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RESEARCH FOR AGRI COMMITTEE - THE POST-QUOTAS EU SUGAR SECTOR

STUDY

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Abstract

The liberalisation of the sugar market in the EU will bring about changes in the sugar sector. Elimination of production quotas and the minimum price for the purchase of sugar beet will affect competition and sugar production. Foreign trade will play a key role in the market balance. The EU market will become strongly linked to the world market. The sugar sector is of strategic importance and CAP market policy should include instruments that allow the maintenance of sugar production.

CONTENTS

LIST OF ABBREVIATIONS

ACP	African, Caribbean and Pacific Group of States
AGRI	Agriculture and Rural Development Committee
APO	Association of Producer Organisations
CAP	Common Agricultural Policy
CEFS	European Association of Sugar Producers
CIBE	Confédération Internationale des Betteraviers Européens
CMO	Common Market Organisation
CXL quota	Preferential quota linked to enlargements of the EU
EBA	Everything but Arms
EC	European Commission
EJ	Energy Joule
EPA	Economic Partnership Agreements
ERS USDA	Economic Research Service U.S. Department of Agriculture
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FRB	The Federal Reserve Board of Governors in Washington DC
LDC	Least Developed Country
LFA	Less Favourite Area
MERCOSUR	Mercado Común del Sur, The Common Market of the South
OECD	The Organisation for Economic Co-operation and Development
PO	Producer Organisation
RDP	Rural Development Programme
r.s.e.	Raw Sugar Equivalent
SAPS	Single Area Payment Scheme
SPS	Single Payment Scheme
TFEU	Treaty on the Functioning of the European Union
TTIP	Transatlantic Trade and Investment Partnership
VECM	Vector Error Correction Model
VAR	Vector Autoregression Model

w.s.e.   White Sugar Equivalent

WTO   World Trade Organisation

WB   World Bank

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Background

In the European Union (EU) the sugar industry is a strategic division of the food sector. Sugar is the primary sweetener and maintenance of production is an important element of food security. The sugar industry is of economic, environmental and social importance in the EU.

The sugar market in the EU is one of the most regulated food markets, and market regulations strongly interfere with the market forces. The regulatory system is based on production quotas, official prices and regulations of foreign trade. The quota system will end as of 30 September 2017[1]. Reform of this system will lead to big changes in the functioning of the sugar industry in the EU.

Elimination of sugar production quotas and isoglucose and the minimum purchase price of sugar beet will cause a **significant change in market conditions**. This applies to the production and distribution of sugar, and therefore the elimination of production quotas will change the rules of competition between producers (oligopolistic behaviour), the risk posed by substitute products, the possibility of entry of new players, and the bargaining power of growers (position in the supply chain, because of the elimination of the minimum purchase prices).

In the season 2015/2016 the amount of sugar produced in the EU (13.5 million tonnes) is lower than the demand on the internal market and the rules on non-quota disposal of sugar are restrictive. Elimination of production quotas will mean that the internal market more supplied from production.

Other instruments of market regulation, above all in the field of foreign trade, will not change. As a result of current trade agreements, developing countries will still be able to export sugar to the EU under preferential conditions. Elimination of production quotas and unchanged regulations of foreign trade will mean that foreign trade will play a greater role in the balance of the market in the EU. In addition, the liberalisation of the conditions of production will ensure that the EU internal market will be more strongly linked to the world market. The impact of the world economic situation will be stronger than ever, as shown by the experience of recent years.

The **global sugar market** in the long term will show moderate growth development, and the determining factor will be the increasing demand. World demand will grow by approximately 2% per annum and the growing population and changing consumption patterns in developing countries will have the key impact on the level of growth in demand. Growing demand will be a stimulator of production. Production of raw cane sugar will increase in many regions. The potential for increase in production occurs mainly in South America. In Africa, the increase in production will require large investments, and in Asia production is characterised by high volatility due to climatic conditions. Growing global demand creates an opportunity for the sugar sector in Europe, including in the EU.

World sugar prices are highly volatile and the business cycle lasts approximately five years. Sugar prices are determined by the supply and demand situation (e.g. the level of closing stocks) and are correlated with oil prices. These trends will continue in the future, and therefore the forecasts of developments in the world and the EU markets should take into account cyclical economic fluctuations. Monitoring of these trends and the ability to

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[1]   http://ec.europa.eu/agriculture/sugar/index_en.htm

interpret and use this information should be an important element of market regulation (e.g. market monitoring).

Aim

The aim of the study on "The post-quotas EU sugar sector" is to look at the options for the future EU sugar policy. The study includes:

- General overview of the current situation on the EU and international sugar markets.

- Scenarios of development of the sugar market in the EU after 2017.

- Proposals for future sugar market regulations in the EU.

