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Distributional effects of direct payments in Switzerland

El Benni, N., Mann, S. and Lehmann, B.

1, 3 Agri-Food and Agri-Environmental Economics Group, ETH Zurich, Switzerland
2 Research Station Agroscope, Tänikon, Switzerland

elbennin@ethz.ch

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Abstract

The switch from market-support to direct payments in Switzerland had impacts on the income distribution among farmers. In this paper, the distributional effect of the switch as a whole and of the different kinds of direct payments are elaborated through a presentation of different decomposed Gini coefficients. Although the income distribution in Swiss Agriculture is still more equal than in most other countries, the Gini coefficient has risen from 0.27 in 1990 to 0.38 in 2009 and is by now strongly dependent on the composition of direct payments. Off-farm income and direct payments decrease, while market income increases income inequality.

Keywords: income distribution, direct payments, Gini decomposition, agricultural policy

JEL classification: Q00, Q18, Q28.

1. INTRODUCTION

The analysis of the effects of different income sources on income distribution within the farm population has received little attention so far. Particularly research about the impact of specific direct payment programs on income inequality is scarce (e.g. Keeney, 2000, Schmid et al., 2006). However, most direct payment instruments within agricultural policy have at least partially the objective of income redistribution towards the neediest parts of the farming population (Mann, 2005). Therefore, the goal of this paper is to measure the effect of Swiss agricultural policy reforms on the distribution of income within the farm population. By using FADN data from 1990 to 2009, at first, the effect of direct payments in general on household income is analysed. Secondly, a more specific analysis is undertaken to measure the effect of several direct payment programmes on farm income distribution. The results can be used by policy makers to examine the distributional effects of past as well as proposed policy changes.

A pattern that was found from the literature is that farms with high incomes tend to get more direct payments than low-income farms, and that direct payments can reduce overall income inequality. For instance, Keeney (2000) found that due to an increasing share of support payments on total farm income, Irish farm income inequality decreased between 1991 and 1996 (pre- to post-MacSharry reform). Whereas programs that target farmers in less favoured areas reduced income inequality, per hectare arable payments support mainly farmers with already higher incomes. By comparing pre-support with post-support Scottish farm income, Allanson (2005) shows that the measures of the MacSharry reform progressively support farmers with negative or low pre-support incomes. Schmid et al. (2006) show that less-favoured area payments have had only a minor effect on absolute income inequality in Austria, but that direct payments and agri-environmental payments increased absolute income inequality. Results of Witzke and Noleppa (2007) show that direct payments significantly contribute to income inequality in German agriculture.

This paper is structured as follows. In section 2 the main developments of Swiss agricultural policy between 1990 and 2009 are described. The data and methods used in this paper are presented in the 3rd and 4th section. In the 5th section the static and dynamic effects of agricultural policy reforms on household income distribution are explored as well as the effects of different direct payments on the farm income distribution. The analyses investigate the hypothesis that changes in income inequality can be attributed to agricultural policy reforms. Section 6 summarizes and discusses the results and is followed by the conclusion section.

2. DIRECT PAYMENTS AND THE AGRICULTURAL POLICY REFORM IN SWITZERLAND

Roughly two main steps within the reform process of Swiss agricultural policy can be distinguished, the first being in 1992 and the second in 1999. With each change, market support was reduced and farm-level based subsidies were introduced in compensation. Pre-reform subsidies that were already available to farmers prior to 1992 included payments provided per farm household that aimed to stabilize farm income. Support in the frame of these payments ended in the late 1990s. With the first policy reform in 1992, decoupled direct payments were introduced. Swiss farmers could voluntarily apply to agri-environmental schemes that aim to promote environmental-friendly production systems. With the next reform cycle starting in 1999 a new direct payment system was introduced that divides support payments into general and ecological direct payments. General direct payments are based on a cross-compliance approach¹. Farmers had to comply with baseline criteria regarding environmental and animal friendly production, with the most restrictive being the set-aside of seven percent of their farmland as ecological compensatory area (Mann, 2003). As previously, farmers can apply voluntarily to ecological direct payment programs. Since 1999, no considerable changes in the direct payment system were made. One exception is the introduction of a new performance-oriented ecological direct payment program in 2001, aiming to enhance and increase the biodiversity on cultural land. Nowadays, general direct payments constitute most of the financial support (79% in 2009) and include animal unit and area based payments to farmers in the valley regions and additional payments for farmers producing under adverse production conditions in the hilly and mountainous regions. Ecological direct payments include payments for extensive crop production, ecological compensation areas, and organic farming payments. Furthermore, two animal welfare programs are available². Beside direct payments, the production of oil seeds, grain legumes, fibre crops, potato seed, maize and fodder plants are supported by arable payments. While these payments were adapted over the last two decades, they are paid with the aim to enrich crop rotation and for food security reasons. This support measure falls under the aforementioned cross compliance condition as well.

