Agro-structural patterns in the Alps 2000–2010

Muster des Agrarstrukturwandels in den Alpen 2000–2010

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Summary

Agro-structural change continues. In the European Union (EU) and particular in the Alps its characteristics and challenges are manifold. This paper thus intends to detect Alpine-wide major driving forces by means of an agro- and socioeconomic monitoring system. Analyses rest on a statistical comprehensive dataset (2000/10) of 5.758 municipalities (LAU2). The detailed assessment of agro- and socioeconomic variables at LAU2 enables the aggregation of general agro-structural trends to a higher geographic scale. Under the current agro- and socioeconomic framework conditions, the results from linear regression analysis highlight significant variables impacting the change in farms among Alpine countries and EU farm types. This holistic view based on the latest agricultural census intends to support mountain agriculture policies.

Keywords: Agro-structural change in the Alps, monitoring, driving forces

Zusammenfassung

Der Agrarstrukturwandel schreitet voran. In der Europäischen Union (EU) und besonders in den Alpen sind seine Ausprägungen und Herausforderungen vielfältig. Dieser Artikel beabsichtigt, alpenweit mithilfe eines agrar- und sozioökonomischen Monitoring Systems wesentliche Gründe dafür zu bestimmen. Die Analysen beruhen auf einem statistischen Datensatz (2000/10) von 5.758 Gemeinden (LAU2). Die detaillierte Befassung mit agrar- und sozioökonomischen Variablen auf LAU2 ermöglicht es, allgemeine Trends des Agrarstrukturwandels auf eine höhere geografische Ebene zu aggregieren. Unter den derzeitigen

Erschienen im *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie*, Band 24: 275-284, Jahr 2015. On-line verfügbar: http://oega.boku.ac.at.

agrar- und sozioökonomischen Bedingungen bestimmten lineare Regressionsanalysen signifikante Variablen, die maßgeblich die Veränderung landwirtschaftlicher Betriebe der Alpenländer sowie der EU Produktionstypen beeinflussen. Dieser alpenweite Gesamtblick auf Basis der letzten Landwirtschaftszählung beabsichtigt, die Berglandwirtschaftspolitik zu unterstützen.
Schlagworte: Agrarstrukturwandel in den Alpen, Monitoring, Bestimmungsgründe

1. Introduction

Across Europe agro-structural change is evident with distinctive trends towards rising farm size, decreasing farm numbers, over-aged farmers, lacking successors and few employees in the primary sector (EC, 2006). Despite that general picture, the dynamic of the agro-structural change among EU member states (MS) seeks its origin in the manifold varieties of agro- and socio-economic conditions (STREIFENEDER, 2010). Initial point of the paper is to analyse the latest agricultural census data from 2010 and 2000 at municipality level (LAU2) to design statistical models exploring agro-structural changes – for administrative units (MS) and thematic units (EU farm types) (FADN, 2010). It is tested which of these two statistical models determines agro-structural change best.
At EU level, basic instruments reflecting agro-structural dynamics are regional agricultural statistics from EUROSTAT and Farm Accountancy Data Network (FADN). Both provide information at NUTS2 (regional level). However, with only 26 of them covering the whole alpine area and as parts of their areas being located outside the Alpine Convention (AC) territory, NUTS2 is not the appropriate resolution to analyse agro-structural disparities in the Alps. A more detailed territorial breakdown is NUTS3 (provincial level). Here, additional socio-economic information from various public databases is available to enhance the agro-structural models. These 98 NUTS3 units covering the Alps would be enough for an "Alpine-wide" model. Nevertheless, a spatial-specific incoherency of NUTS3 regions to the delimitated AC area persists; and due to the high variability of agro-structural change within NUTS3, a unique Alpine approach at that level appears little goal orientated.

With that in mind, it seems more practical to apply approaches that put emphasis on homogenous and specific regional units as they are more coherent with the political comprehension and responsibility to cope with the challenge and dynamics of agro-structural change. Even the EU is staying abreast with its locally based policy intervention approaches like CLLD (EC/1303, 2013). This integrated territorial approach considers the primary sector as one of those that encompasses economic, social and environmental concerns in rural areas.
Against this background, the paper examines whether agro-structural change can be determined more significantly when applying models either for thematic (farm types) or administrative (MS) levels.

