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The AFiD-Panel Agriculture: New Potential for Agricultural Research

By Sanna Heinze and Alexander Vogel*

1. Introduction

Based on the farm structure surveys as well as the census of agriculture the AFiD¹-Panel Agriculture allows detailed longitudinal analysis of the agricultural sector. The data set provides comprehensive information concerning land use, livestock and economic conditions of German farms collected by official statistics.

As agriculture has become one of the most integrated policy areas in the EU consuming a major share of the EU budget, there exists distinctive political interest to collect extensive information in order to monitor the success of policy measures. Therefore, the EU mandates regular surveys of the agricultural sector in all member states, the farm structure survey forming the backbone of the whole system.

The data collected provide the most important source for analysing the medium and long term evolution of the agricultural sector as well as the social development in rural areas. Based on those data agri-environmental indicators are calculated and the Economic Accounts for Agriculture (EAA) can be prepared, a significant instrument for monitoring and assessing the Common Agricultural Policy (CAP). Furthermore, the data is used for preparing policy measures. The surveys' legal basis is constituted by the current versions of the related EU regulations and by the German Law on Agricultural Statistics.²

Beyond these functions of official statistics, the Research Data Centres (RDC) of the Federal Statistical Office and the statistical offices of the federal states provide the opportunity for scientists to analyse data of the German farm structure surveys as well as of the census of agriculture. These statistics have been merged into the AFiD-Panel Agriculture, which currently covers the reference periods 1999, 2001, 2003, 2005 and 2007. Thus, the data can be

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¹ AFiD: "Amtliche Firmendaten für Deutschland".

² For further reading see Haffmans (2006, 14).

used for scientific purposes to observe the developments in the German agricultural sector over time.

The following sections of this paper initially give an overview of the agricultural statistics (section 2). Section 3 presents the variables included in the AFiD-Panel Agriculture, whereas section 4 shows selected studies that are based on this data set as well as a short example of a dynamic analysis in order to point out the research potential. Section 5 gives an outlook on upcoming extensions of the panel data set as well as changes concerning the thresholds of coverage. Finally, section 6 illustrates the way of data access.

2. The Data Set

In Germany farm structure surveys have been carried out biannually since 1975, alternately as a sample or a full survey. Representative surveys were conducted for example in the years 2001 and 2005, where roughly 100,000 agricultural holdings (representing around one fourth of German farms) were obliged to answer the questionnaire. These sample farms were selected by drawing a stratified random sample depending on the size of the population belonging to a particular federal state. The 26 sampling strata are meanwhile determined by farm size, cultivated crops and livestock. A new sample is drawn for each survey. Within the framework of a representative survey additionally all German farmers were surveyed for facts necessary for keeping the farm register up to date.

General surveys have taken place for example in the years 2003 and 2007, where every German farm was obliged to provide information concerning its legal form, land use, livestock, determination of income, labour force and sources of off-farm income. Questions regarding ownership and tenancies, amount of rented land and lease payments, livestock manure, income combination and environmental characteristics had to be answered only by the sample farms.

Moreover, roughly every ten years a census of agriculture provides general information on all agricultural holdings as well as further details of the sample farms. Besides, a special focus is on topics which are more relevant in a long-term perspective (e.g. farm succession). After carrying out such a survey in the year 1999, currently the agricultural census is being conducted in the year 2010.³

The data collected are provided within two different data sets: the first one containing variables which refer to the agricultural holding as unit of observation and the second one containing variables which refer to the farm's labour force.

³ For the integration of the agricultural census 2010 into the AFiD-Panel Agriculture see section 5.

