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Agriculture and rural development: A quantitative analysis of agriculture's economic and social impacts in Swiss regions

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Abstract

Swiss agriculture has experienced structural change of around 2.5% per year in the last decade. This paper explores the effects of the agricultural sector as well as of agricultural structural change both on the regional economy and on settlement in rural areas in Switzerland.

In order to assess the effects of structural change on the regional economy we apply input-output models based on primary data collected in several lagging Swiss regions. These regions belong to different socioeconomic development types that were identified by hierarchical cluster analysis. In the course of input-output analysis we calculate agriculture's role in terms of contribution to regional turnover, income and employment and pay special attention to the significance of public means such as direct payments.

In order to assess whether agriculture contributes significantly to settlement we first define the term 'particularly vulnerable municipality'. Agriculture is considered to contribute substantially to settlement if a municipality becomes particularly vulnerable or more vulnerable than previously under the hypothetical situation that the agricultural employment share declines to zero. By using statistical data available for all Swiss municipalities we are able to quantify the number of municipalities where agriculture contributes significantly to settlement.

The results show that agriculture has significant backward linkages. However, the overall turnover of the sector is too small for any significant effects on the regional economy as a whole. Agriculture's regional economic impact and its contribution to a decentralized settlement are therefore generally low and only significant in a limited number of regions.

Keywords

Structural change, economic development, decentralized settlement, models for regional rural development decisions.

1 Introduction

Traditionally defined, rural areas are remote, sparsely populated, and often dependent on natural-resource-based industry. Distance from the centre of markets makes rural areas less attractive to people and to industry that is not materials-oriented (Kilkenny 1998). These established characteristics are, however, not sufficient anymore to allow for much of the current reality in industrialized countries. Recent literature provides evidence that the image of rural regions as being the scene of losses of population and jobs, largely associated with the idea of a rapid decline of employment in a supposedly dominant agricultural sector, needs readjustment. Comparative analyses of socioeconomic indicators in rural European regions in the 1980s and 1990s for example show that the decline in agriculture is paralleled by a growing diversity of employment in the manufacturing and services sectors. While in some rural regions non-agricultural employment growth could not compensate the loss of agricultural jobs, it appeared, however, that there were also quite a number of rural regions which outperformed employment growth in the urban regions (Terluin and Post 2000; Terluin 2003; ARE 2004).

The aim of this paper is to provide spatially differentiated empirical evidence of agriculture's role in rural areas today. Structural change in agriculture has manifold effects on settlement in rural areas. Direct effects are caused by sectoral and regional out-migration of the agricultural workforce. Additional effects arise from indirect and induced effects of the agricultural sector on the regional economy and its population base. In lagging rural areas, population decline and a narrowing economic base not only affect future development perspectives, they also put under threat achieving a balance between the interests of the different groups of people who have a stake in the development of rural areas (Errington 2000).

In order to assess the effects of structural change on the regional economy we apply input-output models based on primary data collected in several lagging Swiss regions. In a second step we quantify the number of municipalities where, beyond its economic impacts, agriculture contributes significantly to settlement. For this purpose we use statistical data available for all Swiss municipalities. Based on these findings we arrive at a spatially differentiated pattern of the economic and social impacts of structural change in agriculture in rural areas.

Depending on a region's locational and socioeconomic characteristics, structural change has different impacts on the development of rural areas. The following section 2 describes the current socioeconomic situation in rural areas in Switzerland and provides basis for further analyses in the remaining sections of the paper. Section 3 explores the economic impact of agriculture in rural areas on the basis of input-output analysis. For several case study regions we calculate agriculture's economic role in the regional economy and its dependence on different categories of final demand. In section 3.3 we develop an algorithm to determine those municipalities in Switzerland where agriculture contributes significantly to settlement, i.e. those municipalities with a high social impact of agriculture. A synthesis of the input-output analyses in section 3 and of the area-wide analysis in section 3.3 pro-

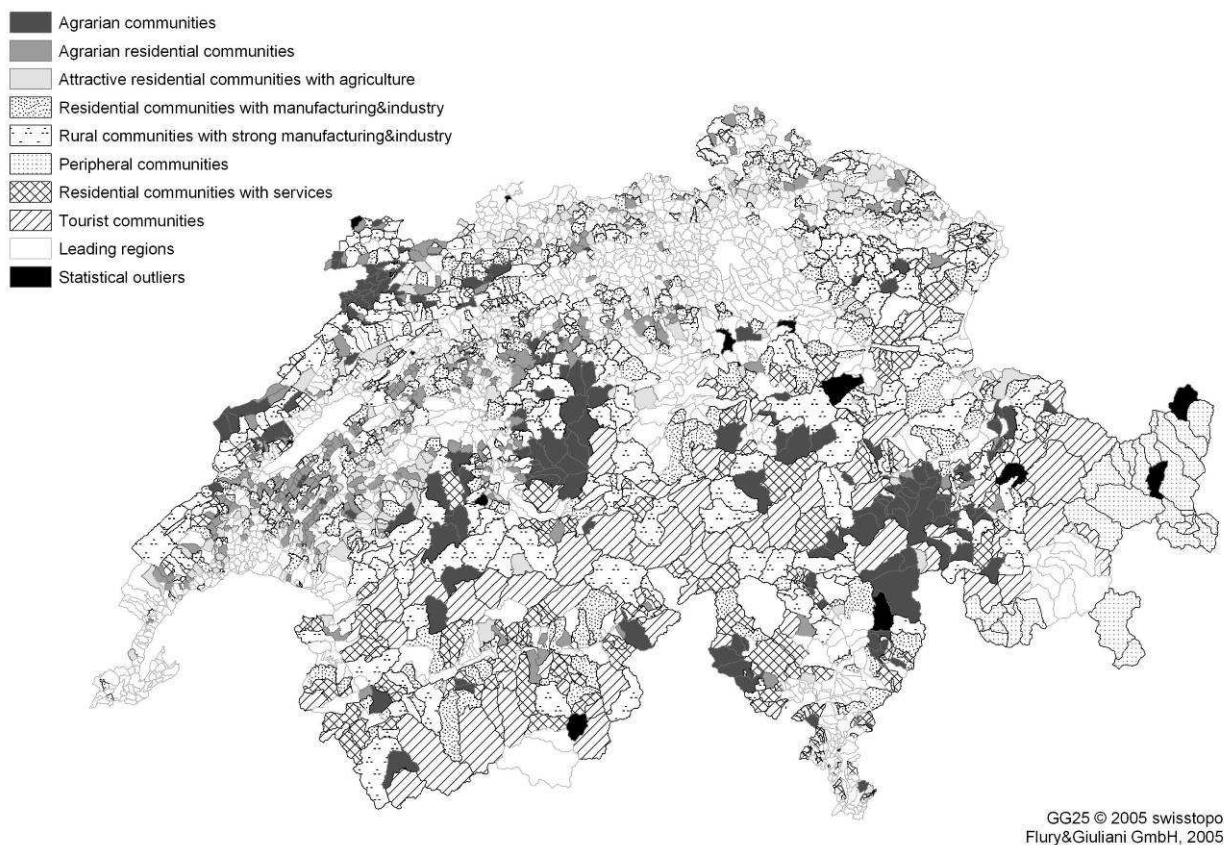
vides insights into the effectiveness and efficiency of agricultural policy aimed at strengthening agriculture's role in rural areas (section 5).