2. Data and method

Analyses of agro-structural change of 2000/10 rely on harmonized agro- and socioeconomic data at municipality level (LAU2) covering the AC area. Herein administrative changes among municipalities and changed national definitions in agricultural censuses in the last decades are considered. For coherency, data from other national sources (IACS data) are supplemented to have available a complete set of farms > 1 ha across the Alps for 2000 and 2010. They encompass information on: farm type, size class, organization form (part-/full-time), agricultural area, livestock or gross margin. Besides, socio-economy like demography, employment, economic details as well as spatial statistical data are included for the 5.758 Alpine municipalities.

Tab. 1: Applied variables for explaining change in farms in the regression models

Δ_Pf	Change in part time farms 2000/10
Δ_Fa_5ha; Δ_Fa5-10ha	Change in farms < 5 and 5-10 hectares 2000/10
Δ_Fa10-20ha; Δ_Fa20ha	Change in farms 10-20 and > 20 hectares 2000/10
%Fa5_10ha/Fa10	Share of farms of 5 to10 hectares to all farms 2010
Δ_Uaa	Change in utilized agricultural areas 2000/10
Uaa_fa10	Average utilized agricultural area per farm 2010
Gr10, Al10, PerCr10	Grassland, Arable land, Permanent crops, 2010
ESU00	European size units 2000
Δ_Lsd	Change in livestock density
Elev_Range	Elevation range
TT_min00	Travel time (min) to cities > 5000 inhabitants 2000
Pop_dens10	Population density 2010

Sources: National statistics of Alpine countries 2000/10, AC, 2013, Diamont database, 2000, Own calculations

The analytical part derives from a comprehensive set of agro- and socio-economic variables in a stepwise approach those that are independent (Multi-Collinearity), explain the change in farms 2000/10 optimal (Adj. R^2) and have normal distributed residuals (table 1). As the standard deviation of change in farms varied between NUTS2 and LAU2 significantly among Alpine countries (table 2), analyses of agro-structural patterns focused at LAU2 to gain reliable results. Besides, a "One Way ANOVA" analysis proofed for "change in farms" the independency among MS and EU farm types (table 3 & 4) and confirmed that it is reasonable to run separate regression models.

3. Results

According to the latest agricultural census 2010, the AC area holds 259,569 farms. Between 2000 and 2010, 24% of the farms were vacated, with an annual growth rate of -2.8%. Thus, the trends observed in former agricultural censuses from 1980 to 2000 (-2.6%) (STREIFENEDER, 2010) did not slow down. Annual average abandonment rates in the last decade are below 1980–2000 rates only in Germany (from -1.7% to -0.9%) and Slovenia (from -3.3% to -1.3%), remained equal in Austria (-1.4%), at a higher level also in Switzerland (-2.1%) and France (-3.4%) and increased in Italy (from -3.4% to -4.5%) and Liechtenstein (from 4.7% to -5.1%, however, mainly due to census definitions).

