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Isoglucose – How significant is the threat to the EU sugar industry?

Isoglukose – wie groß ist die Herausforderung für die EU-Zuckerindustrie?

The EU is about to abolish the sugar – and the isoglucose – quota system in 2016/17. Isoglucose made from corn occupies about 50% of the US sweetener market while its market share in the EU caloric sweetener market is less than 5%. Against this background, this paper analyses the economics of isoglucose production in Europe in order to understand its competitiveness vis-à-vis sugar.
Key results: (1) Isoglucose will become a rather competitive product. The EU sugar industry will have to give up about 40% of its current processing and profit margin in order to sell sugar at the same price as isoglucose will be traded; (2) Once industrial sugar users move to isoglucose, they will tend to be "hooked-in," giving the sugar industry a strong incentive to defend its market share; and (3) Since only about 30% of the current sugar market is able to switch to isoglucose, the sugar industry has the option to practice a mixed calculation. In an extreme scenario, the industry may even opt to cross-subsidize sales. Therefore it's not clear whether investors in isoglucose will be able to gain a major market share in Europe.

Key words: competitiveness isoglucose, economics isoglucose by-products, indifference prices sugar beets

Die EU plant 2016/17 die Zucker- und Isoglukose-Quoten abzuschaffen. In den USA hat Isoglukose bei den kalorischen Süßungsmitteln einen Marktanteil von knapp 50 %, während der Anteil in der EU bei unter 5 % liegt. Vor diesem Hintergrund analysiert das vorliegende Papier die Wirtschaftlichkeit der europäischen Isoglukoseproduktion, um deren Wettbewerbsfähigkeit gegenüber Zucker abschätzen zu können.
Die wesentlichen Ergebnisse: (1) Isoglukose ist ein sehr wettbewerbsfähiges Produkt; die EU-Zuckerindustrie müsste ihre bisherige Verarbeitungs- und Gewinnspanne um ca. 40 % reduzieren, um Zucker zum gleichen Preis anzubieten wie Isoglukose. (2) Da industrielle Zuckerverwender bei einem Wechsel zu Isoglukose aufgrund von erforderlichen Zusatzinvestitionen in eine Pfadabhängigkeit geraten, hat die Zuckerindustrie einen starken Anreiz, einen solchen Wechsel zu verhindern. (3) Die Zuckerindustrie hat die Möglichkeit, ihre Marktanteile mit Hilfe einer Mischkalkulation zu verteidigen, da in Europa nur ca. 30 % des kalorischen Süßungsmittelmarktes mit Isoglukose bedient werden können. Von daher ist es trotz der sehr geringen Produktionskosten unklar, ob es der Isoglukose-Industrie gelingen wird, die technisch möglichen Marktanteile zu realisieren und Zuckernachfrage zu verdrängen.

Schlagwörter: Wettbewerbsfähigkeit Isoglukose, Wirtschaftlichkeit Isoglukose Nebenprodukte, Indifferenzpreis Zuckerrüben

1 Introduction

The EU will abolish the sugar quota system in 2016/17. What many people in the ag community don't realize is that the quota system for isoglucose[1] will be lifted simultaneously as well. This sweetener made from corn occupies about 50% of the US caloric sweetener market (*Ross*, 2011) while its market share in the EU is less than 5%. The exact technical market potential for isoglucose is hard to predict, but based on the assumption that sugar can be easily substituted in soft drinks, bakery products, jellies, canned fruits and dairy products (*Ross*, 2011), a technical market potential of about 30% might be a realistic figure. Therefore, the question arises whether – and under what conditions, in economic terms – does isoglucose have the potential to drastically expand its market share in the EU?[2]
If such an expansion of the isoglucose market share occurs, respective sugar surpluses would appear. In the long run it must be assumed that, due to high tariff rates, EU sugar prices will be well above world market prices. Therefore, any substantial sugar surplus will be hard to sell on world markets. As a consequence, domestic sugar prices will come under pressure. In the long run, a shake-out among EU sugar producers will most likely take place.

1 In the USA the product is called High Fructose Corn Syrup (HFCS); since this term is not very common in the EU we refer to it as isoglucose.