Key findings

There are **three scenarios** presented concerning the development of supply-demand situation in the EU, depending on the economic situation and the level of prices on the world sugar market. It also includes the level of fuel prices, which will determine the consumption of sugar beet for bioethanol production.

- The **first scenario** assumes that the world prices of white sugar in the long term will be maintained at the current level (EUR 350 per tonne). In conditions of relatively low prices restructuring would be required in the EU sugar industry. The area of sugar beet cultivation will decrease and this decrease would be compensated by higher yields per hectare. Reduced consumption of sugar beet for bio-ethanol production would cause a slight increase in sugar production (to 17.0 million tonnes). Owing to the decline in demand in the internal market (to 17.1 million tonnes) a reduction in imports and increase in exports would occur. Self-sufficiency in the EU market would improve. Sugar prices would oscillate around EUR 400 per tonne.

- The **second scenario** assumes a bigger long-term fall in prices on the international market (EUR 250 per tonne), which would put pressure on prices in the EU. In these market conditions, deep restructuring of the sugar industry in the EU would be necessary. The cultivation of sugar beet and sugar production would remain only in the most competitive regions, mainly in the EU-15. Sugar production would decrease (to 16 million tonnes) and substantial imports would be necessary to meet demand. EU would be a net importer. Deep restructuring transformation would result in the elimination of many of the sugar factories and the reduction of the area under sugar beet leading to very adverse economic, social and environmental effects.

- The **third scenario** envisages that world sugar prices will rise (500 EUR per tonne) due to the decrease of supply (e.g. weather conditions) or the improvement of the overall economic situation and the increase in fuel prices. This is an optimistic scenario, as in such market conditions there is no risk for the sugar industry in the EU. World prices would be higher than the reference price, and in such conditions it would possible to increase the production of sugar beet and sugar. It is expected that sugar production in the EU could rise to approximately 18.7 million tonnes and would exceed domestic demand. Imports would be reduced to the duty-free quotas, and the surplus supply would be exported (approximately 4 million tonnes).

The liberalisation of the EU sugar market would result in a stronger integration with the world market and the effect of this would be greater volatility of market conditions (including price) and an increased risk of doing business. The sugar industry in the EU is of economic, environmental and social importance. Therefore, market policy should include a broad set of instruments and regulations (i.e. a safety net) which <u>would</u> enable sugar production in the EU to be maintained, which <u>would</u> be also a feature of food security policy. The policy towards the sugar sector should include income support for farmers, regulation of foreign trade, the possibility of intervention, promotion and monitoring of the current market situation.

INTRODUCTION

In the European Union (EU) the sugar market is one of the most regulated markets in the agri-food sector, since the production of sugar and its special distribution are largely the result of a protectionist market policy. The basis of market regulation is administrative reduction of supply (production quotas), protectionist foreign trade policy and official prices. The sugar sector in Europe has a long tradition and is of great economic, social and environmental importance, and it is an essential element of food security policy. In Europe, sugar beet is the crop with the highest productivity per unit of area, and the products can be used for animal feed or energy production. The **sugar industry** is an important sector of the food industry. Sugar produced from sugar beet remains the primary sweetener, despite the development of the market for starch syrups and low-calorie sweeteners. The **great social importance** of the sector stems from the fact that the production of sugar beet is a source of income for a large number of farmers (growers), and the sugar industry and many service companies contribute to the national income and jobs. Sugar beet production is an **important element of the sustainable development** of agriculture, as it increases its biodiversity and helps to keep agricultural land in good condition.

Elimination of production quotas will result in big changes in the functioning of the sugar sector which will have a **wide variety of economic, social and environmental effects**. Taking into account international conditions, in particular competition from cane sugar and liabilities arising from multi- and bilateral trade agreements, there are likely to be big **changes in the balance of sugar in the EU**. In the changing external conditions foreign trade policy and international economic relations will have a very big impact on the sugar sector. Scenarios of the development of the sugar sector should take account **two basic elements**: changes in the EU market after the reform of the CM regulation and changes in the situation on the international market and conditions of foreign trade. The great economic, social and environmental importance indicates that future policy towards the sector should include solutions that will enable the cultivation of sugar beet and sugar production to be maintained, at least in the most efficient and competitive regions of the EU.

The aim of the submitted expert opinion is to review the current status of the EU and world sugar sectors (§1 to §3 Sections), and to assess the economic, social and environmental impacts of the elimination of sugar production quotas within the prescribed scenarios (§4), and the proposal to implement regulations that would mitigate the negative effects of changes in regulations, potential falls in prices and lower profitability of sugar beet growing and sugar production (§5).

