UNDERSTANDING GLOBAL AGRICULTURE THROUGH AGRI BENCHMARK[1]

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A b s t r a c t. Understanding global trends and perspectives in agriculture is challenging. This paper presents the concept and some selected findings from *agri benchmark* regarding the perspectives of European sugar beet production, Latin American beef production and specialty crops in Kazakhstan. These case studies illustrate that the *agri benchmark* approach allows the identification of the drivers of growers' decision making and their relevant options. Hence it is possible to assess likely future developments under changing economic framework conditions. In contrast, projections based on previous trends do not seem to yield meaningful results. In addition, the case studies demonstrate the value of having access to reliable farm level data which have been derived from a production system approach. At least in crops, FADN based cost of production estimates seem not to add value.

INTRODUCTION

Policy makers as well as investors and farmers around the globe are keen to understand the perspectives for agricultural production: "Will we be able to produce enough food (and biofuel)? Who will or should produce the crops and livestock needed and how?"

Global agricultural production is the result of millions of farmers' decisions on what type of product they produce and how. Hence, understanding economic conditions and options available to farmers is a prerequisite to understanding global agriculture. Detailed knowledge of the profitability of production for individual crops and livestock products is an important ingredient.

But when it comes to assessing possible structural change within a country between different farming systems or products (e.g. beef vs. crops; corn vs. wheat) a detailed understanding of the profitability of individual products alone will not allow for a realistic projection; the reason being that the system "farm" is rather complex. Assuming there is an increase in relative output prices for a certain commodity, farmers are faced with the following options in order to react:

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– depending on the current status of production systems, there may be room for an increase in input usage leading to a growth in supply;
– a shift from extensive crops such as barley to a more intensive crop such as corn can become a viable option. However, this shift itself is subject to non-linearity because there may be an interaction between crops leading to non-monetary effects;
– farmers can move from one production system (in terms of economic theory: production function) to another.

Against this background it becomes obvious that a detailed understanding of the options for and determinants of farmers' decision-making is key to understanding the future of global agriculture. Forecasting based on previous trends and farmers' reactions to market signals very often will not yield meaningful results. This is particularly true in a situation where major commodity prices increased by 100% and more compared to the pre-boom period before 2008.

In an ideal world, agricultural economists could set up a large number of trials in order to measure and analyze the physical and economic effects from a variation in intensity, crop mix, changing production systems and the like. When looking for global trends in agricultural production, these trials would have to be run at all major sites around the world. Obviously, due to financial constraints this is not a realistic option.

Alternatively they could (a) run large scale interviews of growers in order to capture farmers' reactions to changing framework conditions on a regular basis or (b) collect and monitor extended enterprise (not farm) accounting data. In reality both options are also extremely – very often prohibitively – expensive. Furthermore, option (b) – as far as many emerging and developing countries are concerned – is frequently not available at all. Therefore the *agri benchmark* concept of typical farms has been developed as a feasible compromise. A comprehensive analysis of the different options regarding the creation and use of different types of farm level data can be found at Isermeyer [2012].

OBJECTIVE

This papers attempts to illustrate the value of *agri benchmark* in understanding global agriculture and its perspectives. Case studies will be used to illustrate that it is possible to capture the complexity of farming in order to come up with reliable and meaningful projections regarding future agriculture production.

One case study will look at the EU sugar beet production in a more liberalized environment; the other will analyze the perspectives of beef production in Latin America. Finally, the competitiveness of Kazakhstan as a global player in legumes will be looked at. As an introduction to the case studies, in the next section a short introduction to the concept of *agri benchmark* will be provided.

KEY CHARACTERISTICS OF THE AGRI BENCHMARK CONCEPT

Agri benchmark is combining farm production system data with site specific expertise of producers and advisors on a global scale. Data collection is based on so-called "typical farms" which are case studies. They are established by production economists in regional hot spots for a certain product. Detailed figures on quantities and prices for variable inputs,

land, machinery and labor describe the prevailing production system in a region which is the origin of a major share of the national output in a given agricultural product. Respective farm data is validated in so-called "focus groups" which consist of growers who run a farm similar to the stylized typical farm and a regional advisor. However, focus groups are not only used to explore the status quo but also to identify and validate options for future changes in the farming system and outputs. The whole initiative is independent and jointly managed by the Thünen-Institute, which is working under the German Federal Ministry of Agriculture and DLG. A more comprehensive description of the concept and principles can be found at www.agribenchmark.org.