2 The Austrian newspaper "Wirtschaftsblatt" issued an article in which it is assumed that from 2017 onwards isoglucose will "rough up" the EU sugar market. The CEO *Marihart* of Agrana – the leading European isoglucose producer – is quoted as projecting a market share for isoglucose of about 25%. See: http://wirtschaftsblatt.at/home/boerse/analysen/1451888/Kurskorrektur-macht-Agrana-wieder-attraktiv

This paper aims to fulfill the following tasks:

I To estimate the cost of production for isoglucose based on calculated processing and profit margins in the United States. The USA is used as a blueprint because there are comprehensive and multi-annual data available on isoglucose and by-product prices;

II To analyze the interaction between commodity markets and the by-products of isoglucose production in order to be able to render transparent the way that cost of production for isoglucose depends on commodity prices; and

III To draw conclusions regarding the future competition between the two caloric sweeteners on the European market and define the likely implications for the EU sugar industry.

While in the United States, isoglucose is produced from corn, in Europe some plants process wheat. Since there is no comparable information available on wheat-based systems, the following analysis will look at corn-based systems only. Because corn for grain production in Europe is on the rise, it makes a lot of sense to do so.

2 Outline of the analysis

This paper is organized as follows: First, some technical features of the production process are presented. In a second step, the economics of by-products are examined. What is important to analyze is the interaction between corn markets and the by-product markets because when prices for corn change, it is very likely that by-product prices shift as well.

When it comes to the cost of processing of corn to isoglucose, there is no publicly available data to be had for isoglucose. Therefore, estimated processing and profit margins from the USA will be used to estimate cost of processing.

In the main chapter, the competition between sugar and isoglucose will be analyzed. Since there are no publicly available figures on the cost of sugar production, an alternative approach has been developed. Processing and profit margins for the sugar industry are calculated by using data on (a) sugar beet prices received by growers and (b) sugar prices. Based on detailed farm economic data comparing sugar beets and wheat/corn indifference prices, corn prices are generated. Those corn prices are then used to come up with estimates for respective isoglucose prices. In a third step, those isoglucose prices are used to calculate new processing and profit margins for the sugar industry. Finally, those hypothetical margins are compared to those generated in the sugar industry in recent years. In a final chapter some main conclusions are drawn.

3 Main technical features of isoglucose production

Isoglucose is a generic term for four distinct products: glucose syrup, glucose-fructose syrup, fructose-glucose syrup and fructose syrup, each characterized by a different mixture of fructose and glucose. Isoglucose can be produced from starchy crops such as corn or wheat. Depending on the initial raw product, two rather different technological processes must be applied, which implies that producers are not able to switch between the two raw materials. Isolation of starch, which is the first step, is much more complicated when wheat is being processed as compared to corn. Furthermore, the extraction rate is lower and energy consumption is higher than for corn. In recent years, a strong increase in corn yields has been observed while, at the same time, wheat yields have remained stagnant. Therefore in the long run, relative corn prices in the EU will most likely go down. This is why this paper is focusing on corn-based isoglucose production.

Isolation of starch and processing of starch to isoglucose is a complex chemical process which uses several enzymes and other additives to steer, to safeguard and to speed up the separation and conversion of starch. When corn is processed to isoglucose the by-products shown in Table 1 will be produced. Based on figures from *Gray* (1991), about 1.66 t of corn are needed to produce one tonne of isoglucose. In addition, it should be noted that the entire process is rather energy-intensive, mainly because a lot of water has to be removed from the intermediate product. However, it was not possible to get access to precise figures on this.

Table 1: By-products from corn procession in an isoglucose plant

By-product	t/t of corn
Corn gluten meal	0.054
Corn gluten feed	0.232
Corn oil	0.031
Corn germ meal	0.033

Source: *O'Brien* and *Woolverton* (2009), *Blasi* (2001), own calculation.

4 Economics of by-products from isoglucose production

The first economic characteristic of isoglucose production is its strong dependence on corn prices. Since corn prices are fluctuating a lot, different scenarios for corn prices have to be developed.

In order to make a reliable and meaningful statement about raw material costs, one major hurdle has to be overcome: the issue of the value of the by-products mentioned above. More precisely, the question is what price for by-products should be used? This is important, because (a) the amount of by-products is relatively high (approximately 20% of the initial raw material) and (b) some by-products tend to be rather valuable compared to corn. Hence any change in their prices has a strong impact on the total raw material cost.