1. CONTROL SYSTEM OF THE SUGAR MARKET IN THE EU AND ITS REFORM

1.1. Market regulations in 2000-2005

Regulation of the EU sugar market was introduced in 1968[2]. The market policy objectives were: guarantee of self-sufficiency, as an element of food security and price stabilisation ensuring profitability of sugar beet growing and sugar production profitability. By this time most of the countries of Western Europe were sugar importers, and a protectionist market policy meant that the EU has become a major producer and exporter. By 2006, the general principles of regulation of the market had not changed significantly, as the MacSharry reform [1992] and Agenda 2000 did not introduce any specific reforms Some changes related to the regulation of foreign trade, as they were the result of the accession of additional member states to the EU and the liberalisation of world trade in agricultural products at the forum of the GATT / WTO[3]. In 1973 the United Kingdom joined the EEC, and it had preferential trade agreements with the ACP countries and India.[4]

In **2000-2006**, the market regulations in the sugar sector included the following instruments[5]:

- The amount of sugar production to supply the internal market (A) and export refunds (B). Development of non-quota sugar (out of quota) included: exports to third countries without subsidies by the end of the season, consumption on non-food purposes or credit to the quota production in the next season,

- Official prices included the official minimum buying price of sugar beet with standard sugar content of 16%: A - EUR 47.67 per tonne; B - EUR 32.43 per tonne and the intervention price for sugar EUR 631.9 per tonne.

- Regulations of foreign trade included the protection of the market, export support and monitoring of turnover. WTO quota of subsidised exports amounted to 1.3 million tonnes and the value of the support was EUR 497 million. The market was protected by tariffs approximately 419 EUR per tonne and non-tariff tools. Preferential and import tariff quotas granted to various groups of countries on the basis of multi- and bilateral agreements:

  – duty free quota granted to LDCs as part of the EBA / EPA,

  – duty free quota granted to the ACP countries and India (approximately 1.3 million tonnes),

  – duty free quota granted to the Balkan countries (0.38 million tonnes),

  – preferential CXL tariff (0.68 million tonnes) at a reduced duty of EUR 98 per tonne.

- The regulation also included instruments to stimulate domestic demand and provided for the possibility of intervention in supply purchase.

Market adjustments were characterised by high efficiency, because the market remained balanced and there was no need for intervention purchases of surplus supply, as was the

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[2] Council Regulation No 1009/67/EEC of 18 December 1967 on the common organisation of the market in sugar.
[3] WTO Uruguay Round, Agreement on Agriculture, https://www.wto.org/english/docs_e/legal_e/14-ag_01_e.htm, 19.01. 2005.
[4] British Commonwealth Sugar Agreement.
[5] Council Regulation (EC) No 1260/2001 of 19 June 2001 on the common organisation of the markets in the sugar sector, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001R1260&from=EN.

case in the milk market. The regulation was self-financing and did not encumber the EU budget, as producers and growers paid their dues, which financed the export refunds.

1.2. Market regulations in 2006-2015

The regulations of the EU sugar market in force until 2005 have been criticised for the consequent high prices on the internal market and low competitiveness on the international market, and they did not encourage growers and producers to reduce costs and improve efficiency. Subsidised exports from the EU increased supply on the world market and world prices remained at a low level, which negatively affected the economic situation of developing countries. In 2005, WTO at the request of Australia, Brazil and Thailand challenged the EU's export subsidies.[6] In **2006-2010** the European Institutions, taking into account the need to improve the competitiveness of the sector, the position of the WTO as well as the interests of participants in the food market, introduced reform of market regulation[7]:

- **Production quotas A and B** were combined into one amount, which currently amounts to approx. 13.5 million tonnes, against 17.4 million tonnes in 2005 (Table 1).

- The **minimum buying price of sugar beet** was reduced to EUR 26.26 per tonne. Lower income of growers was partially compensated for by direct payments[8] not related to production. The EU devoted EUR 1542 million per year to this form of support in the period 2007-2014. The intervention price for sugar was replaced with a reference price (EUR 404.4 per tonne).

- The aim of the reform was **restructuring** the sugar sector. The cultivation of sugar beet and sugar production were concentrated in regions with favourable climatic and soil conditions. A restructuring system involving renunciations of the production quotas in exchange for financial assistance was introduced to provide incentives to manufacturers with the lowest competitiveness to reduce production. The **restructuring fund** was financed by the manufacturers and they paid to it restructuring charges in the amount decreasing with time. Then the collected funds were paid to producers in order to alleviate the economic and social effects of ending production. As part of aid for the restructuring, approximately 10% of the funds were reserved for growers and entities providing services for growers. Regions particularly affected by the restructuring could count on the so-called aid for diversification.