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1. While formally, farmers can voluntary apply to general direct payments, the high adoption rate of almost 100% shows, that in practical terms farm operations can hardly survive without governmental support.
 2. For more details on the direct payment system in Switzerland see e.g. Curry and Stucki (1997), El Benni and Lehmann (2010), and Mann (2003).

3. DATA

Farm level income data of the Swiss National Farm accounting Network (FADN) over the period 1990 to 2009 are used. Total household income is defined as gross household income minus total production costs, labour costs and interest on debt and land and is reconfigured into off-farm income, income from different direct payments and market income. The latter is calculated as the difference between on-farm income and direct payment income and thus also contains subsidies to farmers through government market interventions. For the analyses, the sample of FADN farm households is weighted based on the farm size, the farm production system, and region³. Since the dataset contains some extreme values, the 2.5% households at the top and bottom end of the total household income distribution were excluded from the analysis.

4. METHODOLOGY

4.1. Static analysis

The Gini coefficient of inequality is a commonly used measure in income inequality research. For non-negative incomes, the Gini coefficient measures the relative income inequality and ranges between 0 and 1. If household income is totally equal distributed the Gini coefficient equals 0 and increases the more unequal the income distribution becomes. To estimate the Gini coefficient, household income Y is assumed to be a random variable, distributed with mean μ over the farm population. By sorting household incomes in ascending order, giving them a rank and dividing the rank by the number of observations, yields the cumulative distribution function $F(Y)$. With the covariance denoted by cov , Stuart (1954) shows that the Gini coefficient of relative income inequality can be written as follows:

$$G = 2 \text{cov} \frac{[Y, F(Y)]}{\mu} \quad (1)$$

To measure the effect of different income sources on aggregated income inequality, the Gini decomposition approach of Fei et al. (1978) and Pyatt et al. (1980) extended by Lerman and Yitzhaki (1985) is applied. Using this method, total household income is defined as the sum of incomes from k different sources Y_k with $F(Y_k)$ denoting the cumulative distribution function of the income source under consideration. The decomposed Gini coefficient can be written as follows:

$$G = \sum_{k=1}^K \frac{\text{cov}[y_k, F(Y)]}{\text{cov}[y_k, F(Y_k)]} \times \frac{2 \text{cov}[y_k, F(Y_k)]}{\mu_k} \times \frac{\mu_k}{\mu} \quad (2)$$

$$G = \sum_{k=1}^K R_k G_k S_k \quad (2a)$$

3. The methodology of sample selection and details of weighting are presented in FAT (2000).

The Gini correlation R_k ranges between -1 and +1 and is defined as the covariance between the k_{th} component income and the cumulative distribution of total income, divided by the covariance between the k_{th} component income with its own cumulative distribution (Pyatt et al., 1980). If the income of the k_{th} income source increases (decreases) with increasing total income, R_k is positive (negative), and if R_k equals 0 the income source is a constant not contributing to total income inequality. G_k is the Gini coefficient of the k_{th} income source, showing how income from the specific income source is distributed within the population. The share of the k_{th} income source on total income is given by S_k . R_k times G_k yields the concentration ratio or Pseudo-Gini coefficient C_k . It measures how income from each source is transferred across a population ranked with respect to the level of total income received:

$$C_k = \frac{\text{cov}[y_k, F(Y)]}{\text{cov}[y_k, F(Y_k)]} \times \frac{2\text{cov}[Y_k, F(Y_k)]}{\mu_k} = \frac{2\text{cov}[y_k, F(Y)]}{\mu_k} \quad (3)$$

The concentration ratio is 0 if all income groups receive an equal amount of income of the given income component (Pyatt et al., 1980), is negative if income from a specific source accrues mainly to the households in the lower tail of the distribution of total income, and is positive, if richer households receive a large proportion of the income from the specific income component. A concentration ratio that is larger than the Gini coefficient of aggregate income proves that the income component in question has had an unequalising effect on the observed aggregate income distribution (Keeney, 2000).