2 Development patterns in rural areas

Rural areas have to be differentiated in several ways. Structural change in agriculture and in the overall economy, for example, leads to different socioeconomic structures and potentials. As a basis for further analyses in the remainder of the paper we therefore elaborated a socioeconomic typology of all the approximately 3'000 municipalities in Switzerland. On the basis of hierarchical cluster analysis, 17 municipality types were identified. These types show similar combinations in the value of 21 socioeconomic indicators. The indicators belonged to five socioeconomic categories: (1) demographic structures; (2) employment structures; (3) commuting and distance; (4) financial power; (5) infrastructure and quality of life. Details of the analysis can be found in Buchli *et al.* (2004).

In a first step of the analysis, all Swiss municipalities were divided into the two categories of leading and lagging regions. In leading regions, the values of all the 21 indicators were above Swiss average. The opposite was the case for lagging regions. Leading and lagging regions were subsequently divided into further socioeconomic development types. For the purpose of this paper, only lagging regions are described. Figure 1 gives an overview over the eight types of lagging regions. On an aggregate level, it also shows the geographical distribution of leading regions and of statistical outliers.

Figure 1: Socioeconomic types of lagging regions in Switzerland (adapted from Buchli et al. 2004: 29).



Cluster analysis assigns a municipality to a specific municipality type. In individual cases, a municipality can differ from the characteristics of the type it belongs to. The differences, however, are still smaller than if the municipality was assigned to another type. The lagging municipality types have the following characteristics (Buchli et al. 2004: 27ff):

- Attractive residential municipalities with agriculture: This municipality type has a share of out-commuters on the total working population that is above average. These municipalities have experienced considerable population growth and the demographic structure is balanced. For those employed locally, agriculture plays an important role.
- Agrarian residential municipalities: Agrarian residential municipalities are smaller than attractive residential municipalities with agriculture. Population growth was less intensive and they are located in more peripheral areas.
- Residential municipalities with manufacturing & industry: This municipality type is similar to the attractive residential municipalities with agriculture. Local employment, however, lies more in the manufacturing and industry sector instead of agriculture. Population growth rate is also lower.
- Rural municipalities with strong manufacturing & industry: These municipalities are, on average, slightly bigger but located more peripherally than residential

municipalities with manufacturing & industry. Population growth is also lower and the demographic structure is characterized by a high share of old people.

- Agrarian municipalities: The share of out-commuters on the total working population is lower in agrarian municipalities than in agrarian residential municipalities. They are also located more peripherally. Population growth was low and the demographic structure is characterized by a high share of old people.
- Residential municipalities with services: These municipalities are characterized by a high share of commuters on the total working population. Local employment is mainly in the service sector, especially the service and restaurant industry. The demographic structure tends towards a high share of old people.
- Peripheral municipalities: The unifying characteristic of these municipalities is the distance variable (distance to expressway).
- Tourist municipalities: These municipalities are defined by the service and restaurant industry as well as by tourism. They are located rather peripherally so that there are not many out-commuters.

Detailed primary data about regional economic structures are available for the last four municipality types (agrarian municipalities, residential municipalities with services, peripheral municipalities and tourist municipalities). Data were collected for in depth input-output analysis which we describe in the next section. The different municipality types will be further discussed when we describe agriculture's contribution to settlement in section 3.3.

3 Economic impacts of agriculture

In order to assess the effects of structural change on the regional economy we apply input-output models based on primary data collected in several lagging Swiss regions (see section 3.2). In input-output analysis, all economic activity is assigned to one of two sectors: production or final demand. All firms producing a specific product or service are allocated to the production sector. The final demand portion of the model includes households, government, tourism, and interregional or international trade. The amount of a product produced by a given sector is determined by the amount of demand for that product. The flow of products between sectors is measured in monetary terms and referred to as transactions between the various sectors (Dinc *et al.* 2003). Input-output models are widely applied and useful tools for examining regional economic structure. They capture economic linkages between the economic sectors and the dependency of a regional economy on different categories of final demand such as private, tourist, public and export demand.

For the purpose of our paper we are interested in agriculture's role in terms of contribution to regional turnover, income and employment. Special attention will be paid to the significance of public means such as direct payments. Their direct, indirect and induced effect on the regional economies will be analyzed in detail for the a series of case study regions belonging to different socioeconomic municipality types as described in section 2.