EXAMPLE 1: FUTURE OF EU SUGAR BEETS PRODUCTION

European sugar production is faced with a number of economic challenges. Not only does the EU envisage phasing out the quota system, but more importantly due to a significant reduction of minimum prices for beet and a sharp increase vin other commodity prices, the issue of on-farm competitiveness of sugar beets is becoming vital. Therefore, *agri benchmark* Cash Crop headquarters launched a PhD project to analyze the on-farm competitiveness of sugar beets [Albrecht 2012].

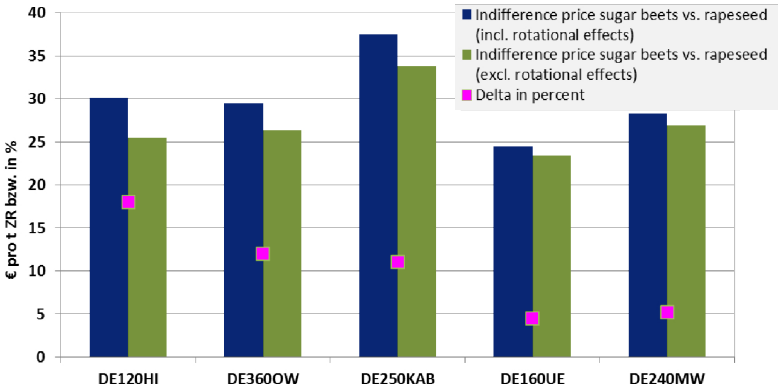
In order to understand the complexity of possible on-farm adjustments the following key questions have been addressed in a series of focus group discussions:

1. What crops are relevant alternatives to sugar beets? Given the diversity in cropping patterns in sugar beets producing regions in Europe, this is not a trivial question.
2. Will there be any yield effects for the competing crop if this crop is grown on land previously devoted to sugar beets. This effect may be relevant because sugar beet tend to be extremely demanding in terms of soil quality, hence where farms operate on rather mixed land it is reasonable to assume that they have reserved prime land for a sugar beet rotation.
3. Compared to crops alternative to beets, what are the effects on yield and cost of production (e.g. use of fertilizers and crop protection products or machinery use) for the subsequent crops.

In order to analyze the on-farm competitiveness of sugar beets, indifference prices have been calculated: What price for sugar beet has been necessary for the grower in order to make them economically indifferent when choosing between sugar beet and the alternative crop "rapeseed". As displayed in Figure 1, this indifference price has been generated twice: Once without taking rotational effects into account and once including those non-budgetary benefits associated with a reduction of beet acreage. The respective average rapeseed prices realized at the typical farms range from 360 to 400 €/t and represent the economic situation for 2010 and 2011.

Figure 1 reveals the following:

1. Taking into account rotational effects leads to a significant increase in indifference prices for sugar beets. That means any forecast about future sugar beet production which includes rotational effects will systematically be too optimistic as far as the competitiveness of sugar beet goes.
2. Depending on the region, the gap between the two indifference prices differs quite a lot.
3. When comparing the conclusion that would be drawn from the analysis without rotational effects with the one including them, it appears that the former concept would suggest that in all relevant German sugar beet regions, a relatively low and uniform



* The abbreviations on the x-axes should be read like this: the first two letters indicate the country where the typical farm is located, the figure stands for the size of the farm in hectares; in the beef section (see below) the figure indicates the number of beef animals produced per year

Figure 1. Estimates for on-farm indifference prices for sugar beets w/wo rotational effects for selected typical *agri benchmark* farms* (ø = average 2010 and 2011)
Source: [Albrecht 2012].

sugar price of about 25 €/t is needed in order to keep beet in the game. From the latter approach one would conclude that in general, much higher sugar beet prices of about 30 €/t are needed to sustain beet production.