Since there is no developed market for isoglucose by-products in the EU, the fundamentals of these market interactions will be generated by using price quotes from the United States. In a first step, the evolution of all prices is displayed in Figure 1. It appears that, in principle, the various prices are linked to each other rather closely. Indeed, when running a regression analysis on the above-mentioned prices, it is shown (Table 2) that more than 80% of the variation in by-product prices can be explained by the variation in corn prices.[3] It is therefore

3 The concept for running this analysis has been developed by *Driedger* (2013). A set of detailed background information can be downloaded at www.agribenchmark.org/cash-crop/sector-country-farm-information/sugar-isoglucose.html

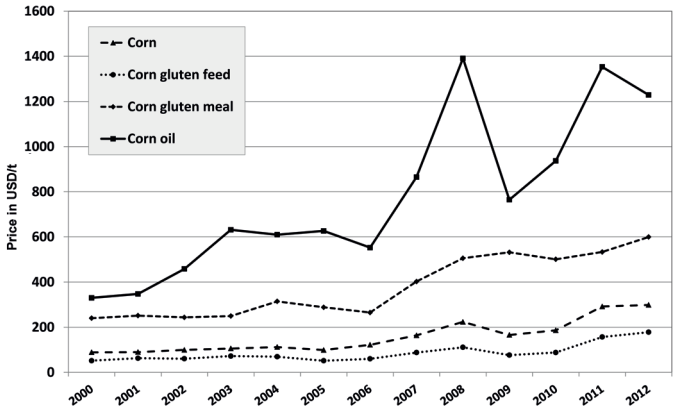

Fig. 1: Evolution of corn and isoglucose by-product prices in USD/t [Source: author's calculation, based on ERS (2013a) and ERS (2013b) and World Bank (2013)]

possible to estimate an appropriate price for a by-product by using the respective equation from the regression function (Table 2). Thereby it is assured that the assumed by-product prices reflect the economic interaction between different commodity markets. However, it must be noted that this is a stylized and long-term outlook. In the short run, of course, rather different price ratios may be observed.

Prices for by-products are calculated based on these equations (first part in Table 3). These derived prices multiplied by the quantities of by-products produced per tonne of corn (Table 1) generate estimates for revenues from by-products (third part of Table 3). Finally, the net raw material cost (bottom line in Table 3) is: corn price minus revenue from corn gluten meal, corn gluten feed, corn oil and corn germ meal[4] times 1.66. Table 3 shows that, due to revenues from by-products, net raw material costs are significantly lower than initial corn prices. For example, if the corn price is €120/t, net raw material costs are estimated at about €110/t of isoglucose even though gross corn expenditures would be at about €200/t. Given the fixed price transmission rates assumed here, the net raw material costs change by almost the same amount as prices for corn change.

Table 2: Equations for regression of by-products prices on corn prices

By-product	Equation	R^2
Corn gluten meal	$y = 1.6855x + 113{,}85$	0.93
Corn gluten feed	$y = 0.5195x + 4{,}8041$	0.83
Corn oil	$y = 4.5424x + 62{,}496$	0.87

Source: own calculation, based on ERS (2013a; 2013b) and World Bank (2013)

Table 3: Estimated net raw material cost for isoglucose production

Corn price in €/t	90	120	150	180
Corn cost in €/t isoglucose	153	204	255	306
Derived price by-products in €/t				
Corn gluten meal	266	316	367	417
Corn gluten feed	52	67	83	98
corn oil	471	608	744	880
Corn germ meal	52	67	83	98
Output by-products per tonne of corn in t/t				
Corn gluten meal	0.054	0.054	0.054	0.054
Corn gluten feed	0.232	0.232	0.232	0.232
Corn oil	0.031	0.031	0.031	0.031
Corn germ meal	0.033	0.033	0.033	0.033
Revenue by-products per tonne corn in €/t				
Corn gluten meal	14	17	20	23
Corn gluten feed	12	16	19	23
Corn oil	15	19	23	27
Corn germ meal	2	2	3	3
Total revenue from by-products in €/t	43	54	65	76
Net raw material cost in €/t corn	47	66	85	104
Net raw material cost in €/t isoglucose	79	110	141	173
Total cost in €/t isoglucose	279	310	341	373

Source: own calculations

5 Economics of isoglucose production

As indicated in the introduction, calculated processing and profit margins from the United States are used as a starting point for estimating processing and profit margins in Europe. The analysis goes like this: published isoglucose prices (ERS, 2013b) are used to estimate revenues from isoglucose sales. By-product prices and corn prices, as demonstrated in Figure 1, are used to calculate net raw material costs. When deducting net raw material costs from isoglucose prices, one derives processing and profit margins (Fig. 2).

