

Increasing costs for land use challenge the international competitiveness of European arable farming – lessons learned from SUFISA case studies in three different areas

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Abstract

Land prices are key driver of farm profitability and competitiveness. Sales prices and leases are determining the viability and the perspectives of farms and their production systems. Our paper aims to analyse the role of land prices for the competitiveness and sustainability of arable farming in Germany, Poland, and France. We test the combination of two methodological approaches that follow similar objectives but use different data and perspectives. The SUFISA case studies show conditions, challenges, farmers' strategies and the sustainability of arable farming in selected regions. The analysis of farm economic data, and - more specifically - of the impact of land prices and rents is based on the farm comparison data and analyses of agri benchmark model farms. The latter highlights that costs for the factor land affect the economic situation in all areas. Differences in returns, subsidy payments, and cost structures present the viability of crop farms in the German, French and Polish case study regions. However, results show that farmers cannot increase efficiency by farm enlargement anymore due to lacking access to land. In relation to that, increasing land prices hamper farmers' succession. Due to shrinking margins, German farmers fear they have to abandon well-accepted practices that helped to improve sustainability effects. Although land prices in Poland are lower than in other regions, access to land and high operational costs in cropping are critical issues. Overall, the combination of both methodological approaches is challenging but indicates that the complementarity of the insights are worth further development.

Keywords: *Arable farming; farmers' strategies; farm economics; land prices; sustainability; farm comparison network*

Introduction

Land prices, rents and costs of land used for arable farming have always been key issues for economic analyses, and various investigations are at hand for this traditional agricultural research topic because the use of land as a means of production is one of the key characteristics and constraints for agricultural production. However, the discussions with farmers and agricultural stakeholders brought up the importance of supposed jumps in land leases on our research agenda. We learned that the increasing costs for the factor land in recent years would challenge more and more the profitability of arable farming. For that reason, we wanted to understand if and how relevant the costs of the factor land currently determine farming systems in the case study areas of our cross-disciplinary European research project¹.

Adam Smith, the agricultural economists from the 18th century, explained his concept of the value of farmland: from the sum, there shall be deduced the expenses for used inputs and costs of work (and capital) input, the result is called return to land (Ziegler, 2008). Ricardo contributed to the differentiation of this analysis in the beginning of the 19th century. He investigated the rising demand for food and the phenomenon of the cultivation of more and

¹ SUFISA – Sustainable Finance for Sustainable Agriculture and Fisheries. Horizon 2020 research and innovation project, 2015-2019. Grant Agreement No. 635577. www.sufisa.eu.

more land that had been unused before. He found that returns to land depended on the quality of the soils, and he recognised that owners are ‘monopolists’ on the land market because fields is not expandable. Finally, he concluded that landowners could realise (under favourable conditions) the whole return to land as lease (Ziegler, 2008). However, farmers’ returns to land differ as well between farms because some realise higher yields or negotiate lower prices for inputs. Areas do not have one common return to land (Zimmer, 2015)

Since then, various studies showed that land markets are much more complex. We do not see leases to be as volatile as commodity markets, but the demand from non-agricultural land use impacts heavily on sales prices and leases (Source). Housing, industrial zones, infrastructure development etc. need land for their constructions. Leisure activities such as horse keeping impact on land prices as well. Moreover, public law with e.g. the Nitrate Directive or environmental compensation requirements, and the civil law with different kinds of leasing contracts are important drivers for the costs of the production factor land in the different countries (Menghi et al., 2015).

Due to the increase of commodity prices since the 2000s, institutional investors such insurances or retirement funds are interested in commodity food markets because the purchase of productive land is seen as a relatively save investment. In particular, since they experienced the financial and economic crisis in 2008/09, international corporations are seeking for low-risk investments (Zoomers, 2010). Possible returns for an investment in arable land are rather attractive in times of exceptionally low interest as currently seen in the western world (Zimmer, 2015)

Our Paper has two objectives; firstly to test a combination of two independent methods, and secondly, to analyse the impact of rising land prices on farms’ competitiveness. The methodological objective focuses on the testing of potential benefits emerging from the combination of two farm economic approaches. We aim to learn more about potential synergies by linking a cost and profit accounting approach with the socio-economic concept of CSP-analyses for joint benefits. The data collection for this methodological merge is based on independent projects and therefore is not yet conform.

In respect to the research topic, the paper aims to analyse the role of land prices for the profitability and competitiveness of arable farming and the related sustainability aspects in Poland, France and Germany. We selected the factor land and the related costs and constraints because the first steps of a comparative analysis of arable farming in these countries indicated that the factor land is a highly important cost position for farmers in the area. Since various non-agricultural factors drive the costs of land use, the paper does not aim to analyse the role of the different drivers. Instead, the focus is on the impact on farms’ profitability and competitiveness.

The idea of combining the results of both project approaches in one paper is an attempt. Since both the *agri benchmark* and the SUFISA approach lack the insights of the other method’s perspective, it sounded promising to test a combination of both in this IFSA-paper. Both methods have in common that they aim to understand farmers’ actions on given (or changing) policy and market conditions for cash crop production in different countries. This knowledge helps with market outlooks for food- and non-food products, and it can help to shape agricultural policies. Since the aim of the broad range of policies as well as of societal initiatives of governmental and non-governmental organisations is to enhance sustainability² in farming, methods that help to understand farmers’ specific conditions and their strategic decision making are crucial. Farming systems and expected changes in structures or production processes define the current and future agriculture.

In the following, we will present the two methodological approaches used for the analysis in the first section, and we explain why we want to combine them in this paper. Sections two and three will present the results of each approach independently. We will show the analysis

² In this paper, the term *sustainability* stands for the three dimensions of economic, environmental, social and cultural sustainability, and includes climate change mitigation and adaptation.

of the *agri benchmark* model farms, which highlights differences between farming and key far in the different regions. Secondly, will present the four case studies shows key characteristics related to land use and access to the factor land in Germany, France, and Poland. Finally, the discussion will compile results of the two approaches and reflect on lessons learned.

Methodological approaches

This paper combines two methodological approaches because they provide complementary insights: The analysis of farm economic data, and - more specifically - of the impact of land prices and rents on profitability and competitiveness of farms in the selected regions is based on the farm comparison data of the *agri benchmark* network. The *agri benchmark* analysis serves as more general background information highlighting core economic and structural differences between countries. Due to the concentration on farm income and the different type of costs, the farming systems and farmers' decision-making in the different regions represent the focus of this investigation. The *agri benchmark* approach is based on a farm level perspective aiming to provide scientifically consistent and soundly based answers on strategic issues to decision-makers in policy, agriculture and agribusiness.

The second part of the analysis puts the farmer in the centre as well but uses a much wider angle aiming to cover the background and the expectations of farmers that drive their business strategies and decision-making in the short- and long-term. Data and information originate from four case studies of the Horizon2020 project SUFISA. These case studies are based on a multi-method concept³ consisting of a literature review, interviews, focus groups and workshops. The results provide the foundation for the investigation of conditions, challenges, farmers' strategies and the sustainability of arable systems.

Existing methods

The issue of costs of land use and price for farmland has been widely discussed. It is a traditional topic in the field of agricultural economics. Doyens such as von Thünen or Adam Smith laid the foundation back in the 18th century. Organisations engaged in forecasting such as FAO have established econometric models on land use for a long time (George, 2004). Various models have been developed for forecasting issues related to food production, resource use and greenhouse gas emissions (Smith et al. 2018).

Apart from these models that focus on large scale food production, land use models exists for planning purposes in urban and rural settings. These land use models can be applied at a national level for trend extrapolation, scenario studies and optimization, yet can also be employed in a smaller-scale regional context (Koomen et al. 2011). Geosimulation is another approach, which is as well based on various models or technologies. The term represents a new wave of spatial simulation modelling that has come to the fore in very recent years (Mandl et al. 2018).