To measure the effect of a specific income component on aggregated income inequality the Gini elasticity is calculated as proposed by Lerman and Yitzhaki (1985). The Gini elasticity gives information on how the income distribution would change with a marginal percentage change in the mean income of the specific income component. By assuming that the internal ratio between total income distribution and income source remains undisturbed, the rate of change of the Gini coefficient is derived as follows:

$$\eta_k = \frac{\mu_k}{G} \times \frac{dG}{d\mu_k} = \frac{1}{G} \left[\frac{\mu_k}{\mu} (C_k - G) \right] \quad (4)$$

The income source elasticity η_k is greater (lower) than 1 if amounts received under the specific policy program (income component) raise more (less) than proportional to total household income. In case of unit elasticity, the distribution of income from a particular income source is proportional to the distribution of total income, and thus, the concentration coefficient and Gini coefficients coincide (Keeney, 2000, Podder, 1995).

In the presence of negative incomes the here presented Gini coefficient may exceed unity and the estimates of the elasticities are analytically correct but biased upwards (Boisvert and Ranney, 1990). Even if methods exist to estimate Gini coefficients that account for negative incomes (Chen et al., 1982) these coefficients cannot be decomposed by income source (Boisvert and Ranney, 1990) and their interpretation is difficult (van de Ven, 2001). Hence, by

using the here presented Gini decomposition approach, the marginal effects of different income components on income inequality can be biased upwards. Nevertheless, the qualitative policy implications remain by choosing this approach (Boisvert and Ranney, 1990).

4.2. Dynamic analysis

To analyse the dynamic effects of agricultural policy changes on income inequality, the approach of Podder and Chatterjee (2002) is used. Therefore the change of the Gini coefficient over time is divided into a share effect (SE) and a concentration effect (CE):

$$\Delta G_t \approx SE + CE \quad (5)$$

The change in the aggregated Gini coefficient from period t-1 to period t is given by $\Delta G_t = G_t - G_{t-1}$. Changes in the Gini coefficient can be attributed to a change in the share of the k_{th} income component in total income $\Delta S_t = S_{k,t} - S_{k,t-1}$ and to the change in the concentration coefficient between period t-1 and t, namely $\Delta C_{k,t} = C_{k,t} - C_{k,t-1}$. The share effect SE shows, how a change in the share of a specific income component affect the change in the overall Gini. In contrast, the concentration effect CE shows, how the change in the distribution of source incomes over the ranges of total income, affect the change of the Gini coefficient. The SE can be measured with respect to the base period or with respect to the terminal period concentration coefficient which would lead to a different result. The same is true for the concentration effect. Therefore, Podder and Chatterjee (2002) suggest the following approximation of the share and concentration effect:

$$SE = \sum_{k=1}^K \frac{C_{k,t} + C_{k,t-1}}{2} \times \Delta S_{k,t} \quad (6)$$

$$CE = \sum_{k=1}^K \frac{S_{k,t} + S_{k,t-1}}{2} \times \Delta C_{k,t} \quad (7)$$

Hence, the share effect SE of all income components is approximated by the sum of the changes in the shares of the different income components from one year to another weighted by their average changes in the concentration coefficient over the same time period (and vice versa for the concentration effect).

5. RESULTS

In this section the results of the static and dynamic analyses for total household income inequality separated into off-farm income, market, and direct payment income are presented. In a second step, the results of the static and dynamic effects of different direct payments on farm income inequality are shown.

5.1. The effect of agricultural policy reform onal household income inequality

Static analysis

The hypothesis investigated in this section is that changes in total household income inequality can be attributed to agricultural policy reforms, i.e. the change from market support to direct payments. Table 1 shows the share of total household income, off-farm income, and income from the market and direct payments by selected total household income decile for the years 1990, 1995, 2001 and 2009. These years were chosen to represent pre-reform (1990), first reform (1995), second reform (2001) and the current (2009) situation. The average share of total household income received by households in the 10th decile (i.e. the households with the highest incomes) is about 18%, while the share received by the 1st decile (i.e. the households with the lowest incomes) is about 5%. Farms with higher household incomes generate more income from off-farm work than low income farms. Market income is highly unequally distributed within the farm population. Due to negative market incomes generated by households in the lower (and middle) income decile this inequality strongly increases over time. The distribution of income from direct payments over total household income decile reveals some interesting changes over time. While in 1990 households in the lower income decile were mainly supported by direct payments, in 2009 households within the higher income decile received more direct payments.

