Distributive Effects of Direct Payments in German Agriculture under the *New Common Agricultural Policy* of the European Union

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A Report to The German Marshall Fund of the United States
Berlin, November 2006

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Abstract

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Keywords: Common Agricultural Policy; income distribution; farm subsidies; direct payments; agricultural and trade policy; effect of farm subsidies on inequality in agriculture.

Abstract: The Common Agricultural Policy (CAP) of the European Union has been in a process of reform for quite some time. As a result of reforms, agricultural market regulations have become more liberal and direct payments which are to a large extent decoupled from production have been introduced. In this paper, we investigate the effects of the direct payments to farmers on inequality of profits in German agriculture. For this purpose, we decompose absolute and relative inequality in total farm profits into the partial effects of market income and direct payments. Key results of our analysis are that the direct payments employed under the *New CAP* contribute to about one third of the observed income inequality in family farms and to almost 75 percent in large incorporated farms. The introduction of payment limitations at € 100,000 and € 300,000 would not affect the vast majority of farms. Payment limitations would, however, affect large farms. Most of the large incorporated farms would make negative profits under a payment limitation scheme. This would act to increase social welfare, as it would force them to go out of business, or to restructure and become economically efficient.

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A Report to the German Marshall Fund of the United States

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1 A short history of the Common Agricultural Policy (CAP)

The Treaty of Rome established the foundation for European integration and also for the CAP. It was signed in 1957. The CAP was fully implemented in 1967–68 in what was then the European Economic Community of six member countries. The CAP replaced the national systems of farm support of the member countries, each of which had been (more or less) protectionist.

The CAP has served a number of economic and political objectives. Some of them were laid out in the founding Treaty of Rome in 1957; others were not. For the purpose of this paper and for the evolution of the CAP, the following objectives are of relevance:

- The CAP was to provide income support to European farmers through agricultural producer price support in order to reduce the social frictions associated with a rapidly shrinking agricultural labor force.
- It was to provide food security in case of economic and/or political crises.
- It was considered the Guinea pig of future common European policies.

The CAP has certainly served the purpose of providing income support to farmers well. Moreover, it has slowed down the shrinkage of the agricultural labor force. However, this came at the cost of a delayed structural adjustment of farms toward enterprises which are competitive internationally. Moreover, it has reduced social welfare both in the European Union and globally; and it has resulted in high and, at times, rapidly growing EU budgetary expenditures. After almost four decades of the CAP, structural adjustment in the initial member countries, including Germany, has slowed down significantly with only about two percent of the German labor force now being employed in agriculture. Hence, this objective has been met.

High price support together with strong productivity growth in agriculture had led to a significant surplus production in the European Union in many important markets, including grains, meats and dairy. In fact, it is the surplus production that has been the main cause of budgetary burdens caused by export subsidies under the CAP. The initial fear in the European Union of not having enough food has now been replaced by the concern about the budgetary and third–country consequences of too much food in the European Union. At any rate, the objective of securing a sufficient food supply in case of crises has been more than met.

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The European Union started out as the European Economic Community — a customs union. Agriculture was selected as the industry which should demonstrate to the public how beneficial a truly EU-level common (economic) policy would be and how beneficial common policies could be to any industry. Not surprisingly, the price support levels initially granted to farmers were very generous by international standards. However, over time Europe became more and more integrated both economically and politically. The number of member countries increased from six to 25. The European Union has evolved into an economic and political federation. Agricultural policy is no longer anything special; and it is no longer the political guinea-pig of European integration and EU-level political decision making. Rather it has become one of many areas of political activity — albeit one that continues to be very expensive, and in 2005 still accounted for about 40 percent of total EU budgetary outlays (European Commission, 2006).

In short, the key reasons for the creation of the CAP have become obsolete. Therefore, it should not be all that surprising that the European Union is no longer willing to tie up as many political and economic resources in support of farmers as it has done in the past, or that the European Union has

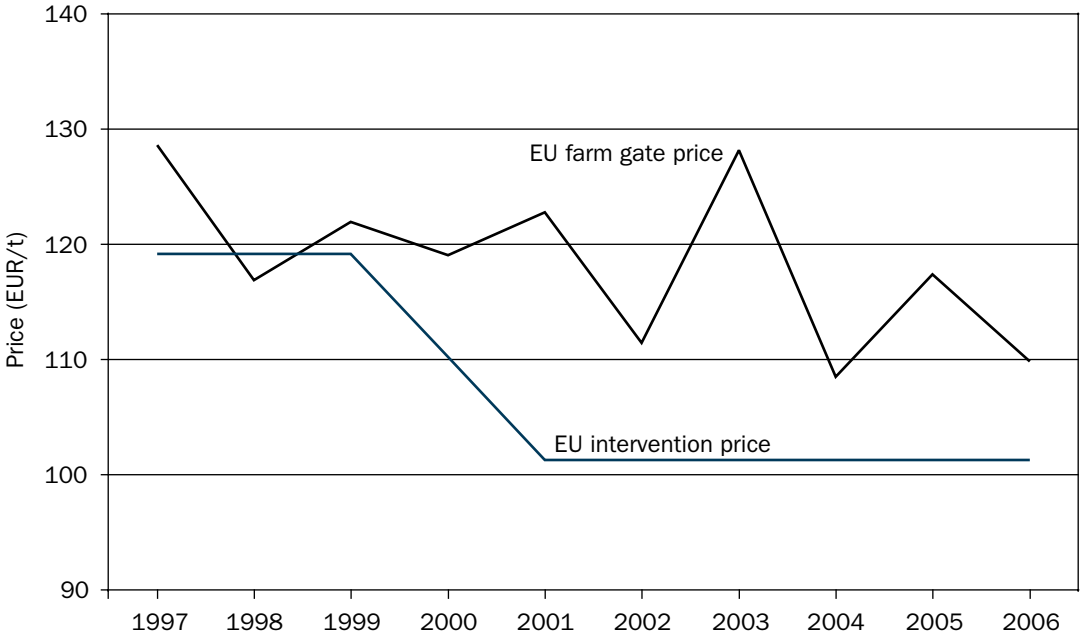
embarked on a process of agricultural and trade policy reforms.