All these models either focus on the production capacity aiming to learn more about the supply of certain food or energy crops or on the aspect of land scape planning and development. Land use analyses that are based on farm economics and socio-economic approached are not available, in particular not for the comparison of competitiveness between countries. However, the family of *agri benchmark* model farms aims to fill this gap for nearly two decades.

Approach of *agri benchmark* 'typical' farms

³ In addition, the multi-method approach of the SUFISA project includes a database inventory for farmers' strategies and a representative survey of arable farms in the case study area. The results of the inventory and the survey were not at hand when the paper was submitted.

The methodological concept of *agri benchmark* is based on the harmonised work of a non-profit global farm comparison network with members from more than 35 countries. The methodology merges farm advisors data collection and production related insights and agricultural economists' analyses of international commodity markets and value chains. Working steps follow guidelines that national teams apply systematically: National teams select a typical region and for this region characteristic farm type for the commodity. They establish typical farms in regions, which are of the highest importance for the national output of interest. The decision about the location of the typical farm as well as the decision about the size of the farm and the degree of specialization is derived from an analysis of official statistics – as far as available. Hence, the *agri benchmark* team focuses on the understanding of agricultural production systems and farmers' decision-making in the selected area. Usually, the model farm is well-organised and often above the average in real farming. The work does not aim for statistical representativity of model farms. Instead, the analysis requires an accurate picture of the real farm situation.

Since data of individual case study farms always contain particularities, data collection uses information from a group of farmers who run farms similar to the envisaged so-called '*typical farm*'. It is important to include the expertise of local farm advisors. The group of local experts consisting of farmers and a farm advisor is a focus group. Members of the *agri benchmark* team are the facilitator and recorder. The focus group identifies the details of 'typical' production systems such as soil fertility, crop rotation, machinery and staff. The data set includes the full picture of expenditures for variable inputs. The analysis of arable systems includes time and diesel consumption for the different processes, working hours needed, maintenance, repair and depreciation for machinery. (Deblitz, 2014)

Data collection in the agri-benchmark approach starts with the study of national and regional statistics and maps that provide an overview of 'typical' products and agricultural structures (farm size, farm transport, infrastructure etc.). Based on statistics, in-depth interviews with farm advisors take place. Data collection includes the use of profit-loss-calculation provided by e. g. extension services. Focus groups with farmers give feedback on draft model calculations for the model farm's profitability. The calculation systems include plausibility checks for data consistency.

Annual adjustments of (market) data allows for trend analyses with the agri benchmark approach when the model type exists for several years. More common are status-quo comparisons between countries or production systems. The tool is useful for scenario analyses as well. However, projections or scenarios need to be developed independently from the model.

Approach of SUFISA case studies

Similar to the *agri benchmark* network, the SUFISA teams defined typical areas for the selected commodities in the different countries (22 case studies in 11 countries). Hence, the SUFISA case study work followed a common methodological guideline for a mixed-method approach that national partner teams applied for their regions and crops.

Data collection started with a literature review that ensured a common understanding for natural and economic, legal and policy conditions for both the region and the crop. Based on the information from statistics and publication from research projects, qualitative data was collected by semi-structured expert interviews. The explorative, open-ended interviews helped to ground-proof the desk study. Reoccurring issues were further investigated in the following interviews aiming to gain additional information and insights. Key statements were cross-checked in subsequent interviews. Methodologically, the interview approach was based on the concept of grounded theory (Tolhurst, 2012). Leading questions emerging from the desk study results and interviews on conditions, farmers' strategies and sustainability issues provided the guideline for the group events, the third tool of the mixed-method approach.

Focus groups with producers aimed to identify the linkages between conditions, strategies and sustainability effects from a farmer's perspective while workshops with mixed

stakeholder groups ensured the validation of the outcome of the focus groups. Consequently, the focus groups defined the core topics to be discussed in a workshop. Teams used meta plan methods for the focus groups and the workshops. In addition, group events were recorded; discussions were (partly) transcribed, translated to English and analysed according to grounded theory (Strauss and Corbin 1998).

The basic idea of the CSP-concept linking conditions, challenges, strategies and sustainability performances is to capture the multidimensionality of conditions that influence farmers' strategies, farm vulnerability and the external sustainability effects. The identification and impact analysis of conditions is complex but of particular importance for the analysis of land markets because many external drivers such as population density, transaction costs, inheritance law, size of fields etc. affect the demand for and the costs of land.

Porter developed a model that presents drivers for competitive advantages for economic activities. This concept was the starting point for the development of the CSP concept applied in the case studies. Porter argues that "competitive advantage is created and sustained through a highly localised process" and that "differences in national values, culture, economic structures, institutions, and histories all contribute to competitive success." (Porter, 1990)

Conditions, strategies and performances of farmers are variously defined and understood, depending on the perspective of the stakeholder and the particular geographical or cultural context. Primary producers in farming face a wide range of regulatory, factor, demand and financial conditions at local levels (which in turn are affected by global, European, national, regional conditions). Legal and policy frameworks include those derived from the Common Agricultural Policy (CAP), environmental legislation, zoning laws, financial policies and competition policy. Factor conditions include access to land, labour, capital and external inputs (e.g. chemicals, fertilizers, energy) and the related costs.

Farmers respond directly to these conditions when they develop and implement their management strategies. "The core of strategy work is [...] discovering the critical factors in a situation and designing a way of coordinating and focusing actions to deal with those factors" (Rumelt, 2011). A strategy starts with the definition of long-term objectives, and defines particular courses of action as well as the allocation of resources necessary for carrying out these actions. Even when decision-makers claim not to have a formalised strategy, the management of the enterprise (or chain) is normally oriented through strategic considerations and decision-making. There is a rich variety of possible strategies (Mathur & Kenyon, 2011). Sustainability performance result from the production systems of the sector investigated. Various indicators are available for the assessment of economic, environmental, social and cultural effects or the impact on greenhouse gas emissions.

Due to the analysis of farmers' strategies, potential developments of the sector are core part of the approach. The analysis focuses on (potential) sustainability performances based on the qualitative assessment of farmers' and stakeholders' situation and perceptions.

Linking both approaches on the level of the case study

The advantage and challenge of this papers' methodological approach are the two different projects because each project is based on its particular selection of geographical areas.

However, they underlying concepts of both agri-benchmark and SUFISA, share the micro-economic focus which is crucial for comparability. The farm is core subject of investigation which is different to the large variety of analytical tools for land use from the literature (see above). Although the farm, the farmer's management and the cropping system with its details is the starting point for the analyses, the approaches differ and therefore provide complementary insights.

From the SUFISA case studies, we chose those case studies for this paper that investigate arable crops cultivated under similar conditions (high-yielding soils, precipitation >650mm/a, family farming structures). These are the case studies 'Oilseed rape in the Wetterau' (Germany), 'Wheat in Ile de France' (France), and 'Wheat in Opolskie Voivodship' (Poland).

From the agri benchmark project network, we selected those typical farm models available that match best with the characteristics given by the SUFISA cases. The 'Hildesheimer Börde' and the 'Köln-Aachener Bucht' which are both located in western Germany. They differ less from the situation in the Wetterau than farm structures in eastern Germany. The 'Picardie' borders with the Ile de France region in the north. The Lublin Voivodship is located in the south-east of Poland and the Opole Voivodship in the south, and the model farm represents an individual farm business.

The presentation of the results of the agri benchmark model calculations on land prices focuses on the case of 'wheat' which is the leading crop in all areas selected for the comparison of this paper (Wetterau, Hildesheim, and Köln-Aachen for Germany; Ile de France and Picardie for France; Opole and Lublin in Poland).

The fact that the case studies from the SUFISA project focus on different commodities (wheat, oilseed rape) is of limited importance for the analysis of land prices and competitiveness of farming because these crops are core elements of the crop rotation system in the selected areas. The costs of land use in arable farming do not link with only one crop but with the cropping system as a whole.