Table 1: Income shares of different income sources by deciles of total household income

Year	Income (source)	Total household income deciles					Mean (CHF)	Sample size (Pop. size)
		1st	3rd	5th	8th	10th		
1990	Household income	4.8	7.2	8.9	12.2	18.0	78918	4086 (60318)
	Off-farm income	6.2	8.7	9.0	10.0	14.0	13579	
	Market income	2.8	6.0	8.5	13.4	21.2	54466	
	Direct payments	12.9	11.4	10.8	8.5	7.3	10873	
1995	Household income	3.8	7.0	9.0	12.6	17.9	62313	4324 (57786)
	Off-farm income	4.6	7.7	10.7	12.0	14.8	16706	
	Market income	-6.7	2.1	5.8	17.8	33.0	16832	
	Direct payments	9.4	9.6	9.9	9.9	10.9	28775	
2001	Household income	4.1	7.1	9.0	12.5	17.8	69885	2909 (50613)
	Off-farm income	6.0	6.8	9.4	12.0	13.4	18532	
	Market income	-25.1	-2.9	4.9	22.7	58.1	8535	
	Direct payments	9.1	9.2	9.6	10.7	11.8	42819	
2009	Household income	3.7	6.8	9.0	12.6	18.5	85416	3199 (45520)
	Off-farm income	5.2	8.4	10.4	12.0	13.0	26354	
	Market income	-216.3	-128.8	-48.2	93.9	418.8	1309	
	Direct payments	8.0	9.2	9.6	11.1	12.1	57753	

Source: own elaboration

Table 2 shows the decomposition results for total household income inequality calculated according to equations 1 to 4. Obviously, direct payments became the most important income source for farmers after the agricultural policy reform in 1992. The Gini coefficients G_k show, that total household income inequality increased by 14% between 1990 and 2009. In the same time period off-farm income decreased by 10% and income from direct payments by 33% respectively, while market income inequality strongly increased⁴. The concentration coefficients C_k show that off-farm income is slightly unequally distributed to farmers with higher incomes. The same is true for market income. As already suggested by the decile analysis, direct payments supported low-income farmers in 1990 but high-income farmers after the agricultural reform. The marginal effects of the different income components on total income inequality are shown by the Gini elasticities presented in the last column of Table 2. It shows that the increase of off-farm income and income from direct payments would decrease income inequality while the opposite is true for market income. For instance, the increase in direct payments of 1% would have reduced inequality by 0.22% in 1990, and even by 0.47% in 2009. Hence, direct payments have become less redistributive in an absolute perspective, but due to their increased importance have contributed increasingly to balance the income distribution among farmers.

Table 2: The effects of agricultural policy reform on household income inequality

Year	Income	S_k	G_k	R_k	C_k	η_k
1990	Household income	100	0.21	1.00		
	Off-farm income	17.21	0.58	0.18	0.10	-0.09
	Market income	69.02	0.36	0.83	0.30	0.32
	Direct payments	13.78	0.43	-0.22	-0.09	-0.22
1995	Household income	100	0.23	1.00		
	Off-farm income	26.81	0.54	0.30	0.16	-0.08
	Market income	27.01	0.94	0.70	0.66	0.50
	Direct payments	46.18	0.28	0.08	0.02	-0.42
2001	Household income	100	0.22	1.00		
	Off-farm income	26.52	0.55	0.26	0.14	-0.09
	Market income	12.21	2.09	0.58	1.21	0.54
	Direct payments	61.27	0.28	0.21	0.06	-0.45
2009	Household income	100	0.24	1.00		
	Off-farm income	30.85	0.52	0.27	0.14	-0.13
	Market income	1.53	16.7	0.58	9.65	0.60
	Direct payments	67.61	0.29	0.24	0.07	-0.47

Source: own elaboration

4. Note, that the Gini coefficients of market income exceed unity already in 2001 due to the high share of negative incomes. Hence, the marginal effect of market income on the income distribution is overestimated but analytically correct.