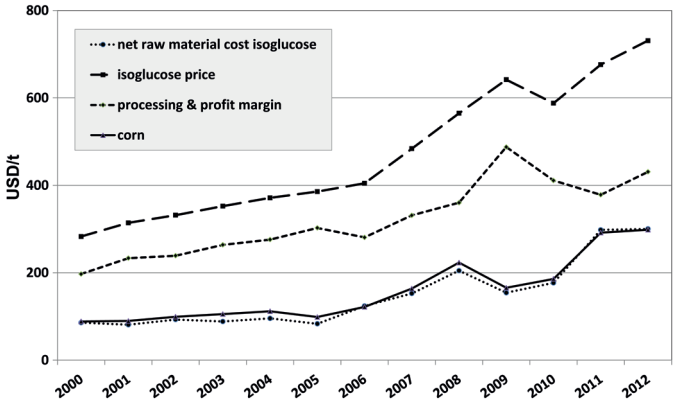

Fig. 2: Economics of USA isoglucose production in USD/t [Source: author's calculation, based on ERS (2013a) and ERS (2013b) and World Bank (2013)]

As displayed in Figure 2, the processing and profit margins in the USA went up from US$200/t in 2000 to more than US$400/t in 2012. Therefore the question arises, which figure is the "right" one?

The following consideration will provide some insight: Changes in the main cost item in isoglucose production which is subject to strong fluctuation – corn prices – are not included here. Therefore they cannot be the cause of the increase in profit and processing margin.

4 Since there is no publicly available price quote for corn germ meal it has been assumed that prices and price transmission from corn prices are similar to corn gluten feed. This assumption is based on the fact that content of nutrients is comparable.

The other input factor that is subject to major increase over time is energy. However, as will be explained in greater detail below, taking rising US energy prices into account only leads to an increase in processing cost of about US$15/t when moving from 2000 to 2012.

From this, it can be concluded that it is rather likely that the lion's share of the increase in margin is due to higher profits. This conclusion is backed by the fact that isoglucose prices in the US tend to follow sugar prices (Fig. 3). When running a regression, it shows that almost 70% of the movement of isoglucose prices can be explained by fluctuations in sugar prices. Finally, one may argue that a processing margin of US$200/t might, in fact, be too low to cover total cost of processing. This is not very likely. Compared to the five-year period before 2000, corn prices in 2000 were very low and isoglucose prices remained either at the same level or lower. This implies that before 2000 processing and profit margins were even lower than in the year 2000. At the same time during this period, isoglucose production was still increasing. From this, it can be concluded that US isoglucose production has been profitable in 2000.

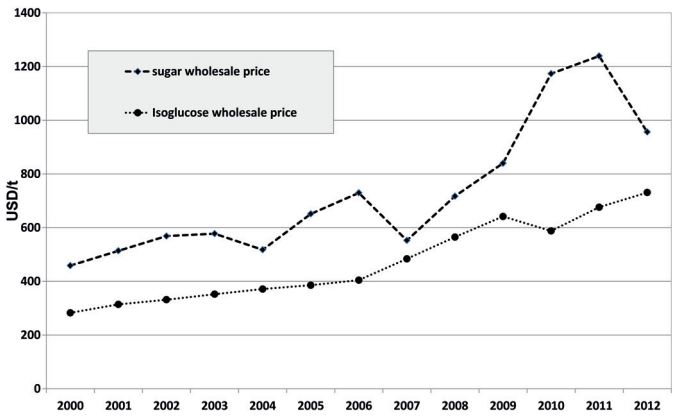

Fig. 3: Evolution of US sugar and isoglucose prices in USD/t [Source: ERS, 2013c]

Therefore the conclusion is that US$200/t is a reasonable estimate for processing and profit margin in the US isoglucose industry.

When it comes to transferring this estimate for the USA in 2000 to Europe today one has to tackle two main issues. First, the conversion process is very energy-intensive. Therefore it is important to take into account that energy prices have gone up significantly since 2000. Secondly, compared to the US, energy prices tend to be much higher in Europe.

Based on cost calculations made by *Wulff* et al. (1987) it is assumed that energy cost per tonne of isoglucose was in the range of US$30/t.[5] When taking US natural gas prices as the indicator for energy prices, an increase of about 50% (EIA, 2013) has to be calculated when considering respective cost in 2012. Furthermore, the resulting figure of US$45/t has to be

5 *Wulff* et al. (1987) also published a calculation on total cost of production for isoglucose. However, since they have analyzed a very small factory in an early stage of the industry development their estimates are not considered to be relevant today, especially as far as capital costs are concerned.