The strength of the SUFISA approach is its holistic character. It goes beyond the agri benchmark analysis of farm economic data but aims to collect information on e.g. individual risk management, farm succession plans, cooperation among producers, income combination, social issues, regional traditions or farmers' expectations. Moreover, it takes into account the non-agricultural drivers. This qualitative data is of core relevance for the understanding and interpretation of the quantitative data from agri benchmark modelling.

The combined approach of agri benchmark and SUFISA starts with an independent analysis with each of the factors driving the demand for and the costs of farmland in the three regions. Since both analyses have different foci, results differ. Hence, the combination of the approaches continues with the comparison of information provided by key results of each approach. This contrasting work is driven by the underlying hypothesis that each approach leaves questions open that the other approach will be able to answer.

Since agri benchmark focuses on the status-quo analysis based on data from the recent economic year and the CSP-approach aims to cover farmers' strategies and related dynamics, the scenario development results of approaches can feed into the analysis of the other.

Quantitative and qualitative indicators

A large number of quantitative and qualitative indicators is available. In the following, we will mainly focus on prices for purchased land, leases per ha in the area and the proportion of leased versus owned land in farms. Prices of farmland sales and their long-term price trends are available through statistics (regional statistics) while prices for leases are not published. For that reason, data on rented land, the duration of the contract and the agreed lease, is not subject to official documentation. This is a problem for the analysis because it is a key figure representing not only land productivity but the demand from non-agricultural sectors as well. Moreover, qualitative information is collected on the access to land for farmers and sustainability impacts of leased versus owned land in the studied areas. In addition, the role of relevant legislation has been studied.

Highly relevant for the interpretation of results is the amount of farmland sealed or used for non-farming purposes such as housing (distance to large cities); infrastructure (road, railway constructions, development of industrial zones); mining industries, d) nature conservation (protected species in zone, new conservation areas based on compensation for sealed surfaces somewhere else); outdoor leisure activities (golf, hunting, race courses etc.); hobby/small-scale farming (horses, garden allotments, community group gardening etc.).

The agri bench analysis of farm economics is based on the following indicators.

- Total costs is the sum of variable costs, which vary according to the quantity of a good produced and include inputs such as labour and inputs, plus fixed costs, which are independent of the quantity produced and include inputs (capital) that cannot be varied in the short term, such as buildings and machinery. In addition, total costs include the total opportunity cost of each factor of production (labour, farmland owned and capital invested). (Euro/farm and year)
- Land costs is the sum of expenses for leases, weighted by the share of rented land, and the assumed interest rate for the capital tied up in own farmland, weighted by the share of owned land (Euro/ha and year). The level of land costs depends on the regional level of prices for leased land and for purchased land and on the assumed interest rate for assets.
- Return on land (RoL): RoL is a ratio used as a measure of the profitability and value-creating potential of the farmland after taking into account the amount of land owned and rented. All direct and operational costs plus depreciations are covered. Family labour, the initial capital invested are included based on wage rates and common interest rates.

$$\text{RoL} = \frac{\text{Total farm return} - \text{direct costs} - \text{operating costs} - \text{depreciations} - \text{opportunity costs for family labour and capital invested (Euro)}}{\text{farmland owned} + \text{farmland rented (ha)}}$$

- The profit is the excess of total revenue (revenue = sales + direct payments) over the total costs (costs = costs + operating costs + depreciations). The definition of profitability, based on this calculation of the profit, differs from its use in profit and loss accounts because (a) it includes opportunity cost for labour, land and capital provided by the family and (b) because depreciation is calculated against repurchase price, rather than on historical purchase prices. For that reason, this profit calculation provides a key figure for the analyses of the long-term profitability.

Farm economic background – analysis of *agri benchmark* farm models

The data from so-called 'typical farms' compare production systems and economic key figures in wheat producing areas of the respective countries. *Agri benchmark* model farms from Germany (Hildesheimer Börde; Köln-Aachener Bucht), France (Picardie), and Poland (South-East: Lublin Province), provide the basis this analysis. In addition, two farms – one from Canada (Ventral Alberta) and one from the US (North Dakota) – serve as a benchmark for global wheat production. Table 1 shows characteristics of the selected *agri benchmark* farms.

Table 1: Description of selected model farms

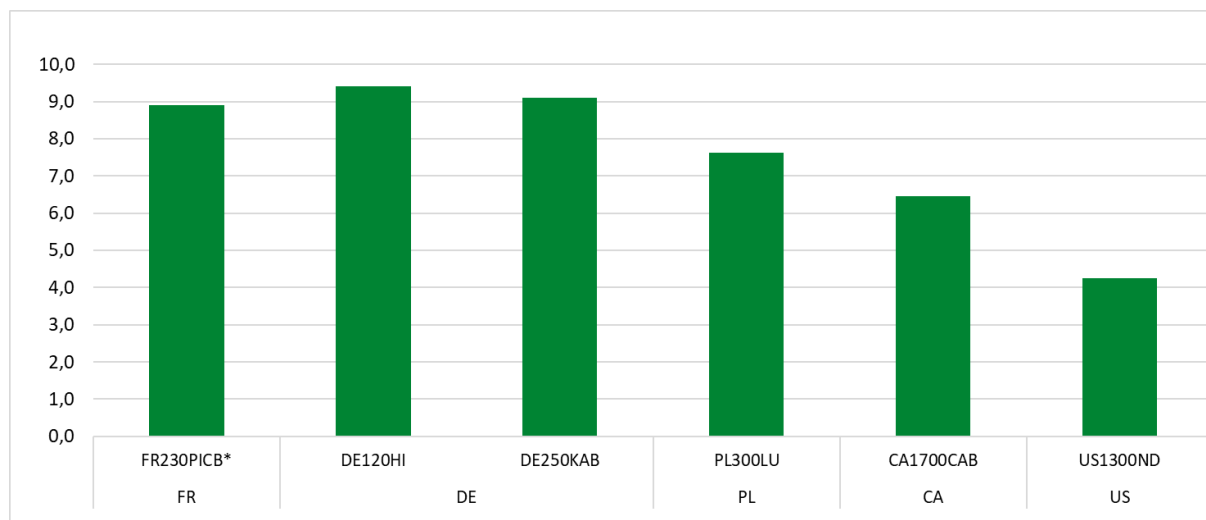
Farm code	Country and region	Size	Annual precipitation	Main crops in rotation
DE120HI	Germany (Hildesheimer Börde)	120 ha	700 mm	Sugar beet Winter wheat
DE250KAB	Germany (Köln-Aachener Bucht)	250 ha	650 mm	Sugar beet Winter wheat Winter rapeseed Potato Winter barley
FR230PICB	France (Picardie)	230 ha	680 mm	Sugar beet Winter wheat Winter rapeseed Barley
PL300LU	Poland (Lubin Province)	300 ha	550 mm	Sugar beet Winter wheat Winter rapeseed
CA1700CAB	Canada (Central Alberta)	1700 ha	550 mm	Summer wheat Summer rapeseed
US1300ND	US (North Dakota)	1300 ha	510 mm	Summer wheat Soybeans Corn (maize)

Source: agri benchmark cash crop (2018)

In order to better understand general differences and key drivers in the regions, the reference for all figures are three-year average values (2014-2016). This avoids misleading interpretations due to annual events such as droughts or other adverse events⁴. For comparability reasons, we selected only farm types with intensive cropping systems.

Figure 1 shows that yield levels of wheat are higher in the European model farms than in Central Alberta and in North Dakota. However, production systems differ slightly because the North American farms grow summer wheat while the European farms produce winter wheat.

Figure 1. Wheat yields of selected typical farms (t/ha), average 2014-2016.



Source: agri benchmark cash crop (2018)

The yields in both German regions and in France are on a similar level of the average with around 9 t/ha and year. This is still very high compared with the national long-term average of 7.7 t/ha wheat in Germany (2010-2016). The model farm in South-Eastern Poland harvests less with around 7.5 t/ha but produces far beyond the national average of 4.5t/ha and year (FAOSTAT, 2018). The farm in Central Alberta has yields of around 6.5 t/ha while the farm in North Dakota harvests only about 4 t/ha and year.