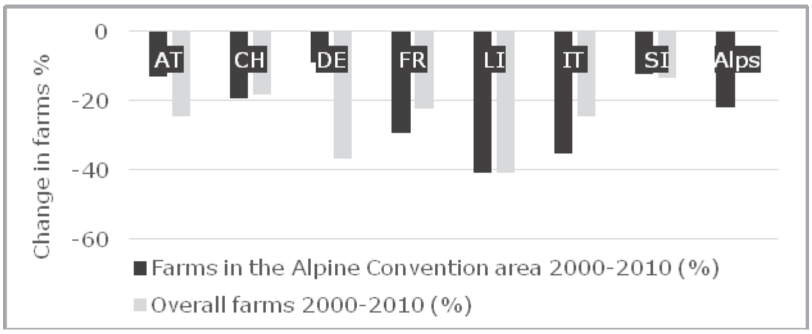

Fig. 1: Farm development in the AC and state area of Alpine countries 2000/10

Source: NATIONAL STATISTICS OF ALPINE COUNTRIES 2000/10

Comparing the change in farms in the Alps with that one of all farms in each country, mountain farming is less decreasing in Germany, Austria and Slovenia. In contrast, mountain farms in Italy and France are more likely suffering from farm abandonment (figure 1). And mainly Italy and France show the highest variances among municipalities (table 2).
That is also shown in the Alpine-wide map on change in farms 2000/10 (figure 2). Considerable variations among countries and the heterogeneity at LAU2 become visible. Observations indicate: moderate agro-structural changes (-20%) in Austria, Bavaria, Slovenia, South Tyrol as well as in Lombardy (IT) and Eastern and Central Switzerland, Espace Mittelland and Graubünden; while increasing farm numbers were identified only in Austrian's AC area between 1980 and 2000 (STREIFENEDER, 2010), this is now true for other regions named above, too.
In contrast, regions in Italy's Northeast (Veneto, Friuli Venezia Giulia), South and Northwest (Aosta Valley, Piedmont, Liguria), the French Alps in Switzerland close to Lake Geneva as well as in Ticino are still facing high relative farm abandonment rates from -20 to over -50%.

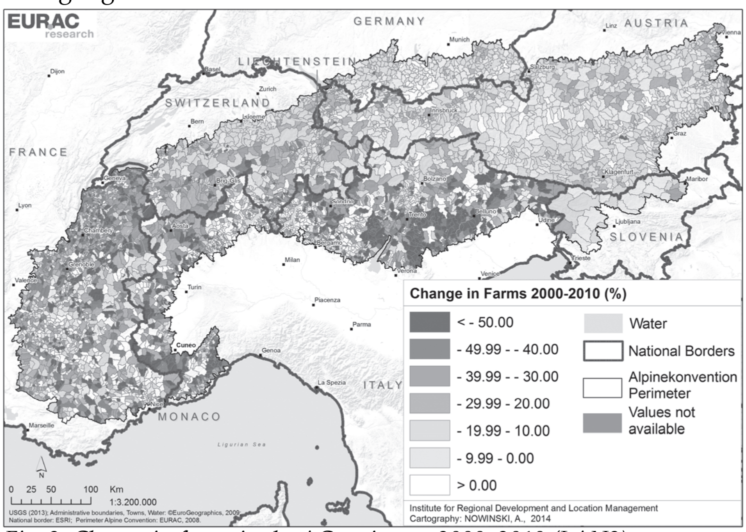

Fig. 2: Change in farms in the AC perimeter 2000–2010 (LAU2)
Source: NATIONAL STATISTICS OF ALPINE COUNTRIES 2000/10

At the same time, change in farms in the AC areas of Italy and France pointed out highly heterogeneous and tessellate changing rates among

municipalities. That is particularly the case for the French southern rural areas (specialised crop and meet production) (AGRESTE, 2014). Among municipalities change in farms varies from strongly decreasing to stable or even increasing farms. Besides, also the urbanized north (dairy/cattle farming) faces high abandonment and strong restructuring processes towards increasing farm sizes (NOURY and GIRARD, 2013). Contrasting farm changes along borders of Austria and Italy and of Northern France and Switzerland may be traced back to different agricultural and regional policy settings for mountainous regions in these countries, since Austria and Switzerland hold a considerable share of their total surface in mountainous regions (STREIFENEDER, 2010).
The previously mentioned heterogeneity of change in farms becomes even more obvious when comparing variances among countries and their municipalities at NUTS3 and LAU2. Alpine-wide, standard deviations (std. dev.) at LAU2 are varying remarkably and exceed two to five times the one at NUTS3. (table 2).

Tab. 2: Comparison of standard deviation and mean values for the change in farms 2000/10 for each Alpine country at NUTS3 and LAU2 level

Alpine Countries	LAU2		NUTS3	
	std. dev.	mean	std. dev.	mean
AT	±11,5	-12,41	±6,98	-15,49
CH	±24,93	-19,38	±4,06	-17,93
DE	±16,24	-7,34	±10,39	-8,7
FR	±27,58	-29,09	±8,06	-27,7
IT	±65,99	-12,11	±29,7	-21,53
SI	±12,04	-10,57	±7,48	-10,6

Source: OWN CALCULATIONS

Remarkable variations of standard deviations of change in farms can be determined for other agricultural factors as well as for socio-economic ones. Also, the correlations of variables at LAU2 and NUTS3 differ in direction and significance. E.g. the correlations for “change in share of farms <5 ha” did not show a significant correlation with the “change of population density” at NUTS3 (-0,121), whereas at LAU2 a significant negative correlation for that data-couple (-0,076**) was indicated. Reasons for this difference are related to the aggregation of LAU2 data to NUTS3 level. Obviously, the correlation of variables differs meaningfully in direction and significance between NUTS3 and LAU2 due to the small statistical population.