3.1 Input-output analysis: method

The input-output method and its applications are discussed in a number of books (Miller and Blair 1985; Lahr and Dietzenbacher 2001). In such an analysis, all economic activity is assigned to one of two sectors: production or final demand. All firms producing a specific product or service are allocated to the production sector. The final demand portion of the model includes households, government, tourism, and interregional or international trade. The amount of a product produced by a given sector is determined by the amount of demand for that product. The flow of products between sectors is measured in monetary terms and referred to as transactions between the various sectors (a_{ij}). An important input-output assumption is that the transactions between sectors are a fixed and constant proportion of the amount of product produced. The sectoral interrelation can be expressed as follows (Dinc *et al.* 2003):

$$x_i = x_{i1} + x_{i2} + x_{i3} + \dots + x_{in} + Y_i \quad i=1, \dots, n \quad (1)$$

x_i = total output from industry i

x_{ij} = output sold from industry i to regional industry j

Y_i = output sold from industry i to final demand

The relationship between the sectors is revealed by the pattern of expenditure as a portion of total expenditure made by a given sector for various inputs. This relationship can be described as:

$$r_{ij} = \frac{x_{ij}}{x_j} \quad (2)$$

The direct regional input coefficients, r_{ij} , are calculated from (1). By substituting equation (1) into equation (2) we get

$$x_i = r_{i1}x_1 + r_{i2}x_2 + r_{i3}x_3 + \dots + r_{in}x_n + Y_i \quad i=1, \dots, n \quad (3)$$

or in matrix notation

$$X = RX + Y \quad (4)$$

The solution of this matrix can be written as

$$X = (I - R)^{-1}Y \quad (5)$$

where $(I - R)^{-1}$ is the Leontief inverse or the output multiplier matrix. Each element in this matrix can be interpreted as the direct and indirect output required from regional industry i per unit of output delivered as final demand from industry j .

The vector X is the product of the direct, indirect and induced effects. The direct effect is the immediate result of a change in demand for the goods produced in in-

dustry *i*. This change in demand also leads to an increase in production in all the other industries (indirect effect). As a consequence of the change in production, employment and income increase which further raise consumption (induced effect).

3.2 Agriculture's contribution to a regional economy

We developed input-output models for a total of seven lagging regions in Switzerland. For this purpose, detailed sector-by-sector surveys of regional purchases and sales were carried out, for example in the year 2002 ('Val Muestair') and 2004 ('Urserntal'). In the course of these surveys, all the relevant actors were interviewed. Information for agriculture and the public sector was complemented by statistical data. The survey corresponds to a primary data collection for an average of the past four years (see also Buser *et al.* 2005b).

The seven case study regions differ in several aspects. Table 1 gives an overview of the socioeconomic characteristics of the regions. The first column indicates the region's name while the second assigns its socioeconomic development type as described in section 2. As a first proxy for the role of the agricultural sector in these regions total agricultural area in hectares is indicated in the fourth column. In mountain regions, the monetary size of the agricultural sector is a direct consequence of the agricultural area available. By dividing agricultural area by the region's population size the significance of agriculture both in the different municipality types and within the same municipality type is illustrated. Agriculture, for example, is more dominant in the tourist region of 'Gadmen' than in the tourist region of 'Urserntal'. This is a consequence of the size of the two regions with 'Gadmen' being one municipality and 'Urserntal' a region consisting of three municipalities, one of which has the function of a regional centre. Finally, the last column contains information on the source of the primary data which were used for our input-output models.

Table 1: Case study regions for input-output analysis

Region	Socioeconomic development type	Population size	Agricultural area [ha]	Agricultural area/ population	Primary data source
Safien	Agrarian	308	696	2.26	Buchli 2002
Gadmen	Tourist	285	277	0.97	Dijkstra2003
Medel (Lucmagn)	Residential with services	570	378	0.66	Buchli et al. 2003a
Val Müstair	Peripheral	1'787	1'008	0.56	Buchli et al. 2003b
Val Poschiavo	Peripheral	4'427	1'688	0.38	Buchli and Giuliani 2005
Urserntal	Tourist	1'699	534	0.31	Hürlimann et al. 2004
Vallemaggia	Mainly residential	5'593	1'010	0.18	Buser et al. 2005a

Based on the Leontief inverse explained in section 3.1 input-output analysis generates a variety of results. For the purpose of our paper we are interested in the calculation of backward linkages (output multipliers). Output multipliers identify how much value added is generated in a region by an incremental increase in output in one economic sector. The value of an output multiplier therefore is the total change in output divided by the original change in output. It integrates direct, indirect and induced effects. Output multipliers can be calculated in absolute and relative terms. When calculated in relative terms, both the original change in output as well as the total change in output is indicated in percent values.

Table 2 lists the results for the calculation of the backward linkages for the seven case study regions. In addition to the backward linkages it also indicates the share of agriculture on total GDP. This information is taken directly from the input-output table (i.e. without inverting the matrix). Total GDP is calculated by subtracting inputs from total turnover (intermediate and final demand including wages).

The backward linkages are calculated with reference to GDP. An absolute backward linkage of 0.60 therefore states that an additional Swiss Franc of output in agriculture leads to an increase in value added of 0.60 Francs of GDP in the entire region. A relative backward linkage of 40% on the other hand means that 40% of the region's GDP depend on the exports of the agricultural sector. The relative backward linkage of agriculture with reference to GDP thus indicates the degree to which the regional economy's GDP depends on agriculture.

Table 2 also comprises the relative backward linkage of the agricultural sector with reference to employment which can be interpreted as the employment effect of agriculture. The difference between the values for the relative backward linkage with reference to GDP and to employment is caused by the different productivities of the economic sectors in a region. Because productivity in the agricultural sector is low the relative backward linkage with reference to GDP is always lower than the employment effect.