Figure 2 presents the key cost elements with direct, operating and land costs. Direct costs are expenses that change proportionally with the area cultivated (seeds, fertilizer, pesticides, related work, fuel etc.). Operating costs depend on cropping but develop disproportionately with the fields planted (see Figure 3). Land cost are calculated as sum of land rents actually paid (taking into account different contract durations) per hectare weighted by the share of rented land from total arable farmland. This added to the average opportunity cost of family owned land multiplied by the share of owned land in total arable land.

Table 2 gives an overview of factors driving the land costs.

Table 2: Characteristics driving land costs in agri benchmark models

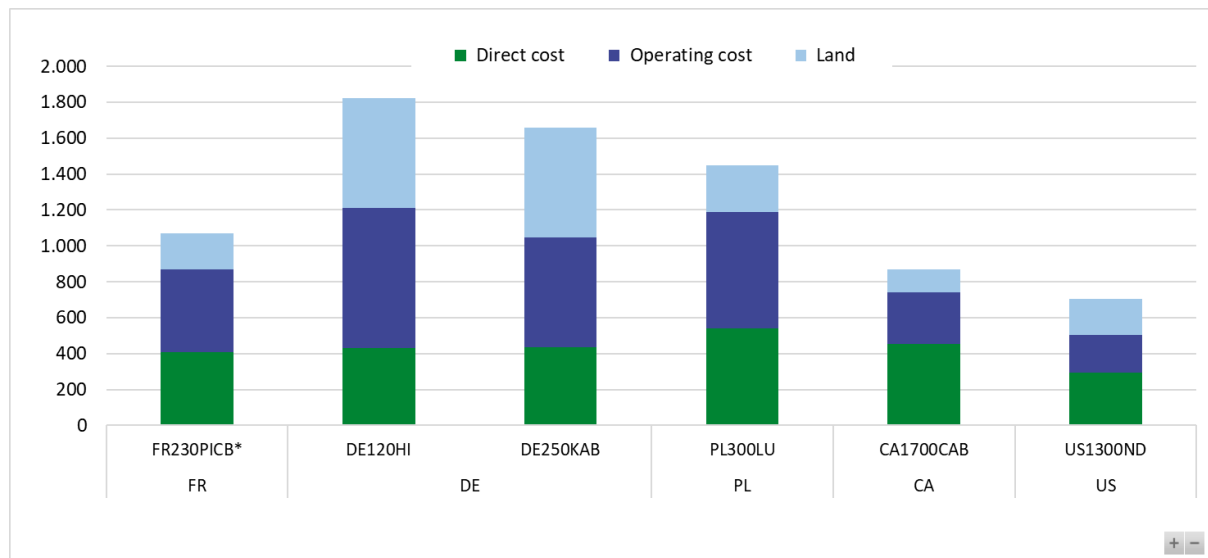
Farm Name	Size	Share of owned land per farm	Average contract duration for rented land	Land rent (old) contracts before 2016 (average)	Land rent (new) contracts in 2016 (average)
DE120HI	120 ha	50 %	9 years	500 Euro/ha	700 Euro/ha
DE250KAB	250 ha	30 %	9 years	550 Euro/ha	750 Euro/ha
FR230PICB	230 ha	13 %	9 years	195 Euro/ha	220 Euro/ha
PL300LU	300 ha	50 %	10 years	165 Euro/ha	355 Euro/ha
CA1700CAB	1700 ha	60 %	3 years	104 Euro/ha	140 Euro/ha
US1300ND	1300 ha	24 %	2 years	240 Euro/ha	245 Euro/ha

Source: agri benchmark cash crop (2018)

⁴ Note that for the Polish (PL) only data from 2016, and for the Canadian (CA) farm type only data from 2015/2016 was available.

These agri benchmark model calculations show that land costs in Germany (around 600 Euro/ha) are higher than the other areas. The lowest land costs has – according to the agri benchmark data in Figure 2 – the farmer in Central Alberta. Figure 2 highlights as well high direct costs of production in the Polish model farm (550 Euro/ha) which exceed direct costs of the German, French and Canadian systems (400 Euro/ha).

Figure 2. Key cost elements (direct cost, operating cost, land cost) of selected model farms (Euro/ha), average 2014-2016.

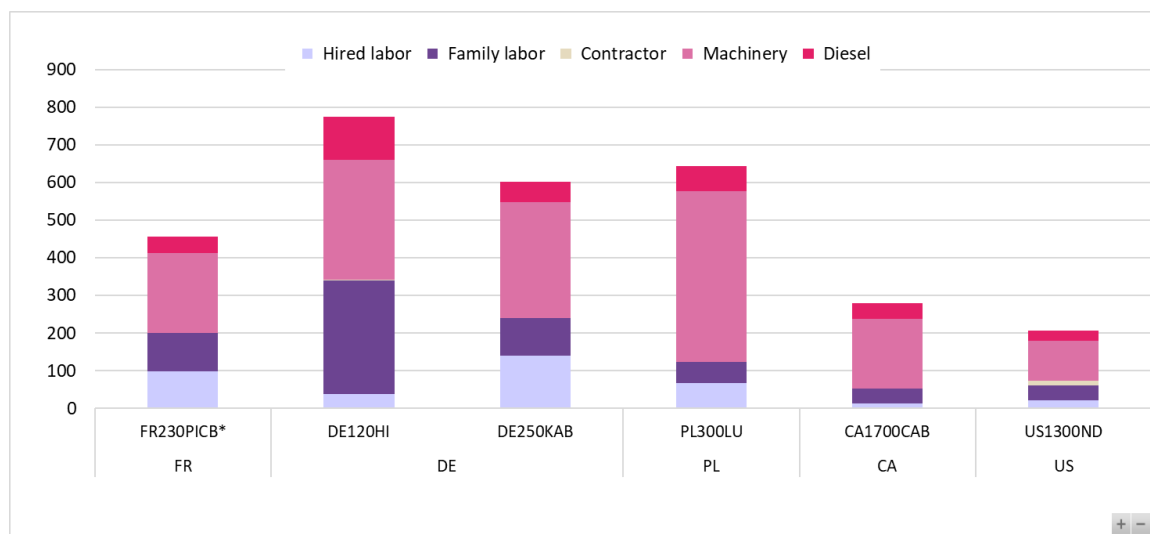


Source: agri benchmark cash crop (2018)

Figure 3 shows a break-up of operating costs which include expenses for hired workers, contractors, own machinery, fuel and family labour related with arable production. Since they are not directly linked with area planted, this key figure reflects differences in labour structure and machinery organisation. All typical farms are family owned farms and with a high share of family labour and additional hired labour.

In the Polish model farm, cost for machinery are very high because farmers investment more in new machinery than in the other countries. The Hildesheim farm has more family labour input than any other farm. In contrast, the other German farm pays more for hired work than the French and Polish farm type. Exceptional high machinery cost in this region of Poland are typical: a lot of new machinery has been purchased during the last years supported by certain EU investments programs.

Figure 3. Operating costs (hired labor, family labor, contractor, machinery, diesel) of selected typical farms (Euro/ha), average 2014-2016.