Table 4: Estimation of European processing and profit margin in isoglucose

	2000	2012
Non-energy cost in USD/t	170	210
US energy cost in USD/t	30	45
Equivalent energy cost D in USD/t		80
Total processing cost in USD/t	200	290
Total processing cost in €/t		200

Source: own calculation

adapted to European conditions. German quotes for natural gas (BMWi, 2013) have been used to come up with a scenario figure. The outcome is that, in 2012, gas prices were about 80% higher than in the United States. Hence the equivalent energy cost in the EU is about US$80/t. Assuming an annual 2% inflation rate for the remaining non-energy cost items, the entire calculation for processing and profit margin looks like this (Table 4).

Preceding calculations lead to the result that, under European conditions, current processing and profit margins in isoglucose production are at about €200/t. When using this figure

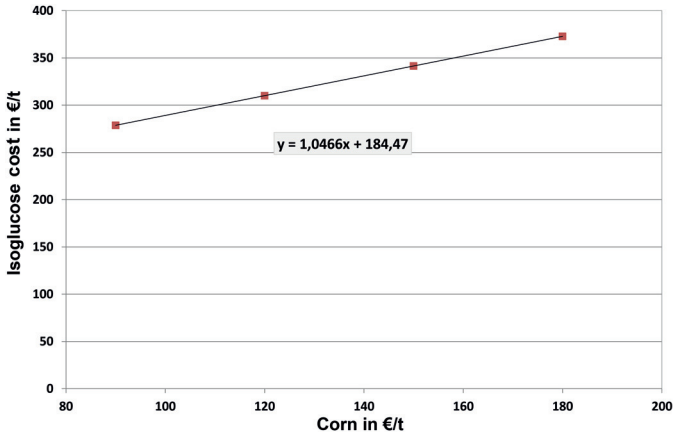

Fig. 4: Total cost of production of isoglucose depending on corn prices [Source: author's compilation]

and the concept of "net raw material costs," as laid out in Table 3, total cost of production for isoglucose can be derived – depending on the price of corn (Fig. 4).

Figure 4 illustrates how isoglucose production in Europe would be only moderately affected by increases in corn prices: Assuming corn prices go up by 100% from €90/t to €180/t, the cost of production for isoglucose would increase by only roughly 35%. This finding stems from high variable and fixed processing costs and a relatively low share of net raw material costs.

6 Competition between isoglucose and sugar

In order to understand the economics of isoglucose, it is necessary to understand the economics of the interaction between sugar and isoglucose markets. Both products are, to a certain extent, substitutes – but there are a lot of applications, not only in private households where sugar cannot be replaced by isoglucose. Furthermore, due to isoglucose's physical and

biological characteristics, its transport, storage and handling require additional investments as compared to sugar.

Because of these differences in infrastructure needs, the competition between the two products at an individual processing factory is a 0/1 decision: Processors will either use the one or the other. This implies that markets will react relatively slowly. Processors need to be convinced that (a) any major cost advantage of isoglucose over sugar is stable and (b) there is a sufficient supply available. The reason for such reluctance is that processors create a path dependency by moving to isoglucose and they put themselves into a kind of "monopsonistic" market condition – especially as long as the isoglucose industry is "under construction." On the other hand, it also means that, once sugar has been removed from the processors' ingredient list, it will be difficult – if not impossible – for the sugar industry to re-enter those markets.

Isoglucose is usually traded at a discount relative to sugar (Fig. 5) of about €100/t to €130/t; an even stronger spread can be observed in the United States (Fig. 3).

Isoglucose prices displayed in Figure 5 give rise to the assumption that the estimated cost of production for isoglucose

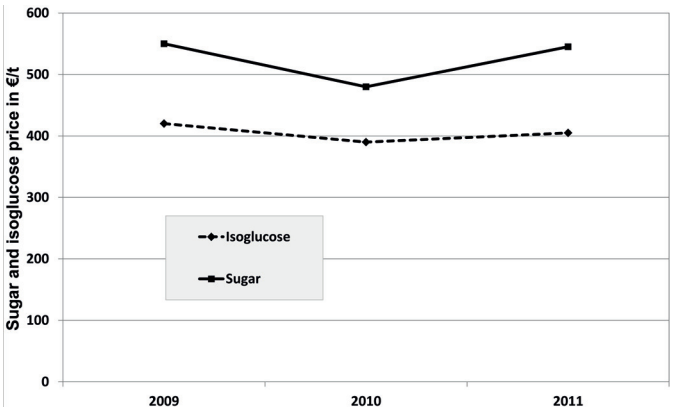

Fig. 5: EU sugar and isoglucose prices [Source: *Wastyn,* quoted from *Driedger* (2013)]