Dynamic analysis

The dynamic analysis reveals information on whether a change in the share or a change in the concentration of a specific income component led to a change in the aggregated Gini coefficient. Table 3 shows that household income inequality increased from the per-reform year 1990 to the post-reform year 1995, then slightly decreased until 2001 and increased again until 2009. Between 1990 and 1995 the increase in inequality can mainly be attributed to changes in market income. On the one hand, the decrease in the share of market income led to an overall negative share effect. On the other hand, the increase in the concentration, especially from market income but also from the direct payment income, led to an overall positive concentration effect. In sum, the increase in the concentration of all income sources to farmers with higher income levels led to an increase in household income inequality. Also the decrease in income inequality between 1995 and 2001 is mainly a result of changing market conditions. Especially the decreasing share of market on total income led to an overall negative share effect which was not outweighed by the positive concentration effect. Between 2001 and 2009 household income inequality increased again due to an overall positive concentration effects that outweighed the negative share effect. This time, especially the increase in the concentration of direct payments to richer farmers led to an increase in total household income inequality. Hence, while the changes in income inequality over the first and second agricultural reform periods are related to changing market conditions direct payments are the driving forces of inequality changes in recent years and contributed to an increase in household income inequality.

Table 3: Source of change in total household income inequality

line		1990-1995	1995-2001	2001-2009
1	ΔG Household income	0.0183	-0.0074	0.0164
2	ΔS off-farm income	0.0960	-0.0029	0.0434
3	ΔC off-farm income	0.0548	-0.0144	-0.0060
4	SE+CE off-farm income	0.0247	-0.0043	0.0044
5	ΔS market income	-0.4200	-0.1480	-0.1068
6	ΔC market income	0.3580	0.5540	8.4388
7	SE+CE market income	-0.0290	-0.0296	-0.0001
8	ΔS direct payment income	0.3240	0.1509	0.0634
9	ΔC direct payment income	0.1143	0.0380	0.0123
10	SE+CE direct payment income	0.0226	0.0265	0.0120
11	$\sum SE$	-0.2000	-0.1326	-0.5698
12	$\sum CE$	0.2183	0.1253	0.5861

Source: own elaboration

ΔG , ΔS , ΔC denote the change in the Gini coefficient of total household income, and the change in the share and concentration of each income component respectively. SE and CE are calculated according to eq. 7 and 8.

5.2. The effect of different direct payments on farm income inequality

Static analysis

Table 4 shows the decomposition results of farm income inequality by means of income from different direct payment programs calculated according to eq. 1 to 4⁵. In 1990 the share of available direct payments on farm income was relatively low but increased after the agricultural policy reform in 1992. As early as 1995, area based payments (introduced in 1993) constituted 19% of total farm income and even more than 40% in 2001 and 2009. Animal unit based payments (RAUval and RAUhill) became important income sources for farmers, too. As shown by the concentration coefficients C_k , farm household payments (Hhp), and payments given to farmers producing under adverse production conditions (Areahill, RAUhill) support mainly households with low income levels. In contrast, all other direct payments support mainly farmers with high income levels. The Gini elasticities show that an increase of income from each of the general direct payment programmes would decrease farm income inequality. For instance, the increase of area based payments for farmers producing in the valley regions (Areaval) of 1% would decrease farm income inequality by 0.24%. In contrast, the increase of support for animal welfare and ecological programs (ecological compensation area, extensive crop production, ecoquality) would not affect the income distribution.

Table 4: The effects of different direct payment programmes on farm income inequality

	1990			1995			2001			2009		
Gini farm income	0.27			0.33			0.33			0.38		
Direct payment programme	S_k	C_k	η_k	S_k	C_k	η_k	S_k	C_k	η_k	S_k	C_k	η_k
Hhp	2.4	-0.14	-0.04	9.8	-0.01	-0.10	-	-	-	-	-	-
Arable	4.5	0.19	-0.01	2.3	0.23	-0.01	-	-	-	-	-	-
Areaval	-	-	-	19.0	0.10	-0.13	46.3	0.14	-0.27	41.5	0.16	-0.24
Areahill	2.7	-0.14	-0.04	4.4	-0.09	-0.06	4.0	-0.07	-0.05	3.6	-0.05	-0.04
RAUval	-	-	-	-	-	-	8.1	-0.09	-0.10	17.7	0.08	-0.14
RAUhill	5.3	-0.23	-0.10	9.5	-0.17	-0.14	8.9	-0.15	-0.13	12.3	0.00	-0.12
AFSS	-	-	-	-	-	-	1.5	0.28	-0.00	2.2	0.26	-0.01
Regout	-	-	-	0.5	0.15	-0.00	5.0	0.16	-0.03	6.0	0.14	-0.04
Eco	-	-	-	2.8	0.15	-0.01	4.1	0.14	-0.02	4.0	0.14	-0.03
Extenso	-	-	-	1.7	0.24	-0.00	1.2	0.22	-0.00	1.0	0.25	-0.00
Ecoqual	-	-	-	-	-	-	1.0	0.10	-0.02	4.5	0.11	-0.02