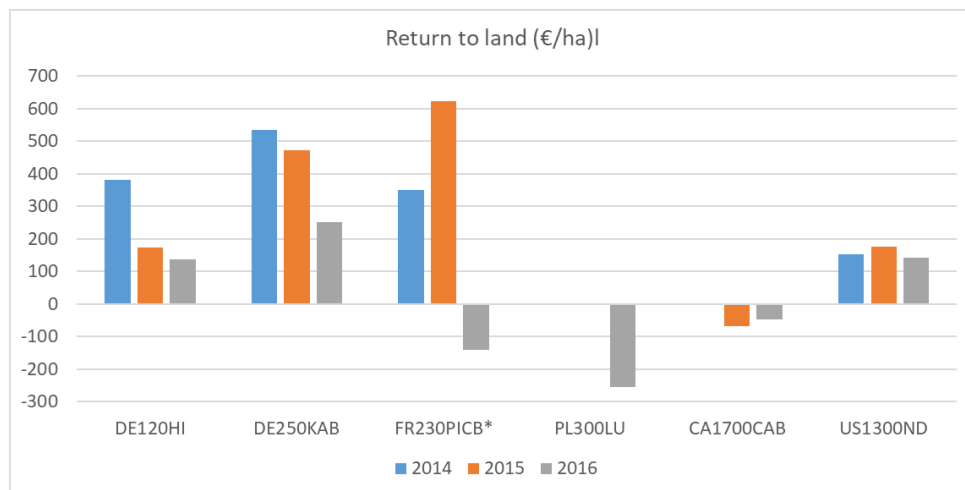


Source: agri benchmark cash crop (2018)

Overall, Figure 3 presents the comparative advantages for the two farms in Canada and the US due to a very lean production system with less than 6 operations from - in the case of Canada - no-till seeding to harvest. More intense production systems in Europe with up to 12 operations from tillage, seeding, fertilization and spaying to harvest results in higher machinery and labour cost.

Figure 4 presents the RoL for the years 2014-2018. The higher the RoL the more money will be available for new rents or land purchases. Due to falling values for the German farms, the RoL tends to fall and the pressure increases on the profits of the farm business.

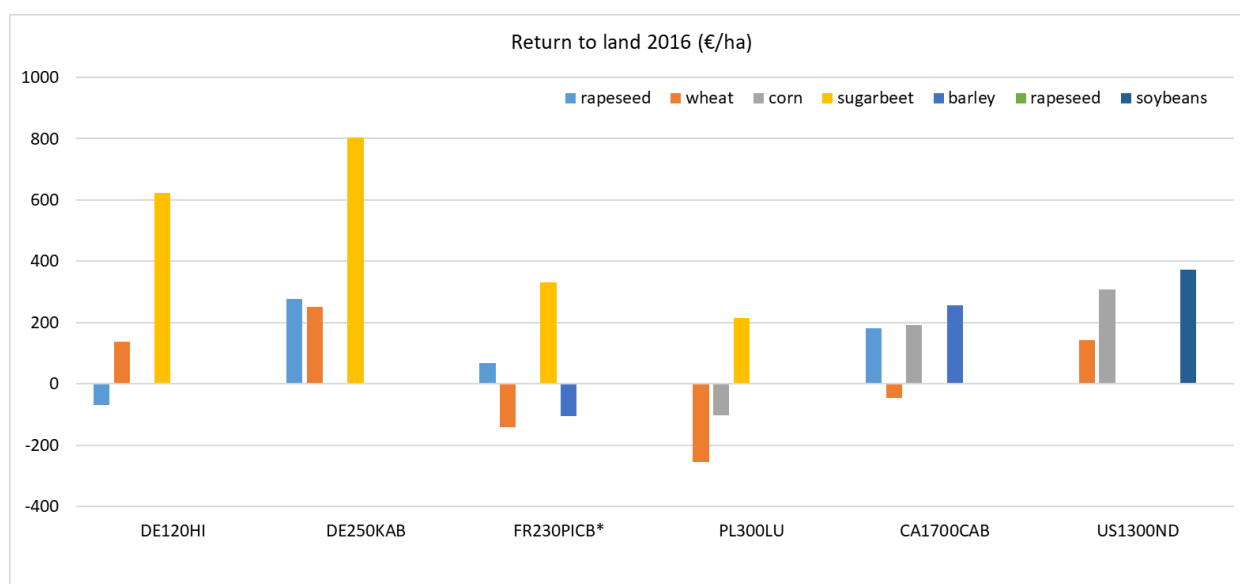
Figure 4. Ground rent – return to land in wheat production (Euro/ha 2014 to 2016).



Source: agri benchmark cash crop (2018)

Bad performance of the French farm in 2016 has plumed yields shrinking to 5t/ha compared to 10-11 t/ha in normal years. Figure 4 shows just a one year snapshot on the Polish farm due to lacking data for the other years. However, machinery cost will become an issue for the Polish crop farm. In North Dakota, the economic situation is very stable, while the Canadian farm seem to be under constant pressure with negative RoL (2014 data is missing).

Figure 5: Ground rent – return on land for different crops (Euro/ha in 2016).

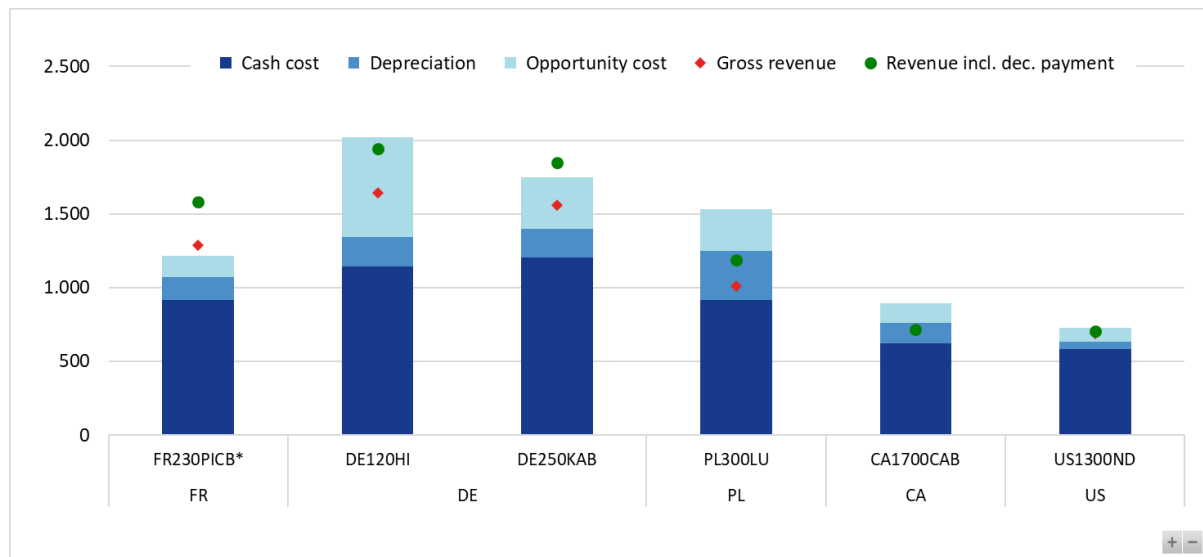


Source: agri benchmark cash crop (2018)

Figure 5 presents RoL for different crops in 2016. RoL from sugar beet was above the other crops in the European farm models.

Figure 6 shows economic results for wheat. Since the revenues including direct payments are above cash costs and depreciation, in general all farms are profitable in wheat production. However, opportunity costs for land, labour and capital are not fully covered in the Hildesheim, the Polish and the farms in Canada and the US, long-term viability based on only wheat production is an issue.

Figure 6. Wheat: Total cost, revenues and decoupled payments of selected typical farms (Euro/ha), average 2014-2016.



Source: agri benchmark cash crop (2018)

At first view, in international comparison, leases for land in Germany seemed to be very high. However, considering (a) differences in economic land productivity and (b) direct payments, German leases are even low in international comparison.

Analysis of SUFISA case studies in different European regions

Short overview of the case studies in Germany, Poland, and France

The German case study focuses on oilseed rape production in the Wetterau district, which is located in the centre of Germany. Traditionally, it has been the fertile backyard of the city of Frankfurt. The production (and market) of oilseed crops is driven by the renewable energy policy in Germany since the early 2000s. The vegetable oil is an important input for food and non-food supply chains but farmers compete on the international market of oilseed crops.