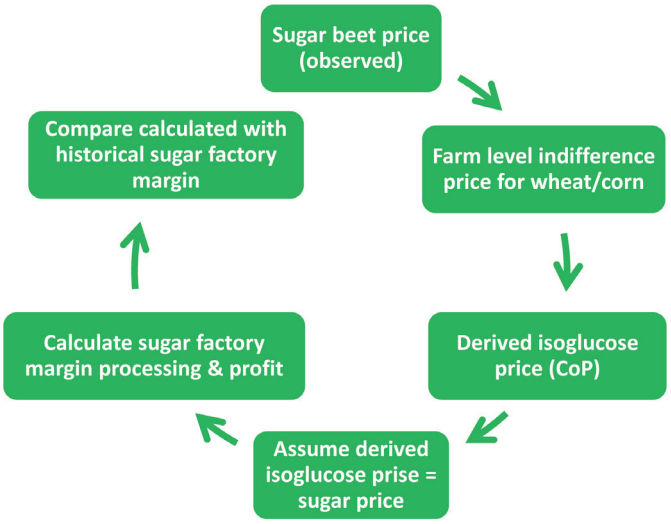

Fig. 6: Scheme to assess competition from isoglucose on sugar market [Source: author's compilation]

(Fig. 4) is not too high because, only at corn prices of €200/t would the cost of production be in the range of €400/t. In 2009 and 2010, corn prices were in the range of €140/t, well below €200/t. Whether the cost estimates are too low or whether isoglucose production was extremely profitable, remains to be seen. Since, during the time span analyzed here, EU isoglucose production was restricted by a quota system, conventional economic wisdom would suggest that profits have been rather high.

It has to be noted that EU sugar prices are significantly above the politically administered EU reference price which is set at €404/t. The main reason is that EU sugar quotas have been defined well below domestic consumption. At the same time import tariffs are still very high and hence, without reduced tariffs there is no economic incentive for international sugar producers such as Brazil to export to the EU. And, so far, sugar imports from ACP and LDC countries, which have tariff-free access to the EU sugar market, have not been high enough to seriously put pressure on EU sugar prices.

In order to understand the potential pressure from increased isoglucose production on the European sugar industry, the likely changes in their processing and profit margins will be calculated. Given the estimate that 25% to 30% of the EU caloric sweetener market, in technical terms, will be available for isoglucose (see Introduction), any major cost advantage of isoglucose over sugar will result in respective pressure on profits in the sugar industry.

When using the publicly available prices for sugar beets paid to growers as well as sugar prices, it is possible to calculate an estimate for the processing and profit margins that the sugar industry has realized. Furthermore, when referring to the range of possible corn prices – which were used to estimate long-term raw material costs in Table 3 – it is possible to calculate growers' *indifference prices* for sugar beets. The indifference price is defined as the price which leads to the same profitability of land use as the alterative crop – in this case, wheat. Wheat is used as the alternative crop because most European beet growers typically do not grow corn but wheat. Since wheat and corn are normally traded at parity, it is reasonable to use wheat prices as a substitute for corn.

In a subsequent step, these derived indifference prices for corn/wheat are used to calculate the total cost of isoglucose by using the formula from Figure 4. Assuming that the isoglucose industry will be ready to sell its produce at a cost price, sugar prices are set to the same level. This sugar price is finally used to calculate a new processing and profit margin for the sugar industry. By comparing historical to calculated margins, the probable economic pressure on the sugar industry can be assessed. In Figure 6, a scheme for this entire analytical process is documented.