- The reform introduced relatively small changes in **foreign trade**. The EU market is still protected by high tariffs, but a number of preferential quotas are also used, mainly granted to economically developing countries (ACP, LDCs), as well as the CXL quotas and granted to the Balkan countries. Reductions in the amount of production resulted in an increase in the share of imports in the market supply. At the same time there was the need for development of out of quota sugar. Export refunds could be paid under the WTO quota, but in 2008 they were suspended.

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[6] European Communities – Export Subsidies on Sugar, AB-2005-2, WTO, 28 April 2005.
[7] **Council Regulation (EC) No 318/2006** of 20 February 2006 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3Al60041. **Council Regulation (EC) No 319/2006** http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R0319&rid=1
Council Regulation (EC) No 320/2006 of 20 February 2006 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R0320&from=EN. **Regulation (EU) No 1308/2013** of the European Parliament and of the Council of 17 December 2013 http://eur-lex.europa.eu/search.html?DTN=1308&DTA=2013&qid=1464169606113&DB_TYPE_OF_ACT=regulation&DTS_DOM=EU_LAW&typeOfActStatus=REGULATION&type=advanced&lang=en&SUBDOM_INIT=LEGISLATION&DTS_SUBDOM=LEGISLATION.
[8] In 2015 payments connected to payments production for sugar beet were introduced in some EU Member States.

- Supporting instruments to maintain the balance of the market did not change. **Intervention buying-in** may be up to 600 thousand tonnes of sugar. The intervention price is 80% of the reference price. Furthermore, there are activities such as transfer of produced surpluses for the next season and support of private storage.

Table 1: Selected elements of the sugar market in the EU

Specification	2006/07	2007/08	2008/09	2009/10	2015/16
The amount of production [thousand tonnes]	17,440.5	16,599.1	13,468.8	13,336.7	13,529.6
The reference price for white sugar [EUR / t]	631.9	631.9	541.5	404.4	404.4
The reference price for raw sugar [EUR / t]	496.8	496.8	448.8	335.2	335.2
The minimum price for beet sugar [EUR / t]	32.86	27.78	27.83	26.29	26.29
Production charge [EUR / t]	-	12	12	12	12
The restructuring amount [EUR / t]	124.6	173.8	113,3	-	-
The restructuring aid [EUR / t]	730	730	625	520	-
Sugar payments [million]	907	1,542	1,542	1,542	-

Notice: In 2011-2014, market regulations were the same as in the season 2015/2016, but in 2013 Croatia joined the EU and the amount of production was increased.
Source: Council Regulation (EC) No 318/2006, Regulation (EU) No 1308/2013.

Box 1: Impact of production quotas on market functioning

The market policy of the EU sugar industry has a considerable impact on the market forces. The principle of administrative supply reduction can be illustrated using the law of supply and demand. Supply S-and demand-D curves define a market equilibrium E. If determined equilibrium price P is low and does not ensure the profitability of production, and the supply is high Q_0 and there are problems with its development, the administration may impose supply limits. The amount of production is "*rigid*" supply curve 'S'. The introduction of lower production limits $S'=Q_1$ in the conditions of stable demand D sets a new market equilibrium E 'and rising prices P' ("*pension quota*") (**Annex 1**). The economic experience of the EU clearly showed that the mere introduction of production quotas did not guarantee **stabilisation of the market**, since on both the milk and the sugar markets other market regulation mechanisms (e.g. customs protection, export support, support for stimulating demand on domestic market, development of out-of-quota sugar) were necessary.

Moreover, the experience of recent years, including the sugar market, shows that the production quotas do not guarantee **price stability**. The amount of production is much smaller than the production potential of the sugar industry and in conditions of high production problems occurred with the development of non-quota sugar. The EU market is linked to the world market since imports account for a large share of supply and non-quota sugar was largely exported.

Box 2: Production possibility frontier in context of production quotas

Production quotas are important in the context of economic efficiency, which is a precondition for building sustainable competitive advantages. Efficiency is understood as the maximisation of production resulting from the proper allocation of labour and capital. The effective allocation shows the limit of production capacity, i.e. the maximum production with the resources available. The company (industry) is effective if the increased production of goods S requires a reduction in the production of goods M. The increase in production S requires more funds and thus there remains lower amount of resources, which can be used for the production - M. Technological progress and restructuring enables the limit to be moved from production SM to S_1M_1. Then it is possible to increase production with the inefficient development of used resources. This process may be limited by the administrative determination of the limits of supply PQ_1 and PQ_2, which are smaller than the limit of production (potential of sector) (**Annex 2**). Business entities need to adapt to these market conditions by carrying out restructuring. The result may be a disorder of the functioning of market mechanisms and such conditions increase with imperfect competition, which is not a desirable phenomenon.