The case study area in Poland is Opolskie region (NUTS 2) which is known for its mild climate, fertile soils, wide plains and rolling hills. Due to favourable conditions, the majority of land is used for highly productive arable farming (62% of total farm land). Agriculture has been very important for the Opolskie region because of economic, social and cultural reasons.

The French case study presents the situation of arable farms in the Ile de France region (NUTS 2), near the capital city of Paris. Similar to the German case, the farmers depend on bottleneck structure of the milling sector. Traditionally, they have been the grain suppliers for the flourmills and bakeries.

It is not an accidental that areas with soils suitable for intensive wheat or oilseed rape production are located in the neighbourhood of large cities. Their urban growth depended from food supply of a productive hinterland since early mediaeval times.

All case studies focus on the production of commodity food products where global markets drive producer prices. In addition, farmers involved in the arable case studies of the different regions experienced rising prices for important inputs such as fertilizer or machinery.

Oilseed rape in Wetteraukreis

The Wetterau district (NUTS 3) is one of the most productive agrarian regions in Germany: the climate is moderate and the soil is fertile. Crop rotation including wheat, oilseed rape and/or sugar beet are characteristic of the area.

A producer survey shows that the average agricultural area is 124 ha/farm. When farming is the main activity, the average size of the farm is 140 ha/farm. For part-time farmers, it is 80ha. The average farm has 86 ha of rented land or 69%. 57% of the farmers rent land from retired farmers, or from their heirs (30%). 9% of the interviewees cultivate leased land that is owned publicly (federal/communal land) or by the protestant church (both 9%).

National statistics show that prices for farmland continued to climb. In 2015, the German average price for arable and grassland rose by 8% to more than 19,000 Euro/ha per year. This increase was below rates in 2014 (+10.5%) and in 2013 (+14%). In Hessen, average prices for land are slightly below the national average (2014: 14,000 Euro/ha). (DBV, 2017) In the Wetterau, land prices increased over time, and meanwhile represent an important proportion of total costs. Farmers fear they have to abandon well-accepted practices that helped to improve sustainability effects if the total costs continue to rise and farmers will not be able to add value to their sales.

The proportion of rented land is high and prices per ha are rising. In 2013, 74% of all farms in Hessen cultivated both owned and rented land. Only 15% of the farms managed only their own land. Overall, around 60% of the farmland in Hessen was leased land (58% in 2013; 64% in 2017). In farms with main income from agriculture, 68% of the managed farm area was rented. Thereof, nearly 10% was rented from family members. The majority of landowners who rent out their farmland are retired farmers, their heirs or other private persons. (Statistik Hessen, 2014) Land owned by the state of Hessen, by other public bodies or by the church represents less than 5% in Hessen (HLG, 2017; EKHN, 2017). The demand for land on lease is high with steadily increasing prices (Langenberg, Theuvsen, 2016).

A survey on land use data showed lessors of Wetterau farmers: interviewed farmers lease an area of 91 ha/farm which they rent from other active farmers, 55 ha from former farmers and 43 ha from heirs of former farmers. The most expensive leased areas are from former farmers (383 Euro/ha and year) and from other private persons (360 Euro/ha). Farmers pay less when they rent land owned by the Catholic Church (200 Euro/ha and year) and by other active farmers (205 Euro/ha).

The role of legislation and policy conditions is very influential in the case of rapeseed oil production in Germany, owing to its predominant use in bio-diesel. Most significantly was the 'Electricity Feed-in Law', which introduced a minimum compensation for electricity from renewable sources that producers fed into the grid. This law contributed significantly to the expansion of maize and rape production since the early 2000s. In addition, farmers pointed out that food processors are free to purchase grain or oilseeds without any sustainability requirements for the imported produce. However, national production has to comply with sustainability standards set by European and national legislation and implemented by rigid controls and fines. This is seen as a significant disadvantage of commodity crop production in the EU, and in Germany in particular because legislation seems to be applied and controlled more thoroughly than in other countries such as Poland.

Cereal farming in Île-de-France region

Cereal farming in Île-de-France (NUTS 2) is dominated by farms with an average size of around 115 ha that mainly grow cereal crops. Crop rotation consists of nearly 2/3rd of cereal (thereof 60% wheat) and rapeseed. Agricultural structures are largely homogenous but production systems vary locally. Farmers in the region are some of the wealthiest in France. However, several climatic events hit the area and weekend the economic performance. In recent years, a major challenge was the volatility of prices for inputs. The variability of prices has led to a disconnection of product prices and production costs which prevented an efficient organisation of inputs. Another major issue is the wheat market for the region, and

competition from Black Sea countries that have put increasing pressure on the industry. Wheat from Eastern European countries tend to have higher protein levels and is available for lower prices. (Aubert et al. 2018)

In the past, farmers in the region aimed to increase efficiency by intensification of arable systems and farm enlargement but this phenomenon ended due to lacking access to land. Some farmers experienced that the investment in both machinery and land purchase weakened the financial and overall economic situation of their farm. Moreover, land tenure issues are particularly important for the Île-de-France region due to the proximity to the Paris metropolitan area. Often non-agricultural investors see farm land as a 'land bank' that can be used for the development of various activities. This requires local governments to develop clear priorities and deciding either for or against farmers' interest. Farmers expect that local agencies develop measures to strengthen existing farms and promote the setting up of new farms (CR Île-de-France, 2014). (Aubert et al. 2018)

Apart from land purchases leases play a major role in the area as well. In France, more than 66% of the Utilized Agricultural Land is leased land, and the Ile-de-France region is supposed to have a proportion of up to 84%. This is a result of long-term land use policies in France. After World War II, main concern was food security and the protection of the producer (and not the land owner). In the 1960's, a structural policy for farming was put in place aiming to 'modernise' the agricultural sector by supporting medium to large-scale family farms. Two public agencies were responsible for the implementation of this policy: the District Committee for Agricultural Orientations) and the Society for Land Management and Rural Development. Staff ensured land distributed to agricultural producers following the agricultural development plan of farms' concentration and specialization. This agricultural structure policy impacted strongly land use systems in Île-de-France. Due to the rising awareness of environmental impacts of intensive farming, new initiatives tried to enhance as well alternative farming in the area since the 1990s. Despite these attempts, the regional government still supports farmers' extension and specialisation strategies. (Aubert et al. 2018)

Farmers discussed the aspect of production costs and farm sizes controversially. Many farmers and professional organisations recon that, besides the additional cost of respecting norms, French farmers cannot compete with German, American or Ukrainian ones because their farms are too small. However, this opinion is not widely shared because some farmers see competitive advantages in their production. Many farmers denounced the fact that the French regulatory conditions were favouring small scale farms. They referred to the premium subsidy given to the 52 first ha of each farmer which large farmers also receive, and the so-called 'structure-policy' that govern agricultural land purchases and leases. This policy measures is actually supposed to favour newcomers rather than to facilitate enlargement. (Aubert et al. 2018)

In France the historical policy and legal framework is of particular importance for the land use. Land use policies that follow the 2nd world war were much concerned by the need to feed the nation. They gave a high degree of protection to farmers in the relationship to the landowner. A second element to consider is the agricultural structures policy that France formulated and started to implement in the beginning of the 1960's. At the heart of this policy was the need to modernise the French agricultural sector by favouring medium to large scale farms but still manageable by a couple. This policy was structured by two sets of measures: one dealing with land use aspects, the other one with the setting up of new farms and generation renewal. Two important structures helped to implement this policy, the Comité Départemental d'Orientations Agricoles (CDOA - District committee for agricultural orientations) and the SAFER (Société d'aménagement foncier et d'établissement rural - Society for land management and rural development), which aimed to ensure that each agricultural land movement at the district level would contribute to the agricultural development plan. This national development plan fostered both concentration and specialization in order to improve competitiveness. The plan defined the allocation of land, the basis of negotiations and the targeted project. These policy measures had a strong impact on agricultural land use at the national level, and more specifically in Île-de-France where the

process of concentration and specialization started earlier than in other French areas. (Aubert et al. 2018)