The Regulation (EEC) No 571 / 88, article 5 (a) defines an agricultural holding as any technical and economic unit under single management which produces agricultural products (see European Parliament, 1988, in its current version). The headquarter of each holding is regarded as the location of the whole farm, irrespective of whether parts of the agricultural area are situated in another municipality, district or even federal state of Germany (see Federal Statistical Office, 2008a, 5). This has to be considered by data users while doing regional analyses and interpreting research results below the federal level.⁴

From the year 1999 until the year 2007 all agricultural holdings with a minimum of two hectares utilised agricultural area (UAA) had the obligation to answer the questionnaire of the census of agriculture or the farm structure surveys, respectively. Furthermore, farmers who cultivated less than two hectares but grew a minimum amount of specialised crops (e.g. 0.3 ha of hops or 0.3 ha of tobacco) or kept a certain number of livestock (e.g. eight cattle or 20 sheep) were equally obliged to report their data.⁵

The data can be analysed by federal state, administrative region, district and municipality. Though, variables belonging to the representative part of the survey may only be processed for the entire federal territory or by federal states.

These surveys are mostly based on field research conducted by the statistical offices of the federal states, while some information concerning land use, bovine herds and subsidies can be extracted from administrative data in order to minimise the farmers' burden (see Haffmans, 2006, 17).

As a part of the AFiD project, first the data sets of the agricultural census 1999 as well as those of the farm structure surveys 2003 and 2007 have been merged via the farms' ID-numbers into the AFiD-Panel Agriculture (see Malchin / Voshage, 2009, 504). The data of the farm structure surveys 2001 and 2005 have been recently included. This panel now contains almost 370,000 agricultural holdings with information for every survey year. The five most frequent pattern of participation are presented in table 1.

When undertaking time series studies disruptions in defining variables have to be considered. Beside some minor changes in the definition of variables, one major change is the modification of defining the type of farming. The

⁴ Principle of the location of the holding: An agricultural holding is registered with all its farmland, further means of production and livestock where the location of the holding is situated. The real position of the agricultural area or stables does not find consideration. While generating regional results it may therefore occur that the area or number of livestock calculated exceeds the actual amount that is present on site. This will apply, in particular, for the newly-formed German states due to the fact that the holdings' farmland partly extends beyond the district borders (Haffmans, 2006, 15).

⁵ For a complete list of the thresholds of coverage see Federal Statistical Office (2008a, 4).

system refers to the structure of the holding’s standard gross margin (Walsemann, 2003). In the year 2003 the classification procedure of the EU was introduced in Germany. The classification remained methodically similar with slight changes in determining the size and type of farming, making it hard to compare over time (for further reading see Blumöhr et al., 2006).

Table 1
The five most frequent pattern of participation

No.	Reporting year					Number of agricultural holdings	% of agricultural holdings
	1999	2001	2003	2005	2007		
1	X	X	X	X	X	367,741	68.2
2	X	X				36,889	6.8
3	X					34,223	6.3
4	X	X	X			29,091	5.4
5	X	X	X	X		26,565	4.9

Data Base: Research Data Centres of the Federal Statistical Office and the statistical offices of the federal states, AFiD-Panel Agriculture 1999, 2001, 2003, 2005, 2007, authors’ own calculations.
Note: “X” indicates that the statistical unit participated in the respective reporting year; a blank indicates that the statistical unit did not participate in the respective reporting year.

3. Variables Included

The AFiD-Panel Agriculture contains data about various topics. Above all an important distinction must be made between items for non-sample farms (N holdings) and items for sample farms (S holdings). Some of the former items are available for all participating holdings over time. This is true for the following variables: location of the holding, legal form, organic farming and use of the total area by primary crop species.

Data about livestock as well as livestock units for all farms exist for 1999, 2001, 2003 and 2007. In the year 2005 only the sample farms had to specify their livestock. Detailed information about the crops grown by all holdings is provided by the census of agriculture as well as the general farm structure surveys, whereas representative surveys supply those data solely for sample farms. Information concerning the cultivation of intercrops is available for all farms for 1999, 2003 and 2007.

Data about the sample farms’ tenancies exist for all years, as well as information about certain characteristics of the holdings’ workforce. Off-farm income has been part of the surveys since the year 2003. Variables, which must be collected once due to EU legislation such as subsidies for environmental performance in 2003, also form part of the survey programme.