Box 3: Impact of tariffs reduction on the market situation

Internal market situation has a big impact on the EU supply-demand relations. If world prices are lower than prices on the internal market, the introduction of production quotas makes economic sense only if high tariffs are maintained. The efficiency of production quotas is therefore dependent on other market regulation instruments. Protectionist policy towards the sugar industry in the EU guarantees the maintenance of production, but has a negative impact on the situation on the world market. A key element of the regulation is **customs protection**. The impact of trade liberalisation and market regulation on prosperity in the economically developed countries and which are net importers can be illustrated graphically (**Annex 3**). Prices in the domestic market PD_1 are the result of the relationship between supply D_1 and demand S_1, and the balance of the market is provided by imports D_1-S_1. Internal market prices are higher than world prices PW_1, and determine the duty t and transportation costs. In simplified form, domestic prices correspond to the world price plus the duty $PD_1=PW_{1+t}$. The duty reduction causes reactions on the supply and demand as a result of a fall in domestic prices to PD_2. Lower prices cause a reduction in the supply of S_2, because inefficient producers will not generate profits. The fall in prices will contribute to growth in demand D_2 and imports D_2-S_2. If the increase in imports would be large it can cause an increase in world prices for PW_2. Reducing the production surplus of sugar producers graphically depicts the area A. At the same time, an increase in the consumer surplus shows the sum of the areas $A + B + C + F$. The decline of customs revenue $C + F$ has a negative impact on the budgetary situation. The effects for the whole economy reflects the sum of the areas $C + E$, which are the consumer benefits reduced for losses of producers and lower budget revenues [OECD, 2007]. The effects of tariff reduction in the sugar sector by 70% in connection with the completion of WTO Doha Round and elimination of production quotas have been analysed. The results showed that sugar prices will fall and further structural changes will be required. However, an increase in the production of sugar is possible [Smit, Helming, 2012].

Box 4: Competition intensity forces in the sugar sector

Market competition is the result of the impact of the **five forces**, which in the sugar sector can be determined as: competition among producers of sugar, bargaining power of suppliers (growers), the bargaining power of buyers (food industry, households), the threat of substitute sweeteners (e.g. isoglucose, stevia), and the threat of entry of new producers (**Annex 4**) [Porter, 2008]. Market regulations limit the impact of some of the forces of competition. Production quotas significantly reduce competition between firms within the industry and preclude entry of new businesses. The threat from imports effectively limited the protectionist trade policy. The sugar market in the EU is a classic oligopoly, as a small group of manufacturers produce a homogeneous product. Production quotas meant that producers of sugar in a small to a little extend could compete with each other by volume production (Steckelberg and Cournot model). The strategy competition of sugar concerns was based primarily on reducing costs and focusing on a specific group of customers (e.g. food factories). The position of sugar oligopoly was strong in relations with growers, despite the trade agreements and the obligation to conclude procurement contracts and the operation of the minimum purchase price of sugar beet. Demand for sugar in the EU is stable and inflexible, which is beneficial for producers. Other sweeteners have small shares of the market, and also the production of isoglucose has been limited by the quota system.

2. IMPORTANCE OF THE SUGAR INDUSTRY IN THE EU

2.1. Economic importance

The sugar industry in the EU has a long tradition and, because it is a strategic department of the agri-food sector great economic importance. Sugar remains the primary sweetener in households and the food industry. In 2012-2015 the **consumption of sugar** in the EU amounted to approximately 19 million tonnes, despite the growing market of other sweeteners. **Isoglucose consumption**, which is the main sugar substitute, amounts to approximately 0.7 million tonnes, and its share in the consumption of sweeteners amounts to 3.5% [European Commission 2015].

The sugar industry also produces **other products**: molasses, beet pulp, energy (electricity, biogas) and slaked lime [$Ca(OH)_2$]. It is estimated that by-products account for approximately 10% of the added value of the sugar industry [Řezbová *et al*., 2013]. By-products have economic importance because they are used as feed and energy fuels, while slaked lime is a mineral fertiliser. The cooperation of the sugar industry and agricultural holdings enables the efficient use of by-products for the economic-production benefit and also for the environment. Such cooperation is an example of the practical application of the principles of sustainable development.

Production and processing of sugar beet create **jobs** and play an important role in regional development. In 2014 there were approximately 139.5 thousand sugar beet growers in the EU, while the number of persons employed in the sugar industry was approximately 30 thousand. [CEFS, 2014]. The share of the sugar industry in employment in the food industry in the EU in 2013 amounted to only 0.8% [Eurostat]. Growers and the sugar industry benefit from the services provided by other firms (e.g. transport, mechanisation, seed, plant protection and fertilisers). According to CEFS [2014] the sugar industry provides direct or indirect employment of approximately 180 thousand people. Sugar refineries are located in smaller towns and their economic activity has a positive impact on **regional development**.