What cannot be seen from the graph is the fact that even though some other rotational effects play a role, the major impact stems from the improved yield for the subsequent crop when sugar beets are replaced by rapeseed. The other important driver is the effect that, as of today, rapeseed tends to be grown on the less fertile soils of the typical farms. When replacing sugar beets, rapeseed will move to the better sites and thereby become more profitable than is currently the case.

Critics sometimes argue that *agri benchmark* figures – in contrast to FADN – are based on a rather small and statistically not sound database. Therefore FADN based cost estimates will be used as a benchmark. In a study on the future of European sugar beet production Kleinhanss [2012, p. 21] demonstrated results from such an approach. When looking at the figures presented, the following observations can be made:

1. The method generates very strong fluctuations for total cost estimates between years (up to 1,000 €/ha).
2. When comparing evolution of variable cost estimates between neighboring European countries, totally different trends will be found. This is extremely unrealistic because fertilizer, crop protection and seed – which are the main items in the variable cost – are purchased from highly competitive, global markets. Hence, major differences in prices between countries are not very likely. Since the quantities applied by growers tend to be rather stable, these fluctuations are most likely an artifact derived from cost estimation.
3. In a number of cases estimates for variable cost are only as high as actual seed prices alone, which would imply that no fertilizers and no crop protection products have been applied.
4. Even though sugar beets are an intensive crop, estimated energy costs are often either extremely low – less than 10 €/ha – or even negative.

All in all, one has to draw the conclusion that at least in crops[2], this attempt to generate cost of production figures from FADN data does not yield very meaningful results. And of course it is not possible to detect the complex interactions between crops and the management implication of different crops.

EXAMPLE 2: PERSPECTIVES OF BEEF PRODUCTION IN BRAZIL AND ARGENTINA

In the last 10 years, global beef prices have gone up significantly. In many countries increases were more than 100 % [Deblitz et al. 2012]. As a consequence, economic incentives to expand beef production are significant. However, grain prices saw a similar increase in the same period.

Beef production of important beef producers such as Argentina and Brazil used to be based on grassland systems. In economic terms, these systems are characterized by a very low use of purchased inputs such as grains for feed or fertilizers and thus they are to a wide extent "disconnected" from global markets – be it agricultural commodity markets or input markets.

What becomes obvious from Figure 2 is that animal purchase is the single most important cost component in the pasture based system. The relatively high proportion of labour cost in the pasture based system is a result of low daily weight gains and subsequently rather old animals which consume a relatively high proportion of labour during their life time. The land costs are also important in the pasture system. The main reasons are (a) low land productivity, (b) long finishing periods of more than two years and (c) high land rents in regions where cattle land competes with crop land.

Without detailed farm level information on new options for farmers, a projection regarding the future of beef production would most likely come up with the forecast that additional grassland – which is readily available in both countries – will be established for

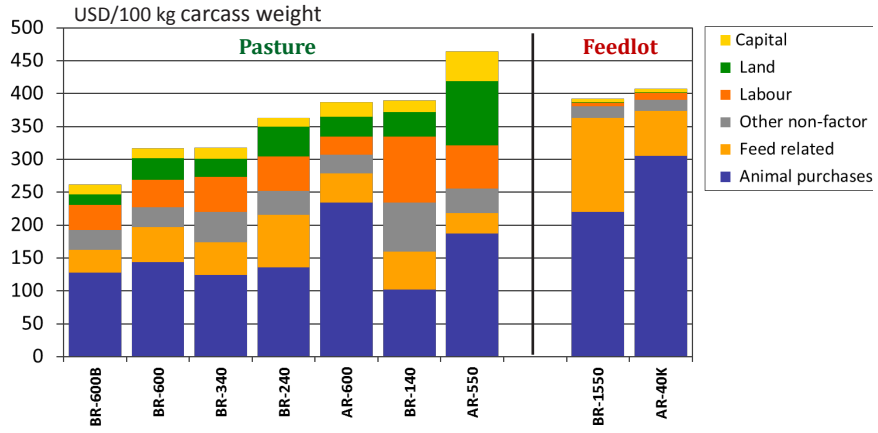


Figure 2. Cost of beef production for *agri benchmark* farms in Argentina and Brazil (2011)
Source: [Debltiz et al. 2012].