The reform process started in the 1980s with rather subtle changes such as the freezing, in nominal terms, of support prices, or the tightening of quality requirements for EU market interventions. When it became clear that these subtle changes in the CAP were insufficient to reduce the budgetary burdens caused by the CAP and to free financial resources for other EU policy fields, a major reform step was undertaken in 1991 in what became known as the *McSharry* reform. The reform process was continued with the 1999 Berlin decisions on the *Agenda 2000* and the *Luxemburg Compromise of 2003*. Together these reforms have led to a significant reduction in agricultural price supports.

In many markets in typical years farmers now receive market prices rather than government regulated minimum prices. This is exemplified in Figure 1 for wheat. The situation in figure 1 is characteristic for other grains, oil seeds and certain animal products as well. Even the highly regulated EU sugar market with a complex system of domestic support prices, import restrictions, export subsidies and domestic production quotas has been reformed, and will soon become a lot more liberal than it has been in the past.

Furthermore, agricultural support is now to a large extent decoupled from actual production. Farmers now receive the bulk of financial support in the form of direct payments from the EU which are not directly linked to production.

Figure 1: EU market price and intervention price of wheat



Source: FAPRI; Toepfer International.

With reform, the political motivation of the CAP has changed as well. Rather than providing income support for an economically troubled industry and achieving food security in case of crises, the direct payments now granted are legitimized by EU policymakers by reference to the 'multifunctional' character of farming. Multifunctionality in this context apparently means that farming generates positive externalities, such as clean water and air, a pleasant landscape for recreation, and that agriculture provides public goods such as food safety (e. g. European Commission, 1999).

Certainly, agricultural markets are not yet completely free of government intervention. But they are a lot less regulated than they were in the past. In essence, one form of subsidy has been substituted for by another. Agricultural subsidies continue to be the single most important source of budgetary expenditures of the European Union, and they are expected to climb to an all time high in 2006.

The fact that the central objectives of the initial CAP have been accomplished, together with the continued high budgetary burden caused by the CAP should also make it obvious even to the casual observer of the CAP that further reform is politically unavoidable.

One key argument against the traditional CAP which attempted to provide income support to farmers has been that this type of policy is poorly suited to realize this objective because of detrimental distributive effects (e. g. von Witzke, 1979; von Witzke and Schmitt,1981). Under the traditional CAP, price support transfers from the EU to farmers are linked to production. Thus, large operations, which typically secure high incomes, are the primary beneficiaries, and not the small farmers for whom this policy was intended. Moreover, it is the land owners rather than the operators who reap most of the benefits of this type of policy, as agricultural producer price support tends to be capitalized to a large extent into farm land prices.

The *New CAP* lacks the explicit agricultural income support objective. As already mentioned, rather it is politically legitimized as compensation for positive externalities and the provision of public goods. Whatever public goods and positive externalities farmers might produce, they will be tied directly or indirectly to the size of the operation. However, the conclusion that, therefore, the distributive effects of farm payments under the *New CAP* do not matter, is false.

Allocation and distribution are two key economic dimensions. Allocative and distributive effects are central variables by which the performance of government policies is measured. Therefore, it is not all that surprising that the distributive implications of agricultural and trade policies in EU countries (e. g. von Witzke, 1983; 1984; Kleinhanss, 2004; Thurston, 2006), the United States (e. g. MacDonald, 2006) and elsewhere have been subject to scientific scrutiny and public debate. The European Union has apparently already felt the public unease with the distribution of farm payments under the *New CAP*, as the EU Commission has repeatedly expressed concern in this regard and contemplated imposing limitations on individual payments to farmers.

At first glance, it might appear paradoxical that the traditional CAP, which had an explicit distributive objective, was acceptable politically for the last four decades despite its inability to meet this objective with reasonable efficiency, and that the distributive consequences of the *New CAP*, which lacks an explicit distributive motivation, have become cause for political concern. This paradoxical political attitude can be resolved, however, when one takes

Large operations, which typically secure high incomes, are the primary beneficiaries, and not the small farmers for whom this policy was intended.

into account that the distributive effects of the traditional CAP have not been transparent to the public because the transfers to farmers were disguised in support prices. Under the New CAP the magnitude of transfers to the farm economy is much more conspicuous even to the casual observer of the CAP.

In the remainder of this paper we intend to quantify the distributive consequences of the direct payments under the *New CAP* for Germany. Germany is a particularly interesting country in this regard, as the old federal states (Länder) in the Western part of the country are characterized by smaller family farms while in the new federal states in the East larger enterprises are common. Following, we will, first, develop a framework which allows us to quantify the distribution of farm income and direct payments. Second, we will present the results of an empirical analysis of a sample of representative farms from Germany. Third, we will exemplify the results of our analysis for a number of typical farms. Fourth, we will predict actual payments to farms based on easily available information. And fifth, we will demonstrate the effect of payment limitations on typical farms. We will conclude with a summary of our results and some implications of our results for the CAP.