Opolskie and Lubleskie Voivodship

Poland is, after France and Germany, the third largest wheat producer in the EU. Opolskie voivodship (NUTS 2 region) has a size of less than 10,000 km² and a population of more than one million people. In Poland, it is the leading region for wheat, oilseed rape and sugar beet due to its favourable soil conditions and climate (period of vegetation between 200 and 225 days in the year), relatively mild winters as well as the highest agricultural valorisation of the land with more than 80 soil points (pts) (81.4 pts). The Polish average soil fertility is 66.6 pts (Ruszczewska 2016). It is also important to stress the role of climate conditions that might have an impact on improving of good enough plant production conditions. In the Opolskie region, the average temperature in the years 1981 – 2010 reached between 8.0 and 9.1 Celsius grades. Such an important increase of temperature has resulted in the length of vegetation periods. The summer period has been prolonged from 90 to 111 days during the year. The period of plants vegetation has been prolonged from 221 days to 235 ones. Even the period of the co-called intensive vegetation has been prolonged from 161 days to 176 ones. In turn, medium sums of the rainfall have been allocated between 586 to 652 mm per year (Skowera, Wojkowski, Ziernicka-Wojtaszek, 2016: 931 – 932).

The Lubelskie region, which is the agri benchmark case study region, is located in the east of Poland. Differences between the Polish case study areas are more distinct than in Germany where agri benchmark and SUFISA case study area share important communalities. Agri benchmark teams selected the case study area of the Lubelskie region because it is an area characterized by intensive cereal production. Among Polish regions, it is more important for cropping than the Opolskie region where mixed systems with field vegetable are widely spread. Climate conditions in Lubelskie differ slightly from the Opolskie region with hotter summer months and colder and dryer winter months.

The important characteristic of agricultural system in the investigated area has been the number of farmers' organizations. In Opolskie region, around 40 producer groups (GP) group wheat farmers (UMWO, 2018). The region hosts 99 agricultural cooperatives. (Mickiewicz, Mickiewicz, Wawrzyniak, 2014: 64). In contrast, the Lubelskie region has only 2 cooperatives (KZRRSP, 2018). In Lubelskie, almost all farm businesses are individual (family) farms (177,700 farms).

The general area of arable lands in the Opolskie region in 2015 has been 520,300 ha and – in comparison to the year of 2014 – increased by 10,300 ha (+2,0%). In Poland, the land area increased by only 0.1%. Individual farms owned 392,000 ha or 75.3% of total agricultural land in the region (national average of 91.2%). In turn, the area of arable land accounted for 496,600 ha or 95.4% in 2015 (national average of 89.2%). The Opolskie comes first on the list of arable land share from total land area compared to other Polish regions.

Average-sized farms cultivate around 18 ha and harvests around 0.45-0.52 t/ha wheat. Some agricultural enterprises farm intensively and reach productivity levels of up to 1 t/ha. Opolskie farmers increased production between 2014 and 2015: wheat and cereals (+3.4%), potatoes and cabbage (+15.9%), carrot (+24%), onion (+13.4%), cucumbers (+21.3%), tomatoes (+8.8%). Even animal production data showed increased with cattle numbers raising by 6.9% and poultry by 35.9%. These were the largest increases in Poland in this period.

The Opolskie region has been also an area of significant increases in chemical inputs. In 2014/15 the amount of 99,200 t of mineral fertilizers was applied (+8.5%). National average applications shrank by 7.4% in the same period. The Opolskie region seems to be the most intensive agricultural production part of Poland using the indicator of mineral fertilizers per hectare.

Access to land for most farmers in the region is very difficult because the demand for land by Polish, foreign or joint venture farm enterprises is high. The regional economic development as well as the improvement of technical infrastructure (mainly roads) resulted in the reduction of farm land. The area of arable land fell to 547,900 ha, which represents a decline of 7.8% from the year 2002 to 2010 (PSR). This is above national average (-6.5%).

Non-farming land buyers treat agricultural land as capital investment. Local family farms report that they often experience discrimination when arable land is on the market for either sales or leases. Arable farmers have a strong attachment to the land and regional and cultural tradition in the agrarian region of Opolskie. Farmers expect a similar commitment to local farming, and criticize regional governance structures and decision making because they do not enhance the development of small-scale family farming in the region. Due to these developments, farmers are disappointed from both national and European policies.

Statistics show that average sales prices for land increased in all Polish provinces. In the period 2009 to 2015, land prices rose by 177% from 4,100 Euro/ha (17,200 PLN) to 11,350 Euro/ha (47,680 PLN). Since 2015, the price stabilised but there is no evidence that (only) legislation contributed to the consolidation of the land market. It is important to note that Poland has two types of land markets, the so-called the 'public or state' market for land and the 'private' market with slightly higher prices. Both markets follow the same legal rules. Since Poland formally joined the EU, state agencies have sold land for prices that have been six times higher than before 2004, while prices in private sales are 5.5 times higher.

In both case study regions, land prices increased. In 2009, the price for one hectare farmland accounted for 11,173 PLN in the Lubelskie, and for 17,581 PLN/ha in the Opolskie region. Seven years later, prices of land rose up to 26,929 PLN/ha in Lubelskie and 47,681 PLN/ha in Opolskie. In both regions the prices of land increased. Moreover, the gap between land prices in both regions grew as well due to a higher price increase in the Opolskie Voivodship. In line with the land priced, leases in Lubelskie were half of rental prices in Opolskie (Kurowska, Ogryzek, Kryszk, 2016).

The average price for rented arable land in Poland (according to the Central Statistical Office) has reached a level of 218 Euro/ha in 2016. In the Opolskie region, price levels are slightly lower with 196 Euro/ha and year. Since 2013, leases increased by 10% (178 Euro/ha). Lessor is mainly a state agency in Poland. However, we have to keep in mind that informal rental agreements are widely spread e.g. among individual farmers. In these cases, the rents are usually connected with the level of direct payments that the renting farmer receives. In Poland, rental agreements are seen as enhancing an unsustainable use and an exploitation of soils.

The legal framework for land purchases changed in 2016 when the transition period ended officially. The new law sets rules for land turnover for both Poles and foreigners. Interviewees agreed that despite the limitations on whom and on what conditions land is sold in Poland, the law does not take into account the key issues related to land use by the farming sector. They perceive investments in land for financial speculation as a major issue.

Discussion of results

In this concluding section, we will compile main findings and discuss the potential of both approaches to supplement each other.

The major problem of high and increasing land costs was mirrored in the SUFISA case study work in the Wetterau. The farm economic model approach of agri benchmark confirmed this finding: the share of land costs in total costs of production is higher in Germany than in any other country. Both methodological approaches highlight this key results.

Even if farmers are able to invest in land purchases, access to land is a major challenge for expanding farms or for new farmers. Land purchases are a major issue in all case study areas. Due to increasing prices and the demand for non-agricultural land for industrial development, housing and nature conservation compensation, access to land is very difficult

in the German case study areas. They are located close to metropolitan areas (Rhein-Main, Köln-Aachen, and Hannover) where the demand from non-farming sectors drives land markets and prices. This effect is similar in the surrounding area of Paris in France. In Poland, some difficulties for farm enlargement by land purchases were identified as well.

The development of modern metropolitan areas started in medieval times. Only where farmers were able to produce food on fertile soils towns and civil communities could grow. For that reason, areas suitable for intensive wheat or oilseed rape production are usually located in the neighbourhood of large cities. The expansion of the urban settlement was possible due to the food supply of a productive hinterland. Today, this traditional advantage has turned into a disadvantage for the farming communities. The cities do often no more demand the regionally produced food but prefer to eat up the farm land. Even the demand from the public sector is significant, for e.g. the construction of roads, railways, power lines or for environmental compensation for freshly sealed land.

The comparison with non-EU countries such as Canada shows that land prices and the related costs for arable farming are higher in EU-countries. We see that in particular 'hidden costs' and regional framework conditions have a lasting effect on land markets and – based on that – on farming and cropping systems.