[2] Since the situation might be rather different in one-product companies such as dairy farms this restriction on crop production is important. See also Isermeyer [2012].

additional beef production. Furthermore, one would conclude that – once production has been expanded significantly – beef prices would go down to previous levels again because grassland is extremely cheap.

However, what is really happening is something rather different. Due to the possibility of converting large parts of the current grassland into arable land, the overall increase in grain prices has led to a sharp increase in the opportunity cost of land. For example, ground rents on arable *agri benchmark* farms in Argentina and Brazil went up between 100 and more than 500 USD/ha from 2008 to 2011. This equals to an increase of 30% to more than 100% [Zimmer et al. 2012]. The change is particularly remarkable because compared to previous years, 2008 was a rather profitable year as far as grain prices and ground rents were concerned.

This sharp increase in opportunity cost for land in turn induces beef producers to switch from one production function to another or – in more applied terms – producers establish feedlots to finish cattle on grains rather than on grassland. This process is much more advanced in Argentina where an estimated share of 40% of total beef production is derived from feedlots while in Brazil this share is in the range of only 6%.

The main reasons for the minor importance in Brazil are (a) the pressure on land prices in the traditional cattle producing regions is lower than in Argentina, (b) expansion of agricultural production to so-called frontier regions in the north of the country and South of the Amazon region was much more pronounced than expansion in Argentina and (c) feedlot ting is still, a rather strategic tool during seasonal droughts.

As Figure 2 shows, such a move to another production system does not necessarily imply an increase in total cost of production. What, however, is obvious is that such a system is much more dependent on animal purchase.

Table 1 shows that the characteristics of the output are changing, too. An increase in carcass weight of 25% implies a significant change, given the fact that processors and consumers have been used to much smaller carcasses. Furthermore, it is likely that higher carcass yields and possibly better carcass conformation result in higher beef prices.

Table 1. Output characteristics of pasture, feedlot and mixed beef fattening systems

	Pasture	Feedlot	Mix	Mix vs. Pasture
Weight at start [kg LW]	190	414	190	
Weight at end [kg LW]	495	577	577	
Finishing period [days]	730	100	636	-13%
Daily weight gain [g/days]	418	1630	609	+45%
Dressing [%]	53	57	57	+8%
Cross weight [kg]	262	329	329	+25%

Source: [Deblitz et al. 2012].

This case study on structural change in Latin American beef production yields the following conclusion:

1. Changing economic framework conditions are creating a whole set of new options for farmers which, at least in some cases, may change incentives and drivers fundamentally.
2. Those new options are neither obvious nor can they be explored through existing data, be it statistics or cost of production figures.

3. Rather, those new options can only become apparent to the public through analysis including in-depth cooperation with farmers and advisors.
4. The realization of those new options does not only change the input side, but at the same time and in various ways it has an impact on the output side. In the case of beef production one might even argue that "new" products in terms of meat types (more marbling) will be on offer. Those changes will normally also affect revenues, which is why just looking at the cost side of any of those changes may be totally misleading.
5. Given the strong increase in productivity figures and in beef produced per head, it is by no means obvious that the overall cost of beef production will change much.
6. Furthermore, given the high importance of purchased feed cost in the feedlot system, it is likely that future beef production in Latin America will be tied much closer to global grain prices than it used to be.

EXAMPLE 3: SPECIALTY CROPS – A FUTURE FOR KAZAKHSTAN?

In technical terms, Kazakhstan has a huge potential to produce and export crops. However, a major challenge stems from the fact that it's a land-locked country. The closest harbor is about 3,000 km away from the main grain producing region in the north. This leads to very high domestic transport and logistics' cost which in turn imply rather low farm gate prices. Kazakhstan is rather similar to Canada in this respect as well as the arid climate is concerned. Therefore the question arises, whether specialty crops, in which Canada is the major global player [Zimmer and Börsch 2013, p. 11] could be an option to Kazakh growers as well?