Table 2: *Agriculture's contribution to the regional economy in the case study regions: backward linkages*

Region	Socioeconomic development type	GDP agriculture/ total GDP	Absolute backward linkage agriculture (GDP)	Relative backward linkage agriculture (GDP)	Relative backward linkage agriculture (employment)
Safien	Agrarian	26%*	0.60*	40%*	60%*
Gadmen	Tourist	28.4%	0.68	28.7%	42%
Medel (Lucmagn)	Residential with services	25%	0.69	14.0%	27%
Val Müstair	Peripheral	5.0%	0.86	4.90%	11%
Val Poschiavo	Peripheral	6.8%	0.97	2.70%	4%
Urserntal	Tourist	2.6%	0.84	2.20%	3%
Vallemaggia	Mainly residential	0.9%	0.82	0.9%	2%

* Estimated values as data incomplete

The importance of agriculture for a regional economy can be derived from the analysis of the factors listed in Table 2: the absolute size of agriculture as a sector of the economy differs from region to region and, at the same time, its importance in the overall gross value added of the region varies. The absolute size of the sector results practically directly from the utilised agricultural area available (Table 1), in particular in mountainous regions. The share held by agriculture in gross value added depends primarily on the socio-economic characteristics of the region and the other sectors. In agrarian regions with a predominant agricultural sector and a lack of non-agricultural sectors, agriculture accounts for a considerably higher share in the gross regional value added than it does, for example, in tourist regions or in regions with a strong energy sector (Val Poschiavo).

In agrarian regions, the effect of agriculture on the regional economy is limited mainly to direct and induced effects. In spite of agriculture's relatively high input intensity, indirect effects are low. The reason for this is that inputs cannot be obtained regionally in these regions and must therefore be imported. The opposite can be observed in non-agrarian regions, where the direct effects of agriculture are lower due to the small volumes in the overall turnover of the regional economy. However, the indirect effects are greater than in agrarian regions since the other economic structures make it possible to obtain inputs locally. From an absolute point of view, the induced effects of agriculture are therefore also higher than in agrarian regions. From a relative point of view however, the induced effects in agrarian regions are more important since they account for a greater share in relation to the overall induced effects in the region.

The values of the backward linkages in agriculture are also influenced by demand structure. On the one hand, agricultural demand structure is determined by the regional demand for its products and services and on the other hand by its competitiveness outside the region (exports). The latter depends on the competitiveness of the products and this, in turn, is influenced by the quality of the products, produc-

tion costs and thus also by input structure and input costs. The amount of money which flows into the regional economic cycle through export activities results from demand structure taken together with the size of a sector. Due to direct payments and the concentration of processing at a few locations, agriculture exhibits a relatively high export share. In mountainous regions this share generally amounts to over 50% of turnover in the agricultural sector. As described above, the economic structures within a region influence the importance of agriculture in the regional economy. On the other hand, the export share held by agriculture or the foodstuff sector depends on whether or not the region has processing plants for agricultural products. If these plants are present, processed products with a higher added value can be exported or sold within the region, as long as they are competitive.

In addition to the inter-relationships already discussed, the economic potential of a region also depends on the input structure and on the share of imported inputs. As opposed to exports which generate a flow of money into a region, the import of upstream services, products and services drain money out of the regional economic cycle. The latter is particularly applicable to agriculture, as in small agrarian regions only a low share of the inputs required for agricultural production and the goods needed by farming families can be obtained within the region. This means that a larger share of agricultural turnover flows out of the region without any additional value added, whereby even the potential of the exports is lost. On the other hand, in larger regions with more diversified economic structures agricultural upstream services are available within the region. This extends agriculture's regional value added chain and has a positive effect on the regional economy. This explains why the absolute backward linkage assumes its lowest value in the agrarian region of 'Safien' while it is considerably higher in regions such as 'Val Müstair', 'Val Pöschia', 'Urserental' and 'Vallemaggia'.

The discussion of these linkages within regional economies shows that sector structure, the demand and input structures of these sectors and gross value added are interdependent. In particular, the size of a region (population number) depends not only on itself but also on the other three factors and influences the factors for regional economy - GDP, employment and income of private households. It can be observed that, from a short-term point of view, there is a conflict of targets between employment and the regional GDP: sector structures with low costs exhibit relatively high value added but, due to their input structures, have little effect on the overall regional economy or employment within the region. From a long-term point of view, sector structures which are competitive when compared to rivals from outside the region are essential as they ensure the long-term survival of the sector and, through direct effects, jobs within the region.

Table 2 also shows that the employment effect of agriculture does not correlate with the absolute size of the sector. Agriculture's share in GDP does not play a great role either. For example, the energy sector in Safien generates a far greater added value than agriculture. However, this is not reflected in its employment effect as the added value is generated with a small staff (high productivity) and there are few linkages to the rest of the economy. Due to the low employment effect of this sector, agriculture is the most important source of employment in Safien; the

lack of non-agricultural activities enhances the importance of agriculture for the regional economy. This influences the relationship between the utilised agriculture area and population, whereby the utilised agricultural area can be interpreted as an indicator for the gross regional added value of agriculture. A comparison of the values between the regions shows that values are lower in those regions with non-agricultural activities, and thus where agriculture is relatively unimportant for the regional economy. The employment effect, on the other hand, increases with higher ratios. Since the monetary volumes of agriculture are defined by the utilised agricultural area, non-agricultural activities within a region are decisive for the degree of the employment and multiplier effects. Therefore, a high degree of dependency on agriculture is not a valid argument for adhering to today's agricultural structures. Rather, in many cases, a high degree of dependency on agriculture reveals a region's structural problems and thus indicates the need for the promotion of non-agricultural activities.

The results in this section show that economic linkages and dependencies within a region depend on four factors:

- Sector structure of the regional economy, whereby the share of the individual sectors in the total is of particular importance.
- Demand structure of the sectors, with the share of the products sold within the region and the share of the products exported.
- Input structure, which is defined by the strength of the net value added, the wage share of a sector and the share of the inputs purchased within the region. The strength of the net value added of a sector is defined by the relationship between the sector's turnover and the costs of purchased inputs.
- Size of a region (or population and GDP, respectively).

