of public goods or address externalities, should become elements of the "second pillar" and should be subject to strict monitoring and evaluation procedures.

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APPENDIX

Lorenz Curve Estimation and Concentration Ratio Computation

Using the data on direct payments published by Eurostat 2005, we estimate Lorenz curves and compute concentration ratios (CR) to measure the distributional effects of direct payments among EU Member States. Hence, the Lorenz curve relates the cumulative proportion of direct payment units (farms), x, to the cumulative proportion of direct payment received, y, when units are arranged in ascending order of their direct payments. The data of Eurostat (2005) provides ten classes of farms (x) and direct payments received (y), of which cumulative proportions are calculated. We use the functional form proposed by Rasche et al. (1980) to estimate Lorenz curves. The explicit functional form is as follows:

(1) $$y = \left[1 - (1-x)^{\alpha}\right]^{1/\beta} \quad where\ 0 < \alpha \leq 1,\ 0 < \beta \leq 1;$$

The function possesses the proper convexity and slope constraints to assure that it always lies in the lower triangle of the unit square (Rasche et al., 1980).

The computation of the Concentration Ratio (CR) is based on the functional form specified in equation (1). It is defined:

(2) $$CR = 1.0 - 2.0 \int_0^1 \left[1 - (1-x)^{\alpha}\right]^{1/\beta} dx,$$

substituting variables

(3) $$u = 1 - (1-x)^{\alpha},$$

this is equal to:

(4)
$$CR = 1.0 - 2.0 \left(\frac{1}{\alpha}\right) \int_0^1 (1-u)^{1/\beta} u^{1/\alpha - 1} du$$
$$= 1.0 - \frac{2.0}{\alpha} B(1/\alpha, 1/\beta + 1)$$
,

where B represents the beta distribution. It ranges between zero (absolute equality) and one (absolute inequality).

Austrian IACS (Integrated Administration and Control System) data from 2001 are examined to validate the results of the concentration ratio computation from estimated Lorenz curves. There are 139,188 farms that have received direct payments in 2001. On average, an Austrian farm has received about 4,000 €on direct payments ranging between 116 €and 960,000 € (standard deviation is 7764 €). Because a sufficient number of observations is available, the concentration ratio (Gini-coefficient) is computed according to Dixon et al. 1987, 1988

$$(5) \quad G = \frac{1}{\bar{x}n(n-1)} \sum_{i=1}^{n} (2i - n - 1) \, x_i$$

Data is ordered by increasing size of individuals, n is the number of observation in the sample, x is the total of direct payments of farm i (i = 1,...,n), and $\bar{x}$ is the mean of direct payments. Lorenz Curve estimations, Concentration Ratio computations, and statistical tests are obtained in the software package SAS (8.2).

Mean Absolute Difference (MAD)

$$(6) \quad MAD = \left\{ \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right| \right\}$$

where x is the income of individual i (i = 1,...,n), and x_i, x_j denote the i'th and j'th elements of the sample.