In the year 2005 an additional survey for horticultural farms has been undertaken along with further questioning of the sample farms regarding machinery and the managers' vocational training. Data about wine-growing estates, about farm succession and accommodations for guests on vacation is available for 1999 only.

For a basic overview over the variables that are included in the AFiD-Panel Agriculture see table 2. A complete list of the variables is available at the homepage of the Research Data Centre (www.forschungsdatenzentrum.de) or from the authors upon request.

Table 2
Variables included in the AFiD-Panel Agriculture

Groups of variables	Reporting year				
	1999	2001	2003	2005	2007
Location of the holding	N/S	N/S	N/S	N/S	N/S
Legal form	N/S	N/S	N/S	N/S	N/S
Type of farming			N/S	N/S	N/S
Livestock	N/S	N/S	N/S	S	N/S
Land use (in general)	N/S	N/S	N/S	N/S	N/S
Land use (in detail)	N/S	S	N/S	S	N/S
Intercropping	N/S		N/S		N/S
Biogas production					N/S
Horticulture				N/S	
Viticulture	N/S				
Farm succession	N/S				
Accommodation	N/S				
Machinery				S	
Tenancies	N/S	S	S	S	S
Manure	S	S	S	S	S
Organic farming	N/S	N/S	N/S	N/S	N/S
Off-farm income			S	S	S
Subsidies for participation in agri-environmental programmes			S		
Family labour force	N/S	S	N/S	S	N/S
Non-family labour force	N/S	S	N/S	S	N/S
Vocational education	N/S		S		

Data Base: Research Data Centres of the Federal Statistical Office and the statistical offices of the federal states, AFiD-Panel Agriculture 1999, 2001, 2003, 2005, 2007.

Note: N indicates non-sample farms, S indicates sample farms. This is just an undifferentiated scheme, minor deviations may occur in detail.

4. Research Potential

In this section we present some examples of analyses conducted using the AFiD-Panel Agriculture. In a first step, we give an overview over some studies that used at least the cross-sectional data of the census of agriculture 1999 and/or the farm structure surveys. In a second step we present a short example how the AFiD-Panel Agriculture can be used to show the dynamics of development within the agricultural sector in Germany.

4.1 Literature Overview

Hüttel / Margarian (2009) use the AFiD-Panel Agriculture 1999, 2003, 2007 to investigate the structural change in the West German agriculture sector. They explain regionally differentiated patterns of structural change based on a theoretical framework dealing with strategic interaction of farms on the land market. The results of this study confirm the relevance of strategic interaction as a crucial determinant of persistent regional differences in the structure of farm size over time.

Habermann / Ernst (2010) use the census of agriculture 1999 and the farm structure survey 2007 for an analysis about the developments and determinants of farmland rental rates in Germany. The study finds for West Germany that the following parameters positively impact on farmland rental rates: soil quality, stocking rates, share of arable acreage, share of sugar beets, potatoes and vegetables as well as labour force and farm size measured in hectares. Higher shares of rented land coincide with lower rental prices. The extent of a farm's biogas production does not exhibit a significant effect on farmland rental prices.

Further, Traulsen (2008) develops a simulation model for the epidemiology and control of the foot and mouth disease virus (FMDV) with special emphasis on modelling of airborne spread. The farm data for this model were derived from the farm structure survey 2003. Hillebrecht (2010) uses the farm structure survey 2003 to compute agricultural nitrogen balances based on the level of agricultural holdings, Rathmann (2007) uses among other data the census of agriculture 1999 and several years of the farm structure survey to analyse the income diversification of farm households in the German federal state Schleswig-Holstein, and Röder / Kilian (2010) investigate the determining factors of farm exit rates in Germany based on the census of agriculture 1999, the farm structure survey 2007 and other sources.