Source: own elaboration

Hhp: Farm household payments (CHF/farm household), **Arable**: Arable payments (CHF/ha crop land), **Areaval**: Area based payments for farmers producing in the valley regions (CHF/ha), **Areahill**: Area based payments for farmers producing in the hilly and mountainous regions (CHF/ha), **RAUval**: Roughage animal unit based payments

5. Not all direct payment programs available to Swiss farmers could be analysed here, because of the low number of observations of some farm programmes within the FADN database. Due to space restrictions, the effect of market income is not shown in the table but can be obtained from the authors upon request.

for farmers producing in the valley regions (CHF/roughage animal unit), **RAUhill**: Roughage animal unit based payments for farmers producing in the hilly and mountainous regions (CHF/roughage animal unit), **AFSS**: Particularly animal-friendly stabling systems (per animal unit), **Regout**: livestock with regular outdoor exercise (per animal unit), **Eco**: Ecological compensation area (CHF/ha), **Extensio**: Extensive crop production (CHF/ha), **Ecoqual**: Ecoquality (CHF/ha)

Dynamic analysis

As shown by the first line of table 5 farm income inequality increased over time. Furthermore, the table shows the effects of different direct payment programmes on changes in the Gini coefficient. Direct payments that were available to farmers producing in the hilly and mountainous regions in Switzerland in 1990 and 1995 inversely contributed to the increase in farm income inequality. This was mainly a result of the concentration of these payments to farmers in the lower tail of the income distribution which led to a negative share effect even if both, the concentration as well as share of these payments increased (see eq. 6 and 7 for the approximation of the SE and CE). In the case of arable payments, its negative contribution to the increase in farm income inequality was the result of the decrease in the share of this income source on farm income. Farm household payments positively contributed to the observed increase in inequality which can be attributed to the strong increase in the concentration of this income source to farmers with higher income levels.

Between 1995 and 2001 almost all direct payment programs positively contributed to the increase in farm income inequality. In the case of area based payments for valley farmers (line 8-10), animal unit based payments for livestock with regular outdoor exercise (line 23-25), and payments for ecological compensation area (line 26-28) this was mainly the result of an increase in the share. In contrast, for area and animal unit based payments for farmers producing under adverse production conditions, this was a result of an increase in the concentration to farmers with higher income levels. Payments for extensive crop production inversely contributed to the increase in farm income inequality due to a decrease in share as well as concentration.

Also between 2001 and 2009 most of the direct payment programs positively contributed to the increase in farm income inequality. For area and animal unit based payments (in the hilly and valley regions) and the ecological compensation area program this was a result of an increase in concentration. In the case of the two animal welfare programmes and the ecoquality programme the positive contribution to farm income inequality can be attributed to their increasing shares.

In summary, the most important change in the direct payment scheme of the policy reform in 1992, namely the reduction of arable payments, has had an effect on farm income distribution. Furthermore, it can be observed, that in the early period of programme availability, changes in the share mainly affect changes in the income distribution. The longer a program is available, the more likely inequality changes are a result of changes in the concentration.

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"Evidence-Based Agricultural and Rural Policy Making"

Table 5: Source of change of farm income inequality due to different direct payment programmes