2 Theoretical framework

2.1 Measurement of inequality

A frequently used measure of inequality is the Gini coefficient (G). It captures the average *relative* differences between elements of a distribution and is commonly defined as follows (e. g. von Witzke, 1983, 1984):

$$(1) \qquad G = \frac{1}{n \cdot (n-1)} \cdot \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| y_i - y_j \right|}{2 \cdot \mu}$$

y = individual income
μ = arithmetic mean
n = number of observations

G has a few nice and intuitively appealing properties:

- It can assume numerical values between 0 and 1 (for non-negative observations). 0 means perfect equality where everyone has the same, and 1 implies perfect inequality where one unit of analysis has everything and everybody else has nothing. For ways to address negative values see von Witzke (1983); (0 = equal distribution; 1 = perfectly unequal distribution).
- It is constant with respect to a proportional change of all incomes.
- It is constant with respect to a proportional change in the number of observations and invariant to sample size.
- The transfer of income from one unit to one with higher income causes G to increase.

Eq. (1) is the definition most frequently found for *G* in the literature. That *G* is actually capturing average *relative* rather than *absolute* differences becomes obvious if one rewrites eq. (1) as follows (von Witzke, 1984):

$$(2) \qquad G = \frac{1}{2 \cdot (n-1)} \cdot \sum_{i=1}^{n} \sum_{j=1}^{n} \left| r_i - r_j \right|$$

$$(3) \qquad r_i = \frac{y_i}{\sum_{k=1}^{n} y_k}$$

G can also be illustrated graphically with the Lorenz curve (L). The Lorenz curve depicts cumulatively and in percent the relative share in total income when the individual incomes have been arranged in a non-decreasing order (i. e., beginning with the lowest income). An exemplary Lorenz curve is depicted in figure 2.

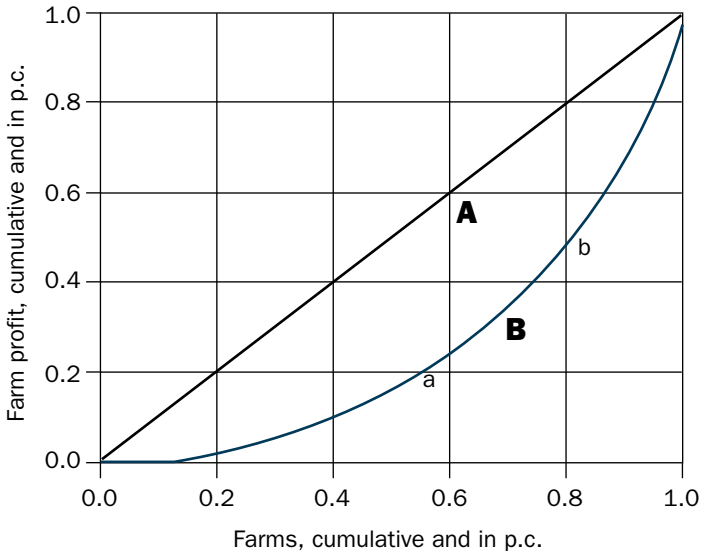
G can be derived from L by dividing the area between the diagonal and the Lorenz curve (A) by the total area under the diagonal (A+B).

$$(4) \qquad G = \frac{A}{A + B}$$

When the Lorenz curve is identical to the diagonal, individual incomes are distributed evenly. Therefore, in this case *A* is zero, and *G* is equal to zero as well. When the distribution is perfectly unequal; i. e., when one person or household has everything and everybody else has nothing, the Lorenz curve is identical to the horizontal axis and at 100 percent it is perpendicular to it. Thus, *B* is zero and *G* equals one.

The interpretation of the Lorenz curve is straightforward. In figure 2, *a* denotes a particular point on the Lorenz curve in which about 20 percent of total profits are accounted for by 55 percent of farms with the lowest profits. In *b*, the interpretation is that the 20 percent of farms with

Figure 2: An exemplary Lorenz curve



the highest profits secure more than 50 percent of total profits

Another important dimension of inequality is average *absolute* differences (*GA*). They can be quantified by multiplying *G* by two times the arithmetic mean (von Witzke, 1984):

$$(5) \qquad GA = \frac{1}{n \cdot (n-1)} \cdot \sum_{i=1}^{n} \sum_{j=1}^{n} \left| y_i - y_j \right|$$

GA is characterized by properties which are analogous to *G*:

- It can assume numerical values between zero and infinite.
- It is constant with regard to an increase in value that is identical in absolute terms for everybody.
- It is constant with regard to a proportional growth of the number of observations, and it is invariant to sample size.
- The transfer of income from one unit to one with higher income acts to increase *GA*.

2.2 Decomposing inequality into its components

In this paper, we wish to determine the extent of overall profit inequality in German agriculture and the contribution of the distribution of direct payments to overall inequality of profits. For this purpose, the two measures of inequality discussed above will be decomposed. This allows us to quantify the contribution of the inequality of profit components to overall profit inequality.