To enhance the research potential of the AFiD-Panel Agriculture it is possible to add external data about the municipality or the district where the headquarters of the agricultural holding is located. Thus, for example, Rathmann (2007) adds unemployment rates on municipality level to the dataset and uses

this new parameter as an additional explanatory variable while estimating the probability of the holder's external employment.

4.2 Example: The Development of Organic Farming in Germany

Official statistics usually solely report cross-sectional results of the agricultural statistics (see e.g. Federal Statistical Office, 2008b). The AFiD-Panel Agriculture, however, allows analysis of the dynamics behind these cross-sectional results. The development of organic farming in Germany represents one example of such an analysis.

If looking at the statistical reports concerning the topic organic farming, we find, for example, that in 2003 13,863 agricultural holdings practised organic farming (according to Regulation (EEC) No 2092/91, see European Parliament, 1991). These holdings managed a utilised agricultural area of 731,177 ha, while 582,931 ha were fully converted and 83,475 ha were still in conversion to organic agriculture (see Federal Statistical Office, 2004, 61). In 2007 the number of holdings with organic farming increased up to 14,474 agricultural holdings with a utilised agricultural area of 861,161 ha, while 735,372 ha were fully converted and 65,070 ha were still in conversion (see Federal Statistical Office, 2008c, 69).

In order to show the advantage of the AFiD-Panel Agriculture we take a look behind these cross-sectional results in two ways. First, we used the opportunity to follow the agricultural holdings over time by presenting some selected patterns of participation in organic farming between the years 1999 and 2007. Second, we focused on the 13,863 agricultural holdings with organic farming in 2003 and describe their development between 2003 and 2007.⁶

Table 3 presents ten selected patterns of the participation in organic farming from 1999 to 2007. 95 percent of all German agricultural holdings that reported to the statistics in all five considered years did not participate in organic farming in any considered year. Only 1.6 percent of the agricultural holdings participated in organic farming in all five reporting years. Besides these stable patterns 3.3 percent of the agricultural holdings changed their status in at least one year within the time period considered. Further, the AFiD-Panel Agriculture allows to quantify how many agricultural holdings start or stop participating in organic farming. Thus, for example, pattern three to six in table 3 show agricultural holdings that start participating in organic farming

⁶ For the reporting years 1999 and 2001 we only have information about the total utilised agricultural area of the agricultural holdings that participated in organic farming. Starting with the reporting year 2003 information about the size of the area that is fully converted or still in conversion is also included in the dataset. Due to this fact, we look at the development of the agricultural holdings with organic farming in 2003.

and pattern seven to ten show agricultural holdings that stop participating in organic farming.

Table 3
Selected patterns of the participation in organic farming
(according to Regulation (EEC) No 2092/91)

No.	The agricultural holding is submitted to the control procedure according to Regulation (EEC) No 2092/91 at the reporting year					Number of agricultural holdings	% of agricultural holdings
	1999	2001	2003	2005	2007		
1	no	no	no	no	no	325,633	95.08
2	yes	yes	yes	yes	yes	5,555	1.62
3	no	yes	yes	yes	yes	1,956	0.57
4	no	no	yes	yes	yes	2,190	0.64
5	no	no	no	yes	yes	239	0.07
6	no	no	no	no	yes	1,246	0.36
7	yes	no	no	no	no	1,956	0.57
8	yes	yes	no	no	no	281	0.08
9	yes	yes	yes	no	no	239	0.07
10	yes	yes	yes	yes	no	212	0.06

Data Base: Research Data Centres of the Federal Statistical Office and the statistical offices of the federal states, AFID-Panel Agriculture 1999, 2001, 2003, 2005, 2007, authors' own calculations.

Note: "yes" indicates that the agricultural holding was submitted to the control procedure according to Regulation (EEC) No 2092/91; "no" indicates that the agricultural holding was not submitted to the control procedure according to Regulation (EEC) No 2092/91. Only agricultural holdings that are in the dataset in all five periods (balanced panel) have been taken into account.