Increasing negative impact of human activities on the natural **environment** has enhanced the need to strive towards sustainable development, which implies a conscious shaping of the relationship between economic growth and care for the natural environment. The United Nations Framework Convention[9] on climate change calls for stabilising greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. For the use of energy from renewable sources it has imposed an obligation to meet the sustainability criteria for all entities producing biofuels [Directive 2009/28/EC]. The aim of reducing GHG emission was confirmed by the Paris Agreement of December 2015. Following this agreement the EU wants to increase its efforts to transform itself into a low carbon economy [European Commission COM(2016)110]. **Biofuels policy** in the EU creates new possibilities for sugar beet, which can be the raw material for the production of bioethanol and biogas [Renouf *et al*, 2008]. It is estimated that in the EU and Ukraine in 2010 biomass production from sugar beet enabled the production of approx. 2.9 EJ, while in 2020 this capacity can be increased up to 4.6 EJ [De Wit, Faaij, 2010]. Sugar beet can also be used for the production of biogas. The raw material for its production may be whole plants, leaves (an alternative to the use of fertiliser) and sugar by-products (beet pulp, molasses). **Biogas production** is made difficult by the problem of long-term storage of roots and leaves and their mineral contamination during the harvest.

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[9]   United Nations Framework Convention On Climate Change, United Nations, 1992, https://unfccc.int/resource/docs/convkp/conveng.pdf

2.2. Food security and food safety

Food security covers the following aspects: food availability, food access, utilisation and stability [FAO, 1996]. Food should also meet health safety standards. Sugar is a product of strategic importance because it is the primary sweetener. As a result of reforms in the period 2006-2009 the EU has become a net importer, and a further reduction in production will result in **greater dependence on imports**. A large share of imports in the market supply means that the supply-demand situation in the internal market depends on the situation on the world market. The result may be an increase in **price volatility**, and thus in the risk of doing business. According to the theory of abundance of resources, the EU has sufficient resources of factors to produce sugar and there is no reason to make largely the supply of the internal market dependent on imports.

Health, taste and aesthetic benefits, which are currently of particular interest to consumers and producers, decide the high quality of the food. **Health safety** of food depends on a number of steps: production in agriculture and food processing, storage and distribution. Agricultural production is the first and most important element for the value of food. Production of "*healthy foods*" in agriculture requires the improvement of traditional technologies and/or the introduction of new technologies, extended with elements of environmental protection.

In the production of sugar, **technology** of cultivation of sugar beet is key, as this determines the quality and quantity of raw material in the sugar industry. It is important to observe appropriate standards of cultivation, adjusting production to the soil and climatic conditions to optimise of the productive potential of agricultural holdings without affecting the environmental balance. The correct technology of cultivation of sugar beet corresponds to the principles of sustainable agricultural production. The document determining the conduct of agricultural production in the EU is a code of good agricultural practices, which contains agronomic and legal recommendations and legal standards of agricultural production and environmental protection.

2.3. Environmental importance

The basic principle of **sustainable agricultural production** is appropriate **crop rotation** and **fertilisation** of plants appropriate to the type of soil. Crop production should be based on multi-crop rotation that will ensure soil fertility and erosion protection, enable a good yield and limit weed growth and the development of pathogens. Accordingly, the production results to a lesser extent will depend on the use of chemical production. Appropriate crop rotation and fertilisation should provide a positive balance of soil organic matter and optimal balance of fertiliser, which are important ecological indicators.

The progress of mechanisation, an increase in the use of chemicals and the market conditions meant that many farmers abandoned the classical form of rotation in favour of monocultures. Simplified crop rotation leads to ecological imbalances as a result of more pathogens, reduced soil fertility and weed competition. The negative effects are postponed because current agricultural production primarily takes into account current market requirements and not the future environmental effects of production. In order to prevent such practices, environmental programmes are an important element of agricultural policy, as are the rules of *cross-compliance*. These programmes emphasise importance of rich crop structure and consolidation of sustainable farming patterns. The scale of the implementation of these programmes, however, is insufficient to take care of natural resources used in agricultural production[1011][Uthes, Matzdorf, 2013].

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[10]   Rural Development in the European Union, Statistical and Economic Information. Report 2012, European CommissionUnion, DG Agri 2012;, Rural Development in the European Union, Statistical and Economic

According to the code of good agricultural practice, rational crop rotation should include 3-4 species of plants on light soils and 4-5 species on heavier soils. Different groups of plants have different effects on the environment and therefore in the rotation alongside cereals should be legumes, root crops, oilseeds and fruit and vegetables. The structure of the rotation indicates a high possibility of the allocation of at least a few percent share to the sugar beet crop [Wrzaszcz, 2014].