A proper analysis of the economic viability of this option consists of two steps: At first it has to be checked whether pulses are competitive at the farm level. Given the arid climate in Kazakhstan, wheat yields – as all other major grains – are relatively low (1 to 1.5 t/ha). Since pulses tend to be low yielding as well they should have a competitive edge over

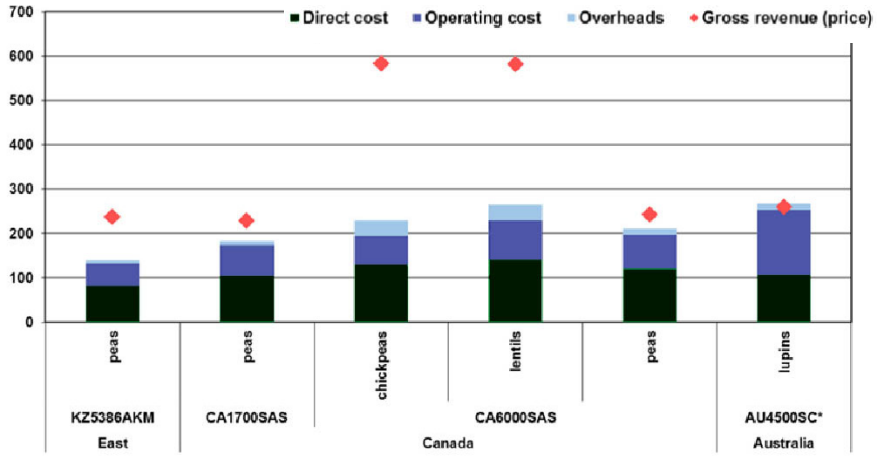


Figure 3. Cost of production for specialty crops for typical farms in Kazakhstan, Canada and Australia (ø 2008/9 – 2011, USD/t)
Source: [Zimmer, Börsch 2013].

wheat. And indeed *agri benchmark* figures for a typical farm in Kazakhstan indicate that in recent years pulses generated higher gross margins than wheat [Zimmer and Börsch, p. 8].

In order to assess Kazakhstan's competitiveness on global pulse markets a comparison of cost of production was carried out for farms in Kazakhstan, Canada and Australia. As can be seen in Figure 3 it seems that Kazakhstan may indeed become a relatively competitive producer of those crops. Whether or not this will come true finally depends on transport and logistics' cost, which are not included here. This topic is one which *agri benchmark* is intensively working on as well.

CONCLUSIONS

With regard to the design of agricultural economic research on the future development of global agriculture, the following conclusions can be drawn from these case studies:

1. At least in the two cases of beef and sugar beet presented here, the complexity of structural change is rather high. An attempt to make projections derived from previous trends alone will most likely not yield realistic outcomes.
2. The *agri benchmark* concept allows the disclosure of the complexity of farm economics and farmers' decision making and the drawing of meaningful conclusions about future trends and changes in agricultural production. The building blocks for the concept are production system based farm data from typical farms and the involvement of farmers and advisors for exploring likely future changes.
3. In order to assess the international competitiveness of farms and products, cost of production as well as transport and logistics' cost have to be generated and analyzed. In the framework of a case study on Brazilian soy exports [Fliehr 2013] a first attempt to capture transport and logistics was developed and successfully tested.
4. Global projections on future agricultural production and trade can of course not be made by *agri benchmark* alone, cooperation with market modeling is highly advisable.

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OBJAŚNIANIE GLOBALNEGO ROLNICTWA PRZEZ AGRI BENCHMARK

Streszczenie

Rozumienie globalnych tendencji i perspektyw rozwojowych w rolnictwie stanowi wyzwanie. Artykuł prezentuje pojęcie i kilka wybranych wniosków z agri benchmark dotyczących perspektyw produkcji buraka cukrowego w Europie, produkcji wołowiny w Ameryce Łacińskiej oraz produkcję upraw specjalnych w Kazachstanie. Przeprowadzone badania wskazują, że podejście agri benchmark pozwala identyfikować czynniki powodujące podejmowanie decyzji przez hodowców. Umożliwia to także oszacowanie przyszłego rozwoju w zmieniających się warunkach struktury ekonomicznej.

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