Table 4 presents a more detailed view on the development of the 13,863 agricultural holdings with organic farming in 2003. More precisely, we look at the development of the area included in organic farming of these holdings. Around 45 percent of the holdings with organic farming in 2003 increased their area included in organic farming between 2003 and 2007. Nearly 29 percent decreased their area included in organic farming. A remarkable share of around 15 percent of agricultural holdings with organic farming in 2003 reduced its area included in organic farming to zero hectares and consequently stopped participating in organic farming.

For more than 6 percent of the holdings we find no information in the reporting year 2007. These holdings for example left the market, are below the thresholds of coverage in 2007, have merged with other agricultural holdings, or moved to another German federal state⁷.

⁷ If a holding moves to another municipality within a state, the ID of the holding remains the same. If a holding moves to a municipality in another state, the holding gets a new ID and, thus, is not traceable anymore.

Table 4

**Development of agricultural holdings with organic farming
(according to Regulation (EEC) No 2092/91) between 2003 and 2007**

Development of the utilised agricultural area included in organic farming		
Holdings with organic farming in 2003 that ...	Number of holdings	% of holdings
... increased their area included in organic farming between 2003 and 2007	6,243	45.03
... decreased their area included in organic farming between 2003 and 2007	4,014	28.95
... did not change the size of their area included in organic farming between 2003 and 2007	629	4.54
... reduced their area included in organic farming to zero ha	2,122	15.31
... are not in the dataset 2007	855	6.17
Total	13,863	100.00

Data Base: Research Data Centres of the Federal Statistical Office and the statistical offices of the federal states, AFiD-Panel Agriculture 1999, 2001, 2003, 2005, 2007, authors' own calculations.

Note: Area included in organic farming is defined as area that is fully converted plus area that is still in conversion to organic farming (according to Regulation (EEC) No 2092/91).

5. Prospects

To expand the AFiD-Panel Agriculture it is planned to also integrate the data of the currently conducted census of agriculture. Even if this integration is technically feasible, major differences occur compared to the previous census in 1999 and the previous farm structure surveys that have to be considered while analysing the data. Major changes are for example the raising of the thresholds of coverage (e.g. the threshold of the utilised agricultural area has been raised from 2 ha to 5 ha), changes in definitions as well as changes in classifications and typification (e.g. concerning the labour units) (see Blumöhr et al., 2010 and Federal Statistical Office, 2010 for more details).

Nevertheless, the census of agriculture 2010 offers new research possibilities concerning a wide range of new variables. Thus, this census for the first time provides information about agricultural production methods like soil tillage methods or protection against erosion. Further, the census provides for example more detailed data on the utilised agricultural area and livestock of holdings doing organic farming, the size of outdoor area that could be irrigated as well as the size of outdoor area that actually is irrigated, and data on the holders' participation in measures of vocational training or continuous advanced training (see Blumöhr et al., 2010, p. 251).

Most variables of the main survey of the census of agriculture 2010 (i.e. the variables of the farm structure survey and variables about the farm succession and the type of turnover taxation) are mandatory for all agricultural holdings. Thus, the combination of the census of agriculture 2010 with the existing AFiD-Panel Agriculture allows a wide range of analyses of the developments on the individual operational level.

6. Access to the AFiD-Panel Agriculture

The access to micro-data of official statistics is provided by the research data centres of the German Federal Statistical Office and the statistical offices of the federal states.⁸ As of this writing the AFiD-Panel Agriculture includes the reporting years 1999, 2001, 2003, 2005 as well as 2007 and it is available via two ways of data access. First, the analysis of the formally anonymised original data may be carried out via remote data processing. Second, it is possible to work with an anonymised dataset of the AFiD-Panel Agriculture within safe centers of the statistical agencies. The panel dataset containing the data of the agricultural census 2010 will probably be released at the beginning of the year 2012.

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⁸ See Zühlke et al. (2004) and www.forschungsdatenzentrum.de for more details about the different ways of data access.

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