Tab. 3: Standardized regression coefficients for agro- & socioeconomic variables estimating the change in farms (Δ_Fa 00/10) at LAU2 level for Alpine countries

Model	AT	CH-FL	DE	FR	IT	SI
Adj. R^2	**0.485**	**0.562**	**0.659**	**0.519**	**0.730**	**0.338**
Δ_Pf	.580$^{(3)}$	---	.566$^{(3)}$	---	---	---
Δ_Fa_5ha	---	.494$^{(3)}$	---	.696$^{(3)}$	.819$^{(3)}$	.591(3)
Δ_Fa5-10ha	.146$^{(3)}$	.210$^{(3)}$	---	---	.137$^{(3)}$	---
Δ_Fa10-20ha	.175$^{(3)}$	.127$^{(3)}$	---	---	---	---
Δ_Uaa	.078$^{(3)}$	.457$^{(3)}$	.327$^{(3)}$	---	.140$^{(3)}$	-
Uaa_fa10	.110$^{(3)}$	-.103$^{(3)}$	-.154$^{(3)}$	---	---	---
Al10	-.087$^{(3)}$	---	---	---	---	---
Percr10	-.063$^{(2)}$	---	---	---	---	---
Elev_Range	---	---	.307$^{(3)}$	-.211$^{(3)}$	---	---
TT_min00	.100$^{(3)}$	---	---	---	---	---
ESU00	.062$^{(2)}$	---	-.105$^{(3)}$	---	---	---

$^{(3)}$ Significant at 99%; $^{(2)}$ significant at 95%; $^{(1)}$ significant at 90%.
Adj. R^2- Adjusted stability index; One-Way ANOVA: $F = 30.393$, p-value= .000.
Source: OWN CALCULATION, 2014

Tab. 4: Standardized regression coefficients for agro- & socioeconomic variables estimating the change in farms (Δ_Fa 00/10) at LAU2 level for EU farm types

Farm Types	Arable-Land	Perma-nent Crops	Grass-land < 1250m	Grass-land > 1250m	Mixed Cropping	Mixed Livestock	Mixed Crops & Livestock
Adj. R^2	**0.743**	**0.895**	**0.473**	**0.564**	**0.645**	**0.764**	**0.730**
Δ_Pf	---	---	.430$^{(3)}$	.241$^{(3)}$	---	---	.256$^{(3)}$
Δ_Fa_5ha	.716$^{(3)}$	.839$^{(3)}$	.390$^{(3)}$	.519$^{3)}$	.781$^{(3)}$	.806$^{(3)}$	.698$^{(3)}$
Δ_Fa5-10ha	---	.067$^{(2)}$	.090$^{(3)}$	.150$^{(3)}$	---	.160$^{(3)}$	.151$^{(3)}$
Δ_Fa10-20ha	---	---	.105$^{(3)}$	.092$^{(3)}$	.170$^{(2)}$	.107$^{(2)}$	
%Fa5-10ha/Fa10	---	---	---	.078$^{(3)}$	---	---	.102$^{(3)}$
Δ_Uaa	---	.191$^{(3)}$	.098$^{(3)}$	.288$^{(3)}$	.174$^{(2)}$	---	---
Δ_Gr	.239$^{(2)}$	---	.142$^{(3)}$	---	---	.181$^{(3)}$	---
PerCr10	.277$^{(2)}$	.090$^{(3)}$		-.062$^{(2)}$	.159$^{(2)}$		.097$^{(2)}$
Δ_Lsd	-.238$^{(2)}$	---	---	---	---	-.115$^{(2)}$	---
Elev_Range	---	---	-.054$^{(2)}$	---	---	---	---
TT_min00	---	---	---	-.050$^{(2)}$	---	---	---
ESU00	---	---	---	.047$^{(2)}$	---	.101$^{(2)}$	.099$^{(3)}$