Assume that total profit (y) is the sum of two components (x and z). Then for any individual farm (i):

$$(7) \qquad G = \underline{r}' \square \underline{l}' \cdot \underline{i}$$

When the vector of individual profits is arranged in a monotonically non-decreasing order (i. e., beginning with the lowest profit), then *G* can be defined as follows (e.g. von Witzke, 1983; Shorrocks, 1982; Pyatt et al., 1980; Fei et al. 1978; Rao, 1969):

(7) $$G = \underline{r}' \square \underline{l}' \cdot \underline{i}$$

(8) $$\underline{r} = \begin{bmatrix} r_1 \\ \vdots \\ r_n \end{bmatrix}$$

In eq. (8), *ri* is defined as in eq. (3) and represents the slope of the Lorenz curve at *i*.

(9) $$\underline{l} = \begin{bmatrix} \frac{2 \cdot 1 - n - 1}{n - 1} \\ \vdots \\ \frac{2 \cdot i - n - 1}{n - 1} \\ \vdots \\ \frac{2 \cdot n - n - 1}{n - 1} \end{bmatrix}$$

(10) $$\underline{i} = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix}$$

$\square$ = the 'box' operator permits a congruent multiplication of vectors or matrices of identical dimensions (Howard, 1971, vol. 2, p. 1107); When A = B · C, then $a_{ij} = b_{ij} \cdot c_{ij}$

When the income vector (y) is arranged in a monotonically non-decreasing order, and the income components are arranged according to y_i, then G, as defined in eq. (7), can be decomposed into the contribution of the distribution of income components to overall inequality. This can easily be seen, as

(11) $$\underline{r}' \square \underline{l}' \cdot \underline{i} = \underline{r}_x' \square \underline{l}' \cdot \underline{i} + \underline{r}_z' \square \underline{l}' \cdot \underline{i}$$

(12) $$\underline{r}_x = \begin{bmatrix} r_{x1} \\ \vdots \\ r_{xn} \end{bmatrix}$$

(13) $$\underline{r}_{xi} = \frac{x_i}{\sum_{i=1}^{n} y_i}$$

(14) $$\underline{r}_z = \begin{bmatrix} r_{z1} \\ \vdots \\ r_{zn} \end{bmatrix}$$

(15) $$\underline{r}_{zi} = \frac{z_i}{\sum_{i=1}^{n} y_i}$$

The two parts of the right hand side of eq. (11) formally look like Gini coefficients of the two income components. However, they are not true Gini coefficients, as they are not necessarily arranged in a monotonically non-decreasing order and, therefore, can assume values outside [0,1]. We will refer to them as **p**artial **p**seudo **G**ini coefficients (PPG_i). Thus, we obtain:

(16) $$G = PPG_x + PPG_z$$

By analogy we can decompose *GA* into the partial contribution of the distribution of the income determining factors to overall absolute inequality:

(17) $$GA = y' \square l' \cdot i \cdot 2 \cdot n^{-1}$$

(18) $$GA = PPGA_x + PPGA_z$$

(19) $PPGA_x = x' \square\, l' \cdot i \cdot 2 \cdot n^{-1}$

(20) $PPGA_z = z' \square\, l' \cdot i \cdot 2 \cdot n^{-1}$

Notice that the PPG_i and the $PPGA_i$ are the products of the distribution of the income components and the share of the i-th income component in total income.

3 Empirical analysis

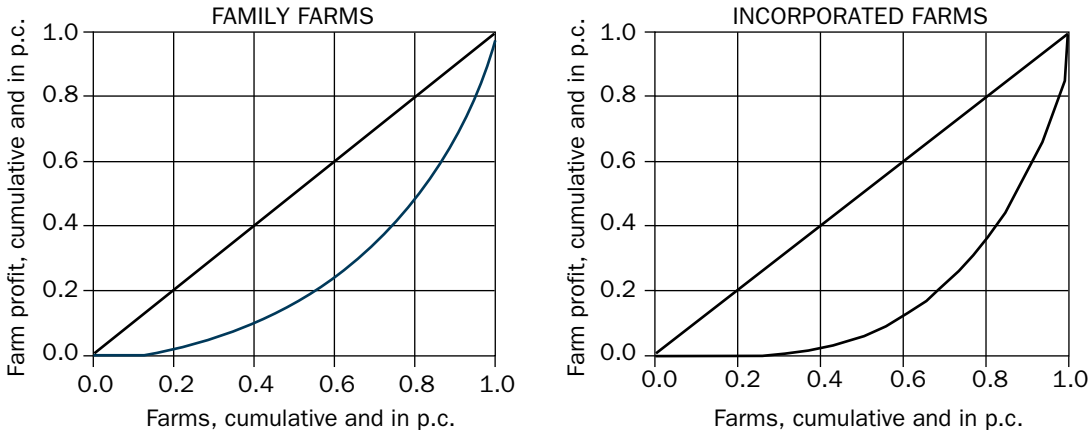
3.1 Data

The data used in this analysis has been made available by the German Federal Ministry of Food, Agriculture, and Consumer Protection. It is the very same data set upon which the annual report on the economic situation of German agriculture is based ("Testbetriebe") and which is reported to the EU farm data network (FADN). A total of 11,756 observations are available for 2005 for single operations and partnerships of (usually) four or fewer partners. They represent more than 250,000 farms. In the remainder of this paper these farms will be referred to as 'family farms'. In addition, there is data available for 2004/05 for 481 large incorporated farms, typically located in the East of Germany. They represent a population of 2,876 farms. The two samples can be considered to be reasonably representative of German farms. The data is grouped by agricultural accounting profit per farm before taxes. We have opted to analyze each sample separately because they cover different time periods, and because the definition of accounting profit is somewhat different between the two farm types. The farm profit ranges according to which the data is grouped are exhibited in Table A1 of the Appendix.