Based on a comprehensive research project on the farm economics of sugar beet production done by *Albrecht* (2013), detailed information on on-farm competition between sugar beets and alternative crops is available. His analysis is based on enterprise-level data from regional farm advisory clubs with about 15 to 30 members. This data does not only include crop-specific direct and operating costs, but also calculated

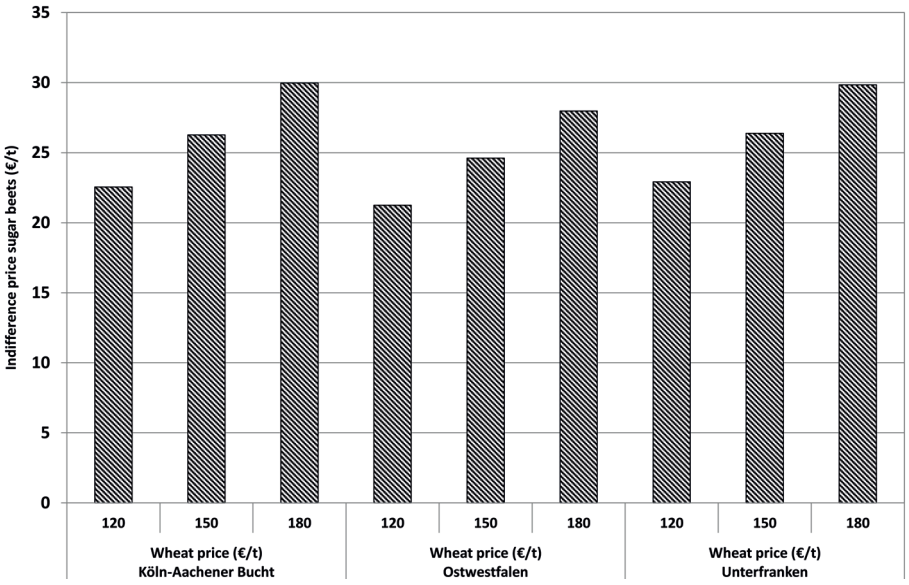

Fig. 7: Indifference prices of sugar beets for selected average farms at different levels of wheat prices [Source: *Albrecht* (2013)]

costs of non-monetary effects such as rotational effects caused by differences in yields according to different previous crops, differences in tillage operations between the different crops and the like.

Even though, in actual fact, sugar beets are competing against rapeseed in most of the cases, respective figures have been converted to equivalent wheat prices. This is necessary because a wheat/corn price is needed in order to calculate indifference prices for isoglucose. The conversion of rapeseed indifference prices to wheat prices was done by using the long-term average price ratio between wheat/corn and rapeseed which is about 1:2.[6] In Figure 7, respective values for farms in three major sugar beet regions of Germany are displayed.

While there is a little variation in absolute figures for indifference prices, the pattern is the same across the sample: With any increase in wheat prices of €30/t, respective indifference prices for sugar beets go up by about €4/t. At wheat prices of €180/t, it will only be profitable for growers to produce sugar beets if they are priced at about €30/t. In the Ostwestfalen region, this threshold is a little lower, roughly €28/t.

For the period 2009 to 2011, there is data available from one of the main European sugar companies, Nordzucker, regarding the prices paid to its agricultural suppliers (see first column in Table 5). When using sugar prices as displayed in Figure 5, the processing and profit margin of the sugar factory can be calculated (see fourth column in Table 5). It is assumed that the average sugar content is 18%, which means that 5.6 t of beets are needed to produce one tonne of sugar. Since, technically, available sugar content is below the chemical content, this figure underestimates raw material costs. In fact, slightly more than 5.6 t of beets are needed to produce one tonne of sugar. On the other hand, it has to be kept in mind that sugar sales are not the only revenue source for sugar companies; among other things, they are selling sugar beet pulp as a cattle feed. This implies that, on the revenue side, the calculation above underestimates the actual economic performance of the sugar industry. It is assumed that the net effect of the two "mistakes" is to level each other off.

Given the fact that sugar beets must be transported from the grower to the factory, the processing and profit margin is overestimated by this calculation. No reliable figure is available to estimate this cost item. Since the same holds true for the corn that must be shipped to the isoglucose factory, as calculated in table 6 below, it is assumed that both omissions have a similar effect on processing and profit margins. This, in turn, implies that the gap between the two margins remains the same while the absolute level of margins is overestimated in both cases.

In a final step, beet prices paid to growers in 2009 to 2011 are used to calculate growers' indifference prices for wheat/corn. Those corn prices are then put into the formula to estimate cost of production for isoglucose (Fig. 4). Assuming that the isoglucose industry is ready to sell its produce at this price, a benchmark for the sugar industry can be calculated by using said prices and the raw material costs of the sugar industry to generate hypothetical processing and profit margins (see second last column Table 6). In order to reflect the fact that sugar beet prices are being agreed upon a year ahead of sugar sales, sugar prices from the subsequent year are used here. What should be noted is that raw material cost for isoglucose as well as for sugar are underestimated because they do not include transport and logistics costs, both being based on farm gate prices. Since this omission is relevant for both products and no figures are available, it is assumed that the net effect on the changes in processing and profit margin will be zero.