$^{(3)}$ Significant at 99%; $^{(2)}$ significant at 95%; $^{(1)}$ significant at 90%.
Adj. R^2- Adjusted stability index; One-Way ANOVA: $F = 15.082$, p-value= .000.
Source: OWN CALCULATION, 2014

Although various socio-economic variables were tested, endogenous agricultural variables influence the change in farms most. It is mainly the development of small farms and part time farms that strongly influences the total agro-structural change. Besides, utilized agricultural area and its sub-categories form another important group.
Both models for MS and EU farm types draw a broadly similarly picture. The significant variables explaining the change in farms nearly don't differ. What differs, is the quality of explanation. The adjusted R^2 indicate that the detection of change in farms attains better results when referring to thematic than administrative units (Tab. 3 & 4).
Generally the designated results are not surprising. What remains unsatisfying is the lacking impact of socio-economic variables. Neither employment nor tourism had any significant influence in any model. Only "Elevation Range" at municipality level or "Travel Time" to cities > 5000 inhabitants played a significant role in some cases. Their potential to explain the change in farms had nearly no relevant impact.
That these findings neglect specific small spatial realities shall be roughly demonstrated by the following case of the province of Belluno (NUTS3). Findings from literature point out relevant push and pull factors explaining the observed developments in the censuses: since the 1960ies, the industrial sector provided an alternative source of income to many farmers resulting in high farm and agricultural area abandonment rates (ZANETTI, 2013). With 70% of employment in the secondary sector in 2000 and high abandonment rates (2000-2010 -74%), the municipality of Mel in the plains of Belluno is exemplary for this evolution. In contrast, farms in Cortina d'Ampezzo even registered rising farm-numbers (+20%). Cortina benefits from a well-developed tourism area, where 78% of the population was employed in the tertiary sector in 2000 and farmers too earned additional income off-farm. These examples underline the heterogeneous realities that cause the problems for designing appropriate models. With this respect, the authors were able to show that the focus on small territorial units (LAU2) uncovers specific framework conditions not visible at NUTS3.

4. Discussion

Results underline that ongoing agro-structural changes have not been slowing down in the Alps from 2000 and 2010 and also the North-

South and East-West gradients (figure 2) remained. From the considered agro- and socioeconomic variables mainly the agricultural ones are impacting agro-structural change across the Alps. Thereby their patterns at municipal level vary significantly among Alpine countries. In contrast, socio-economic variables are less relevant. As the selected variables do not show a statistically clear direction at LAU2, they cannot give decisive explanations on change in farms of Alpine municipalities.

These varieties confirmed in the standard deviation and correlation results encourage to consider LAU2 data for analysing the agro-structural patterns in the Alps. This information can then give support to locally adapted interventions, like CLLD, which is an effective instrument for steering also agro-structural change (DAX, 2001).

For explaining the dynamics in farm structures (regression models), compound agro-structural variables (table 3 & 4) gained a greater relevance than socio-economic ones for predicting future agro-structural development trends. In this constellation results could suggest that agro-structural change develops independently from socio-economic and socio-demographic issues in rural areas. More realistic is the view that even under comparable socio-economic constellations the patterns of "change in farms" can be totally contrary. For proving that, effort should be taken to extend the quantitative set of variables with acknowledged items from literature which are currently not available at LAU2. This concerns: age of farm managers, family-situation at farm-household or farm succession (law) (WEISS, 2006; BAUR, 1999; MANN, 2003); but also labor intensity, ownership, farm income, subsidies and land prices (BAUR, 1999; WEISS, 2006) as well as on-farm tourism and natural site conditions to indicate less favored areas (STREIFENEDER, 2010). Besides qualitative information like political concerns and traditions of mountain farming or rural framework conditions (ESPON, 2013) should be considered in forming clusters of homogenous agro-structural types. And the regression results of the MS (administrative unit) and the farm types (thematic unit) results confirmed the need to design thematically better differentiated units to gain even more consistent results.

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