The cash transfers to farmers considered in this analysis include all direct payments. The bulk of these payments are the (largely) decoupled transfers under the *New CAP*. They are based on historic production figures. The calculation of the actual individual transfers is rather complicated and cannot be discussed here (for details see BMVEL, 2005). In essence, the sum of total payments should correspond well with farm size. Therefore, we expect large operations to receive bigger checks from the government than small farms.

Individual data has not been available because of government data privacy regulations. In fact, only averages are available for each group.

Figure 3: Lorenz curves of farm profits in German agriculture



Source: Own computations based on BMELV.

3.2 Results

3.2.1 Relative inequality

Figure 3 depicts the Lorenz curve, i. e. the relative inequality of farm profits. Notice that in our analysis we have set negative profits equal to zero. This is commonly done in the use of the Gini coefficient and related measures, as it ensures that *G* is always in the interval [0,1]. This greatly facilitates the interpretation and comparison of results. Negative incomes or income components may, however, be accounted for, as demonstrated by von Witzke (1983).

As can be seen, the Lorenz curve for incorporated farms is generally farther away from the diagonal. Therefore, we can conclude that profits are more unequally distributed within the group of incorporated farms than between family farms. This is confirmed by the Gini coefficients of farm profits for both farm types (table 1).

The results of the decomposition of the Gini coefficient are pretty dramatic, particularly so for the incorporated farms. Table 1 shows the results. The numbers have been calculated for total profit (including direct payments), direct payments, and profit minus direct payments. In the remainder of this paper we will refer to profit minus direct payments as 'market profits'. Notice that market profits are not free–market profits, as they are the result also of direct government intervention in agricultural markets through domestic minimum prices, trade restrictions, domestic production quotas and/or other policy instruments.

The Gini coefficient of profits (including direct payments) is fairly high. This is, however, not very surprising when annual farm profit data is used in the calculations, as profit tends to fluctuate considerably from one year to the next because of random events such as weather, plant or animal disease. As can be seen, for family farms the direct payments account for about one third of total inequality. For the large incorporated farms the effects of the direct payments on overall inequality is a lot more pronounced, as almost three fourths of the observed inequality is caused by these subsidies.

Notice, that the results reported in table 1 underestimate the actual contribution of direct payments to overall inequality. The reason is that the inequality of annual market profits is subject to random shocks. Therefore, annual profit inequality is larger than inequality of average profits for more than one year (von Witzke, 1983). Hence, the inequality of market profits would be reduced if these shocks were accounted for.

Table 1: Relative inequality of farm profits, direct payments, and market profits in Germany

1.1 Family farms (2005)

inequality of …	… farm profits G_y	… direct payments PPG_t	… market profits PPG_y-
	.50271	.17154	.33117

1.2 Incorporated farms (2004/05)

inequality of …	… farm profits G_y	… direct payments PPG_t	… market profits PPG_y-
	.64853	.47053	.17800

Source: Own calculations based on BMELV.

It may be surprising at first glance that the contribution of direct payments to total inequality in the incorporated farms is so very high. However, one needs to take into consideration that the PPG_i are the product of two components. One of them is the distribution of the profit component. The other is the share of a profit component in total profit.

An example may illustrate this. Assume that the farm with the highest profit receives a cheque from the government in the amount of € 100 and everybody else receives no payments. Then, of course, there would be perfect inequality of the government payment. However, when the share of this payment in total profit is small, then its contribution to overall inequality is small as well. Essentially, this is the case in the group of incorporated farms, as the bulk of the profits are the result of direct payments.

3.2.2 Absolute inequality

The results of the decomposition of absolute inequality are analogous to those of relative inequality. They are presented in table 2. More than one third of inequality is caused by direct payments in the family farm group while almost three fourths of inequality in the incorporated farms is the result of direct payments. As the numbers are in €, they are, however, somewhat more illustrative.

Within family farms the average profit difference is about € 40,000 of which about € 14,000 are caused by direct payments. Within the group of the large incorporated farms, the result is even more striking. They receive more payments and the contribution to inequality is much larger. The average difference in profits is about € 134,000 of which nearly € 100,000 are caused by direct payments.

Table 2: Absolute inequality of farm profits (€), direct payments and farm profits without direct payments

2.1 Single family farms (2005)

inequality of …	… farm profits (GA_y)	… direct payments ($PPGA_t$)	… profits without payments ($PPGA_y$-)
	40,313	13,756	26,557

2.2 Incorporated farms (2004/05)

inequality of …	… farm profits (GA_y)	…direct payments ($PPGA_t$)	… profits without payments ($PPGA_y$-)
	134,432	97,535	36,897

Source: Own calculations based on BMELV.

4 Exemplifications

The high–profit farm receives almost 14 times the amount of payments of the low–profit farm… The typical large incorporated farm receives more than € 1 million in payments.

Table 3 exemplifies the distributive effects of direct payments on farm profits. For both family farms and incorporated farms we report results for typical low–, medium–, and high–profit farms. As is evident, total direct payments correspond well with profit. The higher the profit, the higher is the sum of all direct payments.