Agri benchmark model calculations link the expenses for farmland leases and opportunity costs for the use of own land. Both cost positions are weighted with the typical proportion of own and rented land per farm in the area. The average costs per farm feed into the calculation of factor costs. Based on this model calculation, non-financial issues do not impact on the profitability of the production systems. In contrast, the SUFISA analysis highlights major differences. Farmers and rural stakeholders in all areas argue that the ownership of land reduces long-term risks for the farm business and facilitates investment. Herewith the contractual period of the leases and related reliability on the agricultural surface plays a major role for the individual farming and the agricultural sector in the areas.

In Germany contracts for rented land usually indicate a duration between five and twelve years, while in many other countries the periods are shorter with one to three years. The longer the duration, the more security farmers have for their business plans. On the other hand, they often experience significantly rising prices after the end of a long-term contract. Price negotiations even sometimes end because the former lessee cannot compete with leases offered by a competitor who produces renewable energy crops or runs an intensive livestock enterprise. Moreover, statistics matter for arable farmers. The duration of the contract has an impact on average prices in the area. The more long-term contracts with relatively low leases exist, the less visible price jumps in new contracts are. This time lag effect makes it difficult for farmers' representatives to argue with politicians. Official statistics of land prices or rental agreements cannot give evidence of the emerging economic risks for working farms.

The results from the agri benchmark approach show that German and French farmers are particularly affected by high factor costs because labour and land are expensive compared to Poland. However, operating costs are higher in Poland. Taken into account that agri benchmark tends to present viable and future oriented farms that usually have results above average, financial challenges will be even more pronounced for the large group of small farmers. Since the SUFISA case study work covers the big picture of farming in an area, all larger groups showing particular characteristics are relevant. A major result is that the big group of small farms (< 20 ha/farm) suffers from high costs of variable inputs.

Since farmers usually cannot influence the level of land costs by their individual business strategies, they depend on the level of leases and land prices as a given external condition and have to adjust. The higher the share of land costs in total costs of production, the stronger farmers will feel the negative effect on the competitiveness of their crop production.

In respect to operating costs related to land use, agri benchmark results show that the level of land costs are high in the Polish model farm, in particular when compared with the lower level of total costs. In this case, the Polish farm is able to cover the costs. Taking into account the relatively high yield of the Polish model farm compared with the much lower

national average, we can imagine that many small farms suffer from the pressure of the land costs.

Operating costs related to land-use related production have a major effect on the competitiveness of crop production in all case study areas, both approaches underline. However, the information provided differs and provides supplementary insights.

The public sector has a particular influence on the land use due to legislation and policies.

Legislation related to agricultural land use and intensive cropping is of core relevance show the SUFISA case studies. In contrast, costs of fertilizer, pesticide use are elements of operating costs in agri benchmark but do not stand out. SUFISA results show that the Water Regulation or the Nitrate Directive and related controls and fines impact significantly on costs and sustainability effects of farming in Germany and France.

German and French farmers complain about the competition with e. g. producers in Poland, the SUFISA reports document. The farmers argue that this competition was unfair because product prices are set on the European or global market but the implementation of legal regulations and the compliances controls are mainly fixed at the national level and therefore differ between countries. Farmers recon that western societies require higher sustainability standards (water, bee, landscape protection etc.) in land use from the farmers in their neighbourhood when they grow wheat, sugar beet or oilseed rape than they expect when buying food products from imported cereals, oil or sugar. For example, civil initiatives criticise the use of glyphosat in national agriculture but do not demand for testing the imported cereals or oilseeds from overseas.

Public agencies implementing land tenure policies: Due to the highest priority to ensure food security after the 2nd World War, France and Germany implemented a strong legal framework and public bodies to ensure the allocation of land to experienced farmers who aimed to ensure or increase food production. The legislation to protect and strengthen established farms is still in place (even when not always free from conflicts). In Poland, however, the legal framework regulating land ownership and land use is young due to the transition from the socialist period. Farmers realise that policy measures and institutions supporting land use for agricultural production are weak or lacking in Poland. This is seen as a significant disadvantage compared to western countries. This fits with the statement identified in the Polish study that land ownership impact on farmers' attitude towards the protection of the soil. In Poland, land rentals are seen as one reason for lacking conservation and improvement of soil qualities. Instead leases would enhance the exploitation of land which contradicts sustainable agriculture, Polish analyses show. In Germany, this issue has not been emerging from the analysis although the proportion of rented land is high.

Conclusion

The paper combines two methodological approaches that are based on a farm data analysis. Agri benchmark uses quantitative data resulting from return and cost calculation on the level of model farms. The aim is provide insights in international competitiveness of farm types which are characteristic for the selected study area. They do not aim for statistical representativity. The SUFISA approach is based on statistical data providing background information and on qualitative methods covering conditions for and strategies as well as sustainability performances of farming. The selected case studies have in common that they represent areas typical for intensive crop farming. Natural conditions are favourable for agriculture due to relatively fertile soils and medium to high rainfall. As a result of the heterogeneity of data, tools and perspectives, both approaches provide complementary insights in the international competitiveness of farming.

Since the agri benchmark farm models analyse well-managed farms, the approach tends to show an economic situation which is more stable than observed in the real world of large numbers of farms. The SUFISA approach, instead, aims to cover the broad picture of the farmers' perspectives in the study area and therefore, can help to discuss the output of economic model calculations in a broader context. Agri benchmark covers well the level of

detailed loss and profit calculation but lacks the encompassing picture of farmers' management and strategic planning.

The agri benchmark can showcase developments in the past when the data for the specific model farm was maintained for a longer period. However, projections are impossible, unless the farmers' visions, aims and strategies have been entered from external analyses to the system.

This paper aimed to test the potential benefit from the combination of both approaches. The objective was to learn more about potential synergies by linking a cost and profit accounting approach with the socio-economic concept of CSP-analyses. Until now, data collection for this testing was not yet conformed which is a weakness of the paper. More systematic work is needed for a further development of options to link data collection and analyses from the different approaches.

Looking at the results of the studies, the SUFISA approach identifies land prices and land rents as key driver of farm profitability and competitiveness. However, it shows as well that a variety of factors impact on land market developments and land prices such as demand from non-agricultural sectors or political interventions. The quality of soil, structural conditions or even farm-specific productivity levels are of reduced relevance. Farmers in all areas studied experience an increasing competition for land. This results in higher prices for land purchases and rising leases for rental land.

In all cases, sales prices and rents for farmland increased in the last decades. In particular, the land prices in Germany and France rose significantly and threaten the farms' profitability. The pressure on the land market from non-agricultural demand is significant. In the Paris or Frankfurt metropolitan areas, where the SUFISA case studies are located, housing and the development of industrial zones drives prices for land and reduces the competitiveness of cropping. Rising land prices and rents are a huge challenge for farming in the Wetterau area and the Ile-de-France region. In these areas as well as in the Opolski region, lacking or very difficult access to land hamper the development of viable farms.

These results are based on both methods used for the development of this paper. We see that the outcome of both analysis fits well. However, it is important to take into account that the model farms of agri benchmark differ from the average farm in the area. In this respect, the methodological approach differ. Agri benchmark tends to focus on over-average farms that are future oriented and can serve as a model for average farms.

In SUFISA, the focus was on the majority of producers and their typical problems and strategies. For that reason, we do not aim to compare the results but to merge the information. Indeed, the wider picture helps to understand external conditions and on-farm conditions that shape farmers' business strategies and decision-making. Since farmers adjust to (changing) economic and policy conditions, the knowledge about underlying on-farm realities is very relevant for policy makers and involved civil society organisations. An understanding of enabling and hampering conditions influencing farmers' strategies is a precondition for politicians and researchers who aim to enhance – if that is the overarching objective – profitability in farming and contribute to ecological and social sustainability of rural areas.

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