In Europe, **sugar beet is an important element of appropriate crop rotation** as it has a beneficial effect on the environment by increasing the diversity of crop production as well as maintaining agricultural land in good condition. It has the highest productivity per unit of land. In cultivation, it is recommended to use organic fertilisers. The cultivation of sugar beet is supported by a high level of knowledge of the crop among farmers and specialist machinery. In this context, reducing the area of sugar beet would have a negative impact not only on the market situation, but also on the sustainable development of agriculture.

The **area of sugar beet cultivation** in the world and the EU is steadily falling. This trend should be stopped for economic and environmental reasons. In the period 2000-2015 the share of sugar beet in the crop structure of the EU fell from 2.1% to 1.2% [EUROSTAT, CEFS 2014]. Following the recommendation that sugar beet should not be grown on the same field more frequently than every 4-5 years, its share in the farm cropping can be up to 20-25%. Sugar beet should have a few percent share in the structure of crops in the EU as the current structure of the crop is far from optimal. It emphasises the need to maintain the existing production area in the EU.

There are a number of **arguments in favour of the positive impact of the cultivation of sugar beet** on the natural environment:

- an important element in the rotation of crops,

- production technology incorporating organic fertiliser and calcium,

- inducing production technology to carry out studies on the soil fertility and its pH, preparation of precision fertiliser balances and soil organic matter,

- the ability to use techniques and production systems providing additional benefits for the natural environment, i.e. conservation tillage, integrated production system,

- the ability to multi-use by-products (e.g. leaves as fertiliser and animal feed),

- the possibility of an alternative use for the main product and by-product for non-food purposes, i.e. biofuel,

- fostering the creation of multidirectional agricultural holdings with plant and animal production (closed circuit of organic and fertiliser ingredients within the holding, the effective use of not only the main product, but also by-products),

- the possibility of wider cooperation with the sugar producer (use of molasses and beet pulp as animal feed, as well as slaked lime as fertiliser).

Information. Report 2013, European Commission, Union DG Agri, 2013;, Agri-environment Measures. Overview on General Principles, Types of Measures, and Application, European Commission , Directorate General for Agriculture and Rural Development, Unit G-4 - Evaluation of Measures applied to Agriculture, Studies, 2005.

[11] CAP CONTEXT INDICATORS 2014-2020, Update December 2014, Agriculture and Rural Developement, http://ec.europa.eu/agriculture/cap-indicators/context/2014/full-text_en.pdf. CAP CONTEXT INDICATORS 2014-2020, 2015 Update, Agriculture and Rural Developement, http://ec.europa.eu/agriculture/cap-indicators/context/2015/full-text_en.pdf,

3. ASSESSMENT OF CURRENT AND FUTURE SITUATION ON THE SUGAR MARKET

3.1. Supply-demand situation on the global sugar market

3.1.1. The cultivation of sugar beet and sugar cane

The raw materials for the production of sugar are sugar cane and sugar beet, the production of which showed different trends. In the period 2000-2013 both the area planted and yields per hectare of **sugar cane** increased. As a result, world production increased by 2.6% per year and currently amounts to approx. 1,808 million tonnes. The reason for the higher production is increasing demand from the sugar industry and bioethanol production. The latter consumes approximately 15% of the world sugar cane harvest. In 2013, the biggest sugar-cane producers were: Brazil (739 billion tonnes), India (341 billion tonnes) and China and Thailand (100 billion tonnes) [FAOSTAT, 2013].

Different trends exist in the world production of **sugar beet**. The area decreased on average by 1.9% per year, but the decline was partly compensated by a per-hectare yield increase of 0.6% per year. As a result, annual global production was approximately 250 million tonnes (**Table 2**). Sugar beet is mainly produced in Europe: France (33.6 million tonnes), Germany (22.8 million tonnes), Poland and Ukraine (11 million tonnes). Other big producers include the USA (30 million tonnes), Turkey (16 million tonnes) and China (12 million tonnes) [FAOSTAT, 2013].

Table 2: The global cultivation of sugar beet and sugar cane

Itmes	Unit	2013	2000=100	Average annual change [%]
Harvested area				
Sugar cane	million ha	25.7	132.5	2.0
Sugar beet	million ha	4.6	76.7	-1.9
Yield				
Sugar cane	t/ha	70.5	108.9	0.6
Sugar beet	t/ha	55.9	134.4	2.1
Production				
Sugar cane	million t	1,807.8	143.9	2.6
Sugar beet	million t	255.9	102.3	0.2

Source: Own compilation based on FAOSTAT data.