line		1990-1995	1995-2001	2001-2009
1	ΔG farm income	0.0539	0.0001	0.0484
Farm household payments (CHF/farm household)				
2	ΔS	0.0741	-	-
3	ΔC	0.1301	-	-
4	SE+CE	0.0026	-	-
Arable payments (CHF/ha crop land)				
5	ΔS	-0.0224	-	-
6	ΔC	0.4380	-	-
7	SE+CE	-0.0032	-	-
Area based payments (valley regions) (CHF/ha)				
8	ΔS	-	0.2731	-0.0485
9	ΔC	-	0.0370	0.0188
10	SE+CE	-	0.0451	0.0010
Area based payments (hilly regions) (CHF/ha)				
11	ΔS	0.0165	-0.0040	-0.0035
12	ΔC	0.0533	0.0167	0.0289
13	SE+CE	-0.00001	0.0010	0.0013
Animal unit based payments (valley regions) (CHF/RAU*)				
14	ΔS	-	-	0.0958
15	ΔC	-	-	0.1725
16	SE+CE	-	-	0.0220
Animal unit based payments (hilly regions) (CHF/RAU*)				
17	ΔS	0.0420	-0.0060	0.0347
18	ΔC	0.0647	0.0163	0.1522
19	SE+CE	-0.0037	0.0025	0.0134
Animal-friendly stabling systems (CHF/animal unit)				
20	ΔS	-	-	0.0067
21	ΔC	-	-	-0.0244
22	SE+CE	-	-	0.0014
Livestock with regular outdoor exercise (CHF/animal unit)				
23	ΔS	-	0.0450	0.0107
24	ΔC	-	0.0060	-0.0164
25	SE+CE	-	0.0072	0.0007
Ecological compensation area (CHF/ha)				
26	ΔS	-	0.0135	-0.0009
27	ΔC	-	-0.0177	0.0070
28	SE+CE	-	0.0013	0.0002
Extensive crop production (CHF/ha)				
29	ΔS	-	-0.0043	-0.0019
30	ΔC	-	-0.0120	0.0295
31	SE+CE	-	-0.0012	-0.0001
Ecoquality (CHF/ha)				
32	ΔS	-	-	0.0347
33	ΔC	-	-	0.0072
34	SE+CE	-	-	0.0039

Source: own elaboration

*RAU: roughage animal unit; ΔG , ΔS , ΔC denote the change in the Gini coefficient of total household income, and the change in the share and concentration of each income component respectively. SE and CE are calculated according to eq. 7 and 8.

6. SUMMARY AND DISCUSSION

Compared to other countries, farm income within the Swiss farm population is rather equally distributed with Gini coefficients ranging between 0.27 and 0.38 (and between 0.31 and 0.41 if the dataset is not trimmed). In contrast, Gini coefficients of between 0.63 and 0.55 were found for Ireland (Keeney, 2000), and a Gini coefficients of 0.54 was found for Germany (von Witzke and Noleppa 2007). This result can be explained by the homogenous structure of Swiss agriculture that is based on small family farms with an average size of little more than 17 hectare (FSO, 2007) and similar capital intensity. Even if structural change took place within the last two decades, no large and highly efficient farm operations were developed.

Between 1990 and 2009, total household income inequality only slightly increased whereas a strong increase in farm income inequality can be observed. This shows that off-farm income plays an important role to balance the income distribution among farmers. It also shows the increasing dualism in the Swiss agriculture between part-time farmers and full-time farmers. The equalizing effect of off-farm income on income distribution was also found for the US (Mishra et al., 2009).

With the change from market support to direct payments, the decline in output prices led to an increasing share of households that generate negative market incomes while the share of direct payments on farm income increased considerable. Nowadays, around half of Swiss farmers live with a negative market income, a situation that is unheard of in any other sector. The per farm household payments of the pre-reform period supported mainly low-income farmers und were thus highly unequally distributed in themselves. The direct payments introduced with the agricultural policy reform in 1992, support farmers over the whole range of income levels (i.e. were more equally distributed in themselves) but are more concentrated to farmers in the upper tail of the income distribution. Hence, payments that are in one way or another related to farm size, such as those introduced in 1992, are also related to farm profits (von Witzke and Noleppa, 2007, Schmid et al., 2006). This was also shown by Mann (2006) for area based direct payments in Switzerland.

The results can also be discussed in the light of changing agricultural policy goals. In the pre-reform period the main goal of direct payments was to support low income farmers that were disadvantaged by adverse production conditions and did not earn a comparable income even though market support led to very high price levels. With the agricultural policy reform in 1992 market support was reduced and direct payments aimed to compensate farmers for income losses they face due to decreasing prices. The new agricultural policy was based on per hectare and per animal unit payments that were made available to all farmers. To a certain extent, this approach conserved the distributional effects of the former policy. As in the case with market support, also the support through direct payments advantaged high income farmers. This is because input factors (such as land) on the one hand enable farmers to produce more output and on the other hand determine the amount of direct payments farmers receive. However, even if high-income farmers receive more direct payments than low-income farmers, they have an

equalizing effect on the income distribution. This was also found for Ireland and the US (Keeney, 2000, Mishra et al., 2009).