3.3 Effects of structural change in agriculture on a regional economy

As in all other sectors, agriculture is undergoing structural change. This is revealed by a decline in the number of farms, whereby the land vacated is usually exploited by those farmers who remain. In the first instance, structural change leads to an alteration of the input structure in the agricultural sector. Due to the growth in the size of the farms, less work is expended per area unit and, as a rule, fewer other inputs are used. Apart from that, structural change only leads to a slight decline in the sector's volumes since, in most cases, the growth of the farms leads to more extensive production. On the one hand, this results in a reduction of indirect effects, while on the other hand the added value generated by agriculture rises – at unchanged product prices. The number of those employed in agriculture sinks concurrently with the decline in the number of farms, whereby the employment slump is offset in part by the use of labour-saving technologies – substitution of labour by capital. If these technologies are available within the region it has a positive indirect effect on regional economy. However, this is probably rarely the case as capital

investments, such as machinery, are generally neither developed nor produced within the region.

The relationship between the adaptation effects determines the manner in which the direct and indirect effects of agriculture alter with structural change. The direct added value effect will rise if the reduction in sector volume generated by extensive methods is lower than the decline in input intensity (size effects and substitution of labour by capital). On the other hand, the indirect effect becomes less important. This pattern is to be observed primarily in regions which already have good agricultural structures. The opposite applies to direct and indirect effects in regions with unfavourable agricultural structures. In these cases, structural change leads to investments which increase indirect effects and at the same time generate a reduction of the direct effect on added value.

Assuming that the decline in the number of farms and the agricultural workforce cannot be offset by employment opportunities in the manufacturing and service sectors, structural change in agriculture will lead to a reduction in the number of private households which in turn lowers the consumption share of the private households within the region. The remaining farming households no longer purchase products within the region. Even if there are prospects of an increase in income due to an expansion of the size of the farm, the consumer goods available in rural regions are generally everyday products which are already available to a farming family on their own farm. In this way, structural change in agriculture even reduces the induced effects of agriculture on the overall regional economy through the private consumption of farming families.

Sinking production costs in the course of structural change lead to an improvement in the competitiveness of the farms and the regional added value generated by agriculture. At the same time, there is an increase in labour productivity in agriculture resulting in a decline in employment in agriculture and, via the indirect and induced effects, in overall employment in the region. Therefore, viewed as a whole, structural change has a positive effect on agriculture while weakening the regional economy. This is particularly applicable to regions which have a markedly agricultural nature as the increase in efficiency which accompanies the structural change can, in general, not generate an expansion of the production volume and exports. This applies to both agricultural products and the multifunctional services which are remunerated by means of direct payments. The main reason for this is the fact that the important production factor - land - is limited regionally.

4 Social impacts of agriculture

In addition to its economic impacts agriculture also contributes to settlement. Direct payments in Switzerland reimburse the provision of positive external effects and of public goods. The Swiss Constitution states that the significant contribution of agriculture to a decentralized settlement constitutes such a public good. In order to assess whether agriculture contributes significantly to settlement we first define the term 'particularly vulnerable municipality'. Agriculture is considered to contribute substantially to settlement if a municipality becomes particularly vulnerable or

more vulnerable than previously under the hypothetical situation that the agricultural employment share declines to zero.

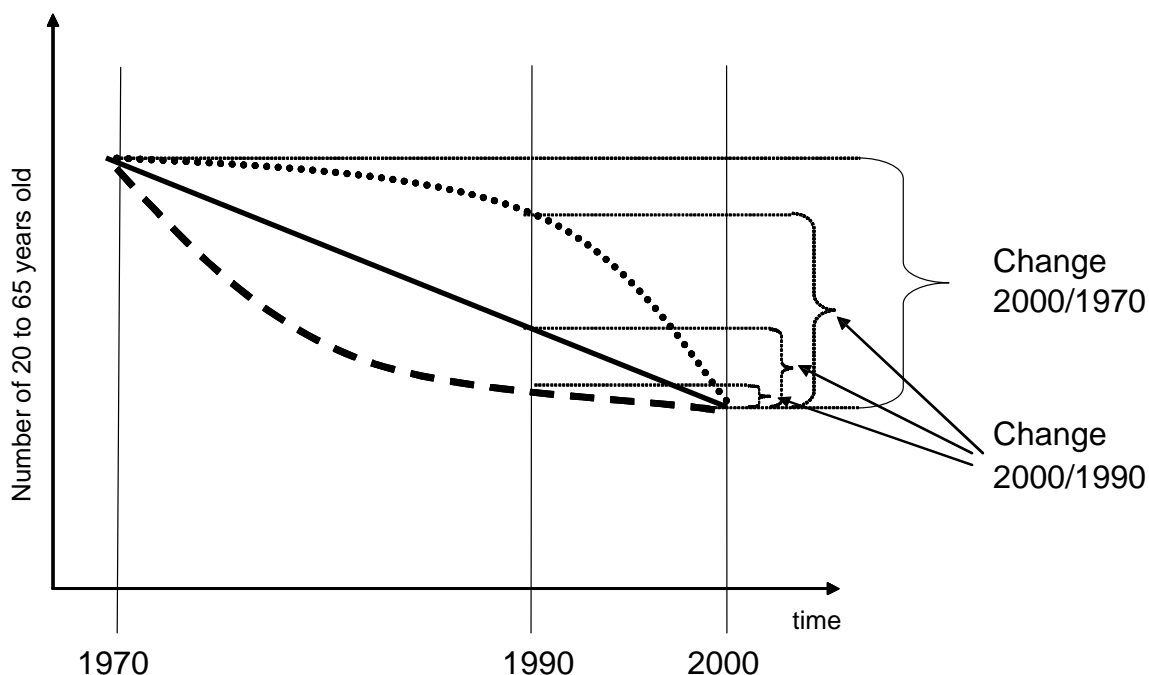
4.1 Particularly vulnerable municipalities

In order to determine agriculture's influence on the viability of rural municipalities we first analysed how viable Swiss municipalities are in general. Viability in this context exclusively refers to the question whether settlement can be maintained in the medium term. A first proxy for viability used is the size of the population. All municipalities with a population of 1'000 or more are considered viable in the medium term and are therefore excluded from the analysis. Thus the study objects were 1'560 of the 2'896 municipalities which fall into the category of 1000 inhabitants or less.