In family farms, the typical high–profit farm secures a total profit of more than € 400,000, of which more than one third is the result of direct payments. The high–profit farm receives almost 14 times the amount of payments of the low–profit farm.

The incorporated farms are much larger than typical family farms. Hence, it is not surprising that the general level of payments is much higher in incorporated farms than in family farms. Even the incorporated farms with negative profits receive more in direct payments than the large and high–profit family farm. The typical large

Table 3: Profit and direct payments in selected German farms

3.1 Family farms (2005)

farm with …	number in sample	number in population	agriculture area per farm (ha)	work force (FTE)	profit (€)	direct payments (€)	market profit (€)
…negative profit	1,117	37,659	29	—	–9,626	11,397	–21,023
…medium profit[1]	1,058	17,752	63	—	44,802	25,830	18,972
…high profit[2]	41	453	403	—	404,499	150,207	254,292

3.2 Incorporated farms (2004/05)

farm with …	number in sample	number in population	agriculture area per farm (ha)	work force (FTE)	profit (€)	direct payments (€)	market profit (€)
…negative profit	94	519	1,442	26.8	–65,162	517,678	–582,840
…medium profit[1]	22	118	1,574	23.1	44,506	623,304	–578,798
…high profit[3]	6	24	2,451	57.1	1,271,034	1,068,636	202,398

Source: BMELV and own calculations based on BMELV.
[1]Profit class € 40,000 to € 50,000; [2]Profit class > € 300,000; [3]Profit class > € 500, 000

incorporated farm receives more than € 1 million in payments. This is about twice the amount paid to the negative–profit farm.

Table 3 also illustrates that direct payments are a substantial part of farm profits in both groups. However, it also becomes evident that direct payments are far more important for profits in the large incorporated farms than in the family farms. Incorporated farms, with the exception of the high–profit group, can only secure a positive profit because of the direct payments (see also table A1 in the Appendix). Essentially, the direct payments subsidize the large incorporated farms which are unprofitable in the absence of these subsidies. Without those payments, the vast majority of these farms would be forced to cease operation or to restructure such that they become profitable.

Notice that the analysis is based on the initial payments under the New CAP. The individual payments will be adjusted over time according to an agreed upon schedule. This, however, will not change the general thrust of the results reported here.

5 Predicting individual payments

Commonly, as in our analysis, individual data on farm profit or profit components such as direct payments is not available. In the following, we will present the results of an econometric analysis which permits one to generate reasonably accurate predictions of direct payments received, based on data that often is readily available.

As discussed earlier, the individual payments for which farmers are eligible require complex calculations, for which detailed information about the individual operation is necessary. In fact, the calculations are so complex and the bureaucratic efforts to calculate the amount of individual payments and to verify the information provided by farmers is so high, that it is sometimes argued that payments to small farms should be discontinued. At any rate, this information is impossible to obtain unless one has direct access to individual farm accounts which is rarely the case.

However, the payments in one way or another are related to the size of a farm. Therefore, one or more variables which capture farm size might be good predictors of total direct payments received by farmers. One variable often used to capture farm size is the area farmed. We found that this variable is indeed an excellent predictor of the direct payments received by a farm. We ran WLS regressions with total direct payments per farm within each profit class as the dependent variable, and area used for farming as the independent variable, where the number of observations per profit class determines the weight of each observation. The results are presented in table 4.

Table 4: Explaining direct payments received per farm by acreage farmed (WLS regression)

4.1 Results of the WLS regression for family farms (2005)

dependent variable	total direct payments per farm (€)
independent variable	agricultural area per farm (€)
intercept[1]	1250.021 (2.509)
slope[1]	372.946 (112.336)
adjusted R^2	.999
F	12619.378

4.2 Results of the WLS regression for incorporated farms (2004/05)

dependent variable	total direct payments per farm (€)
independent variable	agricultural area per farm (€)
intercept[1]	6971.894 (.200)
slope[1]	404.815 (16.782)
adjusted R^2	.949
F	281.644

Source: Own calculations based on BMELV.
[1] t-values in parenthesis

It becomes obvious from table 4 that the area farmed is an excellent predictor of the total amount of direct payments received per farm. For both family farms and for the large incorporated farms the estimates have an excellent fit and the t-values are highly significant. Thus it is, in fact, possible to predict the unknown sum of total direct payments with the information about just one variable and that is farm size in terms of area farmed. Notice that the payments per ha to incorporated farms exceeds the payments to family farms by about nine percent.

A word of caution is in order, however. The estimates are based on grouped data. They reflect group averages. Thus, it is possible that some individual farm characteristics may lead to somewhat higher or lower actual individual payments than one would expect based on the fit of the estimates presented here.

Table 5 presents the results of the predictions of total payments received by exemplary farms which are based on the regression analysis in table 4. As can be seen, predicted profits are fairly close to observed profits. The negative profit incorporated farm represents an outlier in this regard.

Table 6 exhibits the individual payments one can expect a farm to receive as a function of farm size. The numbers have been generated based on the results of the regression analysis presented in table 4. As can be seen, the larger the farm, the higher is the amount of direct payments per farm.

It is, in fact, possible to predict the unknown sum of total direct payments with the information about just one variable and that is farm size in terms of area farmed.