The analysis shows furthermore, that changes in income inequality over the first (1992) and second agricultural reform period (1999) are related to changing market conditions, but that direct payments are the driving forces of inequality changes in recent years (i.e. the increase in income inequality between 2001 and 2009). This is due to the increasing importance of direct payments as income source but also due to its increasing concentration to high-income farmers. It shows furthermore, that the price effect of market support had have a strong impact on the income distribution among farmers.

The detailed analysis reveals that the increase of income from each of the direct payment programs would decrease farm income inequality. This is especially true for general direct payments that make up a high share on farm income. In contrast, the increase of income from animal welfare payments and ecological direct payments would hardly affect farm income distribution because of their low contribution to total farm income.

One particular goal of agricultural policy is to support farmers that are faced by adverse production conditions. Area and roughage animal unit based payments provided for those households in fact support low income farmers. Hence, these payments seem to be well targeted at least when market prices are decreasing. Similar results were found for Compensatory Allowances (Headage) in Ireland that also aim to support farmers in areas facing natural handicaps (Keeney, 2000). In contrast, arable payments, area based payments for valley farmers, animal welfare and ecological direct payments are mainly given to farmers with higher incomes. Hence, payments coupled to the farm size support farmers with a lower risk of low incomes. Furthermore, farmers with bigger farms can more easily provide environmental goods than very small scaled farms (Mann, 2006). The subscription to animal welfare measures require investments (e.g. for new stabling systems) which might explain that mainly farmers in the upper tail of the income distribution are supported by these payments.

The dynamic analysis shows that area based payments given to farmers in the valley regions positively contributed to the increase in the Gini coefficient of farm income. In the early period this was the result of the increasing share of this payment on farm income. Over the later period this was because of the increase in the concentration of this payment to farmers with higher income levels. A similar dynamic can be observed for all payments that are directly or indirectly linked to the farm size. In contrast, ecological direct payments and animal welfare payments mainly positively contribute to farm income inequality due to their increasing share in farm income. This development is suggested to be the result of the adaption behaviour of farmers to changing market conditions and changes in the direct payment system. This includes the optimization of income through direct payments (e.g. the change from crop to livestock production) which is the better able the longer the programmes are available. Further analyses could therefore focus on the impact of structural change on the income distribution. This would give information on whether and to what extent inequality is a direct result of money transfer or the result of the reaction of farmers on incentives given by these transfers.

7. CONCLUSION

The advantage of the Gini decomposition method used in this paper is that marginal effects of single income components on total income distribution can be calculated. Furthermore, it can be shown whether changing shares or changes in the distribution of different income components within the farm population led to increasing or decreasing income inequality over time. However, as this method assumes that incomes from all sources are independent of each other feedback effects are neglected even if they might be substantial (Keeney, 2000). For instance, the contribution of direct payments to the inequality of household income can be identified but the incentives of these payments on production are not taken into account. Nevertheless, this kind of analysis provides interesting information and policy implications can be drawn.

In general, the here presented analysis shows that governmental support in any way influences farm income and income distribution, which should be considered by policy makers. This applies in particular in a country like Switzerland where agriculture is highly dependent on public support. The strong reliance on direct payments which Swiss farms have developed over the last 20 years has not led to a significant change in sectoral inequality altogether. However, the change from volume based market support to structural based decoupled direct payments increased the responsibility of policy makers regarding the distribution of farm income. This is shown by the fact that the increase in farm income inequality within the last decade can mainly be attributed to the change in the importance and concentration of direct payments.

Furthermore, there is now a big gap between farms that manage to earn money on the market and farms that lose money by producing food and forage. In cases where income from direct payments exceeds the actual amount of farm income earned, negative values remain (that represent market income in the current study) and Gini coefficients exceed unity. This creates sharpened methodological challenges if Gini decomposition approaches are used (i.e. how negative values are handled). However, the qualitative policy implications remain. Especially farming families in the lower income tail cannot survive without direct payments and off-farm income. This changes the economic and social character of farming considerably. It also shows the conflict of different policy objectives (e.g. income goals and the increase of the competitiveness of Swiss agriculture) as uneconomic farm operations stay in business which reduces the release of agricultural land and hampers the restructuring of agriculture.

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