In a next step, two indicators were developed in order to determine the municipalities' future viability. Both indicators are based on the development of the population aged 20-65 over time. The first indicator ($X_{00/70}$) reflects the long-term development of the population between 1970 and 2000 and the second one ($Y_{00/90}$) the short-term development between 1990 and 2000.

Figure 2 illustrates the importance of combining the two indicators. It shows the example of three stylized municipalities with identical long-term decline of the 20-65 years old population. Only the additional information of the short-term indicator reveals that in one municipality population numbers are stabilizing while in the other a continuation of the decline after 2000 is likely to occur. The short-term indicator furthermore takes into account the development of the number of young people (20 – 39) between 1990 and 2000 as this is a proxy for the attractiveness of the municipality for young (rural) professionals.

Figure 2: *Different population trends in three rural municipalities (Rieder et al. 2004: 43).*



On this background we define a community to be particularly vulnerable if it corresponds to one of two criteria (see Table 3 for the threshold values applied for the two criteria and Rieder *et al.* 2004 for further methodological details):

- The long term development of the economically active population declines and the short term development exhibits only very moderate growth (criterion 1).
- The long term development of the economically active population shows only very moderate growth but the short term development experiences decline (criterion 2).

The threshold values differ according to the size of the population. The smaller the population, the more sensitive a municipality reacts to a further decline. This is reflected in the fact that the threshold values chosen are more severe for smaller municipalities.

Table 3: Criteria for the classification of municipalities as threatened in their existence (based on Rieder et al. 2004).

Population size	Criterion 1		Criterion 2	
	X 70/00	Y 90/00	X 70/00	Y 90/00
< 300	< 0.95	< 1.3	< 1.2	< 0.9
> 299 and < 500	< 0.9	< 1.1	< 1.1	< 0.9
> 499 and < 1000	< 0.8	< 1.1	< 1.1	< 0.8

X 70/00: working population 20-65 in % of 1970

Y 90/00: $\frac{1}{2} * (\text{working population 20-65 in \% of 1990} + \text{working population 20-39 in \% of 1990})$

According to the chosen indicators and applied thresholds, 231 out of the 1'560 municipalities can be considered as particularly vulnerable (15% of the study objects or around 8% of all Swiss municipalities). Of these municipalities, many are very small: 74% have less than 300 inhabitants.

Particularly vulnerable municipalities not only lie in the more remote alpine valley. Instead, they can also be found in parts of the Pre-Alps, and the Jura in the north eastern part of Switzerland. Their distribution among the Swiss cantons is shown in Table 4.

Table 4: *Particularly vulnerable municipalities grouped according to municipality type and canton (Kopainsky 2005: 40).*

canton	agrarian municipalities	agrarian residential municipalities	attractive residential municipalities with agriculture	statistical outliers	rural municipalities with strong manufacturing & industry	peripheral municipalities	tourist municipalities	residential municipalities with manufacturing & industry	residential municipalities with services	total particularly vulnerable municipalities	total municipalities per canton	share of particularly vulnerable municipalities per canton
FR	2	6			2					10	246	4%
SO	3			3						6	126	5%
AG	1									1	233	0%
BE	6	6		2	8		2	3		27	404	7%
BL				1						1	86	1%
GL					5		1	1	1	8	30	27%
GR	26	3	1	2	9	7	2		4	54	212	25%
JU	11	3	1		6				1	22	83	27%
NE					1			1		2	64	3%
SG					1					1	93	1%
SZ	1									1	34	3%
TI	12	1	1	2	11		1	6	12	46	251	18%
UR	1				2		2			5	21	24%
VD	1	17		2	4					24	388	6%
VS	3	3			3		5	1	8	23	162	14%
Total	67	39	3	12	52	7	13	12	26	231		
a)	180	302	226	17	330	24	84	371	201	a) tot. mun./mun.type		
b)	37%	13%	1%	71%	16%	29%	15%	3%	13%	b) vuln. mun./mun.type		

Table 4 illustrates that most of the particularly vulnerable municipalities are agrarian municipalities, rural municipalities with strong manufacturing and industry, and residential municipalities with services. In a relative comparison, i.e. when the total number of particularly vulnerable municipalities in a municipality type is compared with the total number of municipalities in this type, peripheral and tourist municipalities are also of special importance.