Table 5: Total direct payments (€) received and predicted in exemplary farms

5.1 Family farms (2005)

farms with …	observed	predicted	difference between observed and predicted (percent)
… negative profit	11,397	12,066	–5.9
… medium profit[1]	25,838	24,746	4.2
… high profit[2]	150,319	151,547	0.2

5.2 Incorporated farms (2004/05)

farms with …	observed	predicted	difference between observed and predicted (percent)
… negative profits	517,678	590,715	14.1
… medium profit[1]	623,304	644,151	3.3
… high profit3	1,068,636	999,175	–6.5

Source: Own computations based on BMELV.
[1]profit class € 40,000 to € 50,000; [2]profit class > € 300,000; [3]profit class> € 500,000.

Table 6: Predicted direct payments per farm by farm size

6.1 Family farms (2005)

area farmed (ha)	predicted payments (€)
25	10,574
50	19,897
100	$38,54_5$
500	187,732
1,000	374,215
2,000	747,142

6.2 Incorporated farms (2004/05)

area farmed (ha)	expected payments (€)
500	209,380
1,000	411,787
1,500	614,194
2,500	1,019,010
5,000	2,031,047
7,500	3,043,085

Source: Own computations based on table 4

6 Implications of payment limitations

As the European Union has repeatedly considered limitations on payments to individual farms, we have analyzed how such upper limits would affect German agriculture at present farm structure. We have analyzed the distributive effects of payment limitations of € 100,000 and € 300,000 respectively. The results are presented in table 7 and 8. As can be seen, a payment limit of € 100,000 per farm would have only very limited effects in family farms, while a payment cap of € 300,000 would have no effect at all in these farms. The reason for this is that only the two top profit classes receive direct payments which exceed € 100,000 and that there is no class in which the direct payments exceed € 300,000. Notice that very large farms with single ownership or limited number of partners, which are referred to here as family farms, are not in this sample. As table 6 suggests, these large operations would, of course, also be affected by the payment limitations analyzed here. Notice also that payment limitations create an incentive to split up farms into smaller units.

In the incorporated farms, both payment limitations would be binding in every profit class except one. The reason is that these farms tend to be large, and thus receive large direct payments. Tables 7, 8 and A1 also clearly demonstrate that all incorporated farms

A payment limit of € 100,000 per farm would have only very limited effects in family farms, while a payment cap of € 300,000 would have no effect at all in these farms.

Table 7: Farm profit, direct payments and market profit with payment limitations (€ 100,000)

7.1 Family farms (2005)

profit class (thousand €)	total number of farms	market profit per farm (€)	direct payments per farm (€)	market profit per farm (with payment limitations) (€)
≤ 0	37,659	–21,023	11,397	–9,626
0–5	23,692	–8,606	11,179	2,573
5–10	21,711	–5,056	12,636	7,580
10–15	22,680	–1,491	13,944	12,453
15–20	22,112	1,889	15,539	17,428
20–30	37,193	7,728	17,220	24,948
30–40	27,687	13,347	21,234	34,581
40–50	17,752	18,972	25,830	44,802
50–75	25,651	28,922	31,840	60,762
75–100	10,890	47,458	37,939	85,397
100–125	4,827	63,502	47,174	110,676
125–150	2,294	88,503	47,263	135,766
150–200	1,907	95,895	74,870	170,765
200–300	826	132,018	100,000	232,018
> 300	453	254,292	100,000	354,292

7.2 Incorporated farms (2004/05)

profit class (thousand €)	total number of farms	market profit per farm without direct payments (€)	direct payments per farm (€)	profit per farm (with payment limitation) (€)
≤ 0	519	–582,732	100,000	–482,732
0–5	202	–413,734	100,000	–313,734

profit class (thousand €)	total number of farms	market profit per farm without direct payments (€)	direct payments per farm (€)	profit per farm (with payment limitation) (€)
5–10	94	–274,214	100,000	–174,214
10–15	75	–595,832	100,000	–495,832
15–20	104	–341,835	100,000	–241,835
20–30	184	–310,802	100,000	–210,802
30– 40	151	–439,092	100,000	–339,092
40–50	118	–578,640	100,000	–478,640
50– 75	205	–418,559	100,000	–318,559
75–100	259	–365,899	100,000	–265,899
100–125	141	–567,068	100,000	–467,068
125–150	194	–482,976	100,000	–382,976
150– 200	189	–438,312	100,000	–338,312
200–300	265	–336,022	100,000	–236,022
300–500	152	–484,768	100,000	–384,768
> 500	24	202,442	100,000	302,442

Source: BMELV and own calculations based on BMELV.

Table 8: Farm profit, direct payments and market profit with payment limitations (€ 300,000); incorporated farms (2004/05)[1]

profit class (thousand €)	total number of farms	market profit per farm (€)	direct payments per farm (€)	new profit per farm (with payment limitation) (€)
≤ 0	519	–582,732	300,000	–282,732
0–5	202	–413,734	300,000	–113,734
5–10	94	–274,214	281,623	7,409
10–15	75	–595,832	300,000	–295,832
15–20	104	–341,835	300,000	–41,835
20–30	184	–310,802	300,000	–10,802
30–40	151	–439,092	300,000	–139,092
40–50	118	–578,640	300,000	–278,640
50–75	205	–418,559	300,000	–118,559
75–100	259	–365,899	300,000	–65,899
100–125	141	–567,068	300,000	–267,068
125–150	194	–482,976	300,000	–182,976
150–200	189	–438,312	300,000	–138,312
200–300	265	–336,022	300,000	–36,022
300 –500	152	–484,768	300,000	–184,768
> 500	24	202,442	300,000	502,442