As Table 6 shows, the sugar industry would only be able to compete with isoglucose if it were able to reduce the previous processing and profit margin by about €150/t of sugar or some 40%. This result is in line with the observed spread between sugar and isoglucose prices in the EU (Fig. 5). The rather low value for the needed reduction in 2009 is considered an outlier because, on the one hand, sugar beet prices were relatively high (about €36/t) while the corresponding sugar price was relatively low at €480/t.

Whether or not such an adjustment would or wouldn't be feasible cannot be answered without further in-depth information on sugar industry economics. In any case, it's clear that such a reduction would constitute a major challenge to the European sugar industry.

Table 5: Economics of sugar production in €/t

	Beet prices paid to growers	Raw material cost sugar industry	Sugar prices (subseq. year)	Processing and profit margin
2009	36	203	480	277
2010	33	182	550	368
2011	49	275	700	425

Source: DNZ (2013), own compilation

6 Calculated from figures of the German AMI on the exchange and wholesale prices (Agrarzeitung).

Table 6: Indifference prices for wheat/corn and resulting margins in the sugar industry at different sugar beet prices

	Sugar beet price in €/t	Indifference price wheat / corn in €/t	Calulated Isoglucose price in €/t	Processing and profit margin sugar factory in €/t	Reduction of sugar factory margin in €/t	Reduction of sugar factory margin in %
2009	36	228	423	220	57	21
2010	33	204	398	216	152	41
2011	49	334	534	259	166	39

Source: own calculation

7 Conclusions

Based on the analysis presented here, the following conclusions can be drawn:

I It will be possible to profitably produce isoglucose from corn for €310/t at corn prices of €120/t; when corn is traded at €180/t, the respective total cost to produce isoglucose will be about €370/t.

II Considering recent sugar prices and total cost estimates for isoglucose, isoglucose will be a very attractive product for current industrial sugar users; in particular those who are already using liquid sugar.

III In order to be able to compete with isoglucose, the sugar industry will have to reduce its current processing and profit margins by about 40% or €150/t of sugar. However, this would only be necessary for the 25% to 30% of their current sugar markets in which sugar and isoglucose really compete. Whether the sugar industry will be able and ready to do so remains to be seen.

IV Given the 0/1 decision pattern of sweetener users, there is a very strong incentive for the sugar industry to prevent industrial sugar buyers from switching to isoglucose. The sugar industry has to assume that such a step will be very hard – or even impossible – to reverse.

V Under these conditions, three different scenarios for the sugar industry and respective strategies can be envisioned:

a) The necessary reduction in processing and profit margin is so great that receipts from sugar sales in this segment would not cover variable processing costs – let alone fixed costs and profits. In such a situation, it would theoretically be possible for the sugar industry to opt for cross-subsidizing from other sugar sales in order to compete with isoglucose. However, since this is, economically, a very unattractive option, it can be considered a very unlikely strategy.

b) The reduced margin allows for the covering of variable costs but not fixed costs (entirely). A strategy to purely maximize the profits of the sugar industry would be to decide to give up this market segment in the long run and to not try to compete with isoglucose.
However, those sugar companies that are farmer-driven may consider cross-subsidizing sugar sales in the potential isoglucose market by accepting lower profits for the entire sugar business. The rationale for such a behavior: No need to reduce sugar production, no need to reduce sugar beet acreage, no need to tell individual growers that they are no longer needed. What makes such a strategy relatively easy to pursue? The economic cost is postponed because only in the long run do major re-investments in machinery and buildings occur. On the contrary, isoglucose investors have to recover investments from the very beginning; they do not have the option to ignore fixed costs.

c) The margin can be reduced by reducing profits accordingly. In other words, it is possible, in the long run, to at least cover variable and fixed costs with the new margin. In such a situation, it is very likely that the sugar industry will offer prices to their current sugar users – those who technically have the option to switch – which will prevent them from moving to isoglucose.

VI These considerations make it rather obvious that even though isoglucose is a very competitive product, it is far from clear whether it will be possible for isoglucose investors to prevail in the competition with the sugar industry.

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