4.2 Agriculture's contribution to the viability of rural municipalities

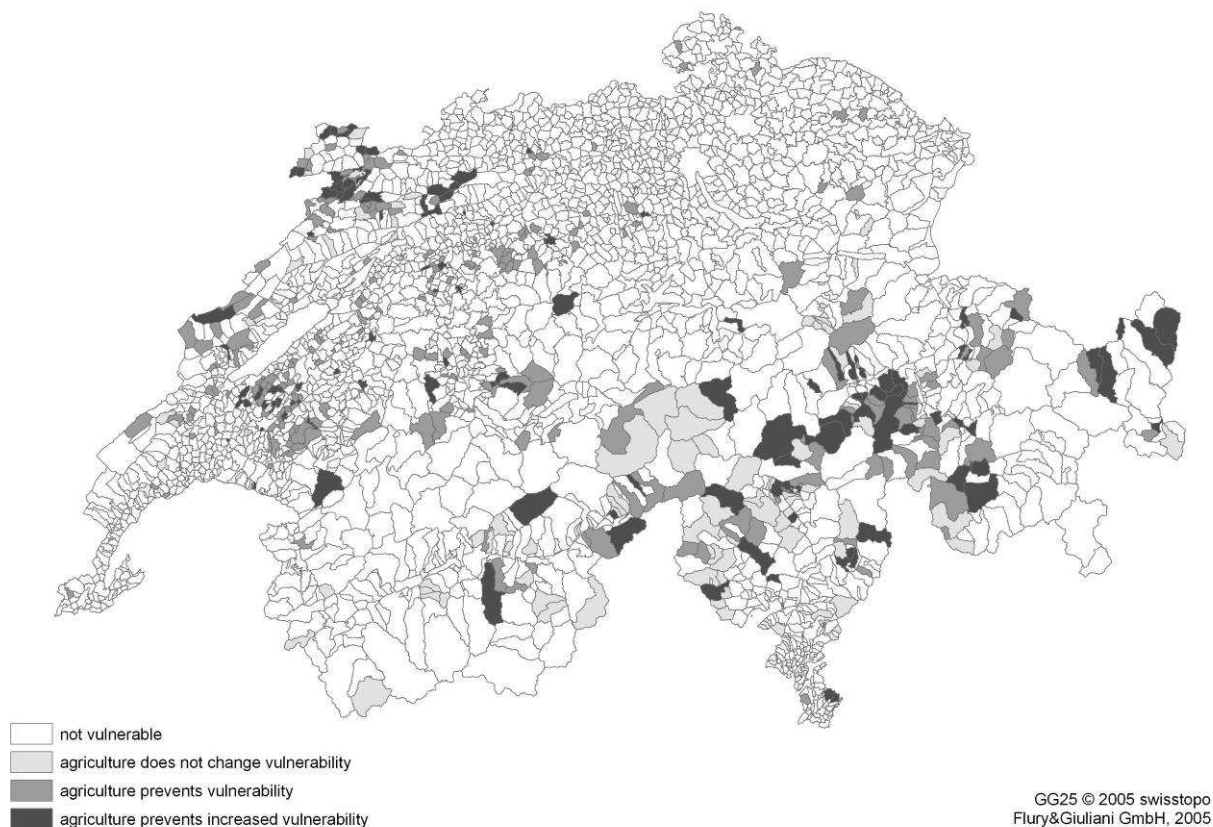
Agriculture is considered to contribute substantially to settlement if a municipality becomes particularly vulnerable or more vulnerable than previously under the hypothetical situation that the agricultural employment share between 1990 and 2000 declined to zero. We therefore simulated the effect of a disappearance of the agricultural sector for all municipalities with a population smaller than 1000 inhabitants. With a few adaptations the same indicators as the ones used to determine particu-

larly vulnerable municipalities were applied¹. These indicators were thus recalculated under the hypothesis that agriculture had disappeared between 1990 and 2000.

Figure 3 illustrates the results of this analysis. It shows the spatial distribution of the particularly vulnerable municipalities and of the municipalities where agriculture contributes substantially to settlement. The figure also makes two further distinctions:

- Municipalities of the categories "agriculture does not change vulnerability" and "agriculture prevents increased vulnerability" are identical with the particularly vulnerable municipalities from section 4.1 and Table 4.
- Municipalities of the category "agriculture prevents vulnerability" critically depend on the existence of the agricultural sector. In case of its disappearance, they change from the category "not vulnerable" into the category of particularly vulnerable municipalities.

Figure 3: Agriculture's contribution to settlement (adapted from Rieder et al. 2004: 58).



¹ The indicator 2000/1990 has to be simplified in the sense that it is no longer possible to include the development of the number of people in the age category 20-39 as the age distribution in agriculture at the municipality level is not known.

Figure 3 demonstrates that the municipalities with a substantial contribution of agriculture to settlement mainly lie adjacent to particularly vulnerable municipalities. The figure therefore does not draw an entirely new picture concerning settlement patterns. Much rather, it differentiates between the main drivers, i.e. it differentiates whether future development perspectives of a municipality are restrained because of structural change in agriculture or because of other socioeconomic processes such as structural change in the overall economy which might affect tourist municipalities or rural municipalities with strong manufacturing and industry.

Table 5 gives additional background information on the characteristics of the municipalities where agriculture contributes significantly to settlement. It lists the number of municipalities in different categories of contribution and also provides their population number and agricultural land. The table distinguishes three categories of contribution. The second column indicates the cases where agriculture does not contribute to settlement. The third column contains the cases where agriculture's contribution is small whereas the fourth column shows the values for the category of municipalities where agriculture contributes substantially to settlement.

Table 5: Agriculture's contribution to settlement in the year 2000 (Rieder et al. 2004: 60).

	No contribution		Small contribution		Substantial contribution	
Municipalities in the year 2000	2'275	78.5%	262	9.1%	359	12.4%
Population in the year 2000	7'091'661	97.3%	102'491	1.4%	89'858	1.2%
Agricultural land [ha] in the year 2002	885'714	83.4%	62'296	5.9%	113'786	10.7%

The sum of the percentages per row in the table can deviate from 100% due to rounding errors.

According to Table 5, agriculture contributes to settlement in 21.5% of the Swiss municipalities. However, only 2.6% of the entire population live in these municipalities and farmers cultivate 16.6% of the overall agricultural land.

5 Conclusions

The aim of this paper was to analyse where, how and how much agriculture contributes to the economy in rural Swiss regions and to a decentralised settlement as a whole. In a further step we developed theoretic arguments concerning the effects of structural change on a region's economy and its population base. The Swiss Constitution identifies a significant contribution to settlement as one of the agricultural services which are reimbursed by direct payments. This paper therefore contributes to the discussion by providing decision support in field of agricultural support and regional policy measures for the assistance of lagging rural areas.