Source: BMELV and own calculations based on BMELV.
[1]Notice that results for family farms are not reported here, as family farms in sample would not be affected by a € 300,000 payment cap.

except those few in the highest profit class would make a loss in the absence of the direct payments. This has a number of implications:

(i) The proponents of decoupled payments claim that this type of subsidy has no effect on factor allocation and, thus, no effect on social welfare either. This presumption is based on a very simple model of neoclassical partial equilibrium analysis in which liquidity does not matter for both production and investment decisions, in which risk and risk aversion do not exist, in which farmers do not hold expectations about future adaptations of agricultural policies, and in which factor payments in agriculture are identical to those outside of agriculture. The findings in this paper contradict this perception and they are consistent with the US experience of decoupled payments to farmers under the 1996 US Farm Bill.

(ii) As this is the case, the direct payments keep farms which are inefficient in business. Without the subsidies under the EU's *New CAP* society would be better off and social welfare would be higher. The structural adjustments would include downsizing the labor force and a reduction in the price of agricultural land.

(iii) In the absence of these subsidies the inefficient farms would go out of business, or they would have to restructure to become efficient.

(iv) Essentially the same is true for payment limitations, except that the economic incentives to adjust are alleviated.

7 Summary and conclusions

The New CAP *contributes significantly to inequality within agriculture. It keeps inefficient operations alive at the expense of taxpayers and society at large, and it delays structural adjustment in agriculture toward farms that are economically inefficient.*

This paper presents a methodological framework for the analysis of the determinants of economic inequality. It is applied here in order to quantify the impact of direct payments under the European Union's *New CAP* on profit inequality between German farms.

The results demonstrate that direct payments contribute significantly to profit inequality in German agriculture. About one third of observed inequality between family farms is the result of direct payments, while direct payments contribute to almost 75 percent of observed inequality between the large incorporated farms. A typical family farm secures a profit of about € 25,000 of which about € 17,000 is accounted for by direct payments. The incorporated farms typically receive a multiple of the payments made to family farms. Even the smaller incorporated farms receive government cheques of more than € 500,000. The larger operations secure direct payments from the government in excess of € 1,000,000. However, the vast majority of incorporated farms would make negative profits in the absence of direct payments.

Usually, the actual payments to individual farms are not known to third parties. Therefore, we have looked for variables which are usually readily available. We found that the total amount of direct payments received by a farm corresponds well with farm size as measured by the area farmed. The area farmed is a variable that is often available and, therefore, permits one to come up with reasonable predictions of payments received by an individual farm.

The EU has repeatedly considered imposing limitations on direct payments made to an individual farm. In this paper, we have calculated the implications of payment limitations at given farm size structure. The payment limitations considered are € 100,000 and € 300,000 per farm respectively. The results suggest that smaller family farms would not be much affected by such payment limitations simply because they typically receive payments that do not exceed the limitations considered here. However, the large incorporated farms would experience a significant reduction in payments. The vast majority of these farms would make negative profits in the absence of the direct payments, and therefore would be forced to go out of business or to restructure and become efficient.

In this context, the issue of equity has to be addressed as well. The *New CAP* has replaced traditional farm subsidies in the form of minimum producer prices through direct payments. Much like the traditional farm subsidies, the direct payments are closely linked to farm size. Thus, it is not surprising that direct payments, much like the traditional subsidies, are rather unequally distributed in favour of large operations. Therefore, the *New CAP* contributes significantly to inequality within agriculture. It keeps inefficient operations alive at the expense of taxpayers and society at large, and it delays structural adjustment in agriculture toward farms that are economically inefficient.

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Appendix

Table A 1: Farm profit class, profits and number of observations per profit class

A 1.1 Family farms (2005)

profit class (thousand €)	number of farms in sample	total number of farms	average profit per farm (€)	average direct payments per farm (€)
≤ 0	1,117	37,659	–9,626	11,397
0–5	672	23,692	2,573	11,179
5–10	724	21,711	7,580	12,636
10–15	842	22,680	12,453	13,944
15–20	910	22,112	17,428	15,539
20–30	1,696	37,193	24,948	17,220
30–40	1,473	27,687	34,581	21,234
40–50	1,058	17,752	44,802	25,830
50–75	1,630	25,651	60,762	31,840
75–100	785	10,890	85,397	37,939
100–125	377	4,827	110,676	47,174
125–150	179	2,294	135,766	47,263
150–200	171	1,907	170,765	74,870
200–300	81	826	237,862	105,844
> 300	41	453	404,499	150,207

A 1.2 Incorporated farms (2004/05)

profit class (thousand €)	number of farms in sample	total number of farms	average profit per farm (€)	average direct payments per farm (€)
≤ 0	94	519	–65,162	517,570
0–5	34	202	2,710	416,444
5–10	17	94	7,409	281,623
10–15	16	75	12,766	608,598
15–20	12	104	17,129	358,964
20–30	27	184	24,398	335,200
30–40	23	151	35,152	474,244
40–50	22	118	44,506	623,146
50–75	31	205	61,602	480,161
75–100	37	259	86,326	452,225
100–125	26	141	115,600	682,668
125–150	29	194	139,218	622,194
150–200	37	189	174,345	612,657
200–300	44	265	249,202	585,224
300–500	26	152	368,832	853,600
> 500	6	24	1,271,034	1,068,592

Source: BMELV and own calculations based on BMELV.

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