For this purpose we developed several detailed input-output models on the basis of which the significance of the agricultural sector in a regional economy can be derived. Based on these empirical data we were able to identify the impact of agricultural support on the regional economies. The regions analysed differed in several aspects and covered different socioeconomic development types such as agrarian, tourist, peripheral and residential regions. The results showed that agriculture's contribution to the overall economy, both in terms of gross value added and employment is generally very low. Additional analyses based on secondary statistical data also revealed that agriculture only contributes significantly to settlement in a minority of the Swiss municipalities. It can therefore be stated that the support of the agricultural sector, e.g. by direct payments, is not effective for maintaining settlement in lagging rural areas.

This general conclusion also holds for cases where agriculture exhibits high multiplier effects. High values of output multipliers cannot be used as a justification for effective and efficient distribution of direct payments for the support of regional economies. Two circumstances favour the existence of high values of multipliers:

- Agrarian regions without significant developments in the manufacturing and services sectors. In these regions, high multiplier values result from direct and induced effects.
- Non-agrarian regions with a diversified overall economy and a strong agricultural sector. In this case, high multiplier values result from indirect effects as agriculture can mainly buy its inputs from within the region.

In order to justify the distribution of direct payments aimed at supporting a decentralised settlement, agriculture's contribution to settlement instead of agriculture's contribution to the regional economy has to be considered. Supporting the agricultural sector with direct payments is an effective policy measure in cases where the overall viability of the region critically depends on the agricultural sector. Today, this is the case in 21.5% of the Swiss municipalities. However, only 2.6% of the entire population live in these municipalities and farmers cultivate 16.6% of the overall agricultural land.

Supporting the agricultural sector with direct payments will, however, not result in stabilising these regions in the long term. Structural change in agriculture will increase these regions' vulnerability. If settlement is to be maintained employment alternatives in the manufacturing and services sectors therefore have to be created or increased. As a consequence of a more diversified and more significant overall economy, multiplier effects in agriculture, especially indirect effects, will also increase. The effectiveness and efficiency of agricultural support in terms of agriculture's contribution to the overall economy will only increase in the course of such a development.

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6 References

- ARE (Bundesamt für Raumentwicklung) 2004. Nicht-städtisch, rural oder peripher – wo steht der ländliche Raum heute? Analyse der Siedlungs- und Wirtschaftsentwicklung in der Schweiz. Verkauf Bundespublikationen, Bern.
- BLW (Bundesamt für Landwirtschaft) 2004. Agrarbericht 2004. Bern.
- Buchli S. 2002. Wirtschaftsstrukturen der Gemeinde Safien. Semesterarbeit, Institut für Agrarwirtschaft, ETH Zürich.
- Buchli S., Buser B., Rieder P. 2003b. Die regionalwirtschaftliche Situation im Val Müstair. Institut für Agrarwirtschaft, ETH Zürich.
- Buchli S., Kopainsky B., Furrer H.P., Rieder P. 2003a. Wirtschaftsstrukturen der Gemeinde Medel(Lucmagn). Institut für Agrarwirtschaft, ETH Zürich.
- Buchli S., Kopainsky B., Rieder P., 2004. Funktionale Typisierung der Schweizer Gemeinden. Institut für Agrarwirtschaft, ETH Zürich.
- Buser B., Giuliani G., Rieder P. 2005a. L'economia regionale della Vallemaggia. Institut für Agrarwirtschaft, ETH Zürich.
- Buser B., Giuliani G., Rieder P. 2005b. Festsetzung regionalpolitischer Prioritäten im Schweizer Alpenraum auf der Basis regionaler Input-Output Tabellen. *Geographica Helvetica* 4/05 (forthcoming).
- Dijkstra P. 2003. Nachhaltige Entwicklung Gadmental. Diplomarbeit, Geomatikingenieurwissenschaften, ETH Zürich.
- Dinc M., Haynes K.E., Tarimcilar M. 2003. Integrating models for regional development decisions: A policy perspective. *The Annals of Regional Science*: 37 (1): 31-53.
- Errington A.J. 2000. Rural development and the rural economist. In: Hillebrand H., Goetgeluk R., Hetsen H. (eds.). *Plurality and rurality. The role of the countryside in urbanised regions*. Agricultural Economics Research Institute (LEI), The Hague. Vol. 2/2: 115-128.

- Hürlimann M., Buser B., Zraggen K., Rieder P. 2004. Studie des Instituts für Agrarwirtschaft (IAW) im Rahmen von „Ursern Network“. Regionalwirtschaftliche Studie zur Schaffung von Entscheidungsgrundlagen. Institut für Agrarwirtschaft, ETH Zürich.
- Kilkenny M. 1998. Transport costs and rural development. *Journal of Regional Science* 38 (2): 293-312.
- Kopainsky B., 2005. A system dynamics analysis of socio-economic development in lagging Swiss regions. *Berichte aus der Volkswirtschaft*, Shaker-Verlag, Aachen.
- Lahr M.L., Dietzenbacher E. 2001. *Input-Output Analysis: Frontiers and Extensions*. Palgrave, Basingstoke.
- Miller R.E., Blair P.D. 1985. *Input-Output Analysis: Foundations and Extensions*. Prentice-Hall, Englewood Cliffs.
- Rieder P., Buchli S., Kopainsky B. 2004. Erfüllung des Verfassungsauftrages durch die Landwirtschaft unter besonderer Berücksichtigung ihres Beitrags zur dezentralen Besiedlung. Forschungsprojekt zuhanden des Bundesamtes für Landwirtschaft. Institut für Agrarwirtschaft, ETH Zürich.
- Terluin I.J. 2003. Differences in economic development in rural regions of advanced countries: an overview and critical analysis of theories. *Journal of Rural Studies* 19 (3): 327-344.
- Terluin I.J., Post J.H. (eds.) 2000. *Employment dynamics in rural Europe*. CABI Publishing, Oxon/ New York.