3.1.2. Global sugar balance

The global sugar market is characterised by long-term dynamics of development. Production and consumption increase by approximately 2% per year. According to FO Licht and FAO-OECD, world production currently amounts to approximately 182 million tonnes r.s.e. (**Table 3**, **Annex 4**). The share of cane sugar (80%) in production is steadily increasing, which is reflected by a change in the production of raw materials [Gocht, 2012]. The biggest producers are Brazil (40 million tonnes), India (28 million tonnes), the EU (17 million tonnes), China (13 million tonnes) and Thailand (11 million tonnes). Sugar production is increasing in developing countries, and stagnating or declining in developed countries (**Annex 6**).

Demand for sugar is generated by households, the food industry and other sectors of the economy (e.g. the pharmaceutical industry, beekeeping). World sugar consumption is approximately 180 million tonnes r.s.e. The increase in demand is determined by the growing population and rising incomes in economically developing countries, and the effect of changes in consumption patterns (*westernization of diet*) [Pingala, 2007]. Average sugar consumption per capita is 25.3 kg. Significant differences in consumption exist between developed countries (33-39 kg / per capita) and developing countries (14.5 kg / per capita). The greatest amounts of sugar are consumed in China (26.3 million tonnes) and India (16.2 million tonnes), but this is mainly due to the large population, since per capita consumption is low. Other large consumers include the EU member states (19 million tonnes) and Brazil (12 million tonnes) (**Annex 7**).

World trade in sugar is covered by protectionist policy, as most countries safeguard their own markets or support exports. The world trade volume amounts to approximately 64 million tonnes r.s.e., which represents approximately 35% of production. In the period 2000-2015 the average annual foreign trade growth rate was approximately 2.5%, and was slightly higher than production and consumption. The largest **exporters** are Brazil (approximately 25 million tonnes) and Thailand (7 million tonnes). Other large exporters include the countries of the Caribbean region and the United Arab Emirates, which is a re-exporter. Sugar **importers** include China (4 million tonnes), Indonesia and the USA (3.5 million tonnes) (Annex 8).

Table 3: World production, consumption and foreign sugar trade

Items	Unit	2015	2000=100	Average annual change [%]
Production	million t r.s.e.	181.7	133.8	2.1
Imports	million t r.s.e.	62.4	148.6	2.7
Consumption & disappearance	million t r.s.e.	179.5	138.3	2.2
Exports	million t r.s.e.	64.3	147.2	2.4

Source: Own compilation based on F.O. Licht's World Sugar Balances.

On the world sugar market, there are large closing **stocks**, which constitute 35-48% of the consumption. Fluctuations in closing stocks are due to changes in production because the demand is increasing steadily. The decrease in production can be caused by adverse weather conditions. Changes of closing stocks are correlated with the phases of the business cycle, which on the world sugar market is five years [Isermeyer, Kleinhanß, 2005], [Szajner, Hryszko, 2013]. In periods of falling prices of sugar cane the least competitive producers decrease their production leading to a fall in total sugar cane production. At this time closing stocks also fall, as the consumption grows. There is a clear statistical correlation between stocks and prices of sugar on the world market (**Annex 13**). The increase in supply, including inventory, results in falling prices. An important factor in closing stocks may also be the price of energy (fuel). Under conditions of high fuel prices and large stocks of sugar, part can be processed into bioethanol.

3.1.3.   World market prices for sugar

3.1.3.1.   *Trends in world prices for sugar*

In the last decade, the world prices of white and raw sugar[12] were characterised by **large fluctuations**. In 2007 the price of white sugar was approximately USD 300 per tonne,

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[12]   White sugar prices – London, contract No. 5, Raw sugar prices – New York, contract No. 11.

while in 2010-2011 it exceeded USD 700 per tonne. From 2012 there has been a downward trend in prices. Analogous directions of changes, but at a lower level, characterised the raw sugar price (**Figure 1**).

Average prices for white and raw sugar have similar cyclical fluctuations of no longer than two years (**Figure 1**). Time scope of analysis does not allow us to state the presence of other variations, however, as indicated in the literature, world sugar prices are also characterised by a variation of approximately five years [Isermeyer, Kleinhanβ, 2005], [Szajner, Hryszko, 2013]. A significant share of the variability of world sugar prices is seasonal fluctuations. Estimated (X-12 ARIMA procedure)[13]. seasonal factors changed over time and the amplitude slightly decreased. The course of the seasonal prices of white and raw sugar is the same: seasonally lowest prices are in the April-June period (**Figure 1**).

Sugar prices are highly volatile and the **price volatility** of raw sugar is generally higher than that of white sugar (**Figure 1**). The estimate of standard deviation allows us to conclude that volatility is not the same over time. The biggest uncertainty as to the future prices took place in 2009-2011. This was a period in which the closing stocks fell to 35% of global consumption, and this may have triggered further speculation on international markets [Cheng Xiong, 2013].

Figure 1: World prices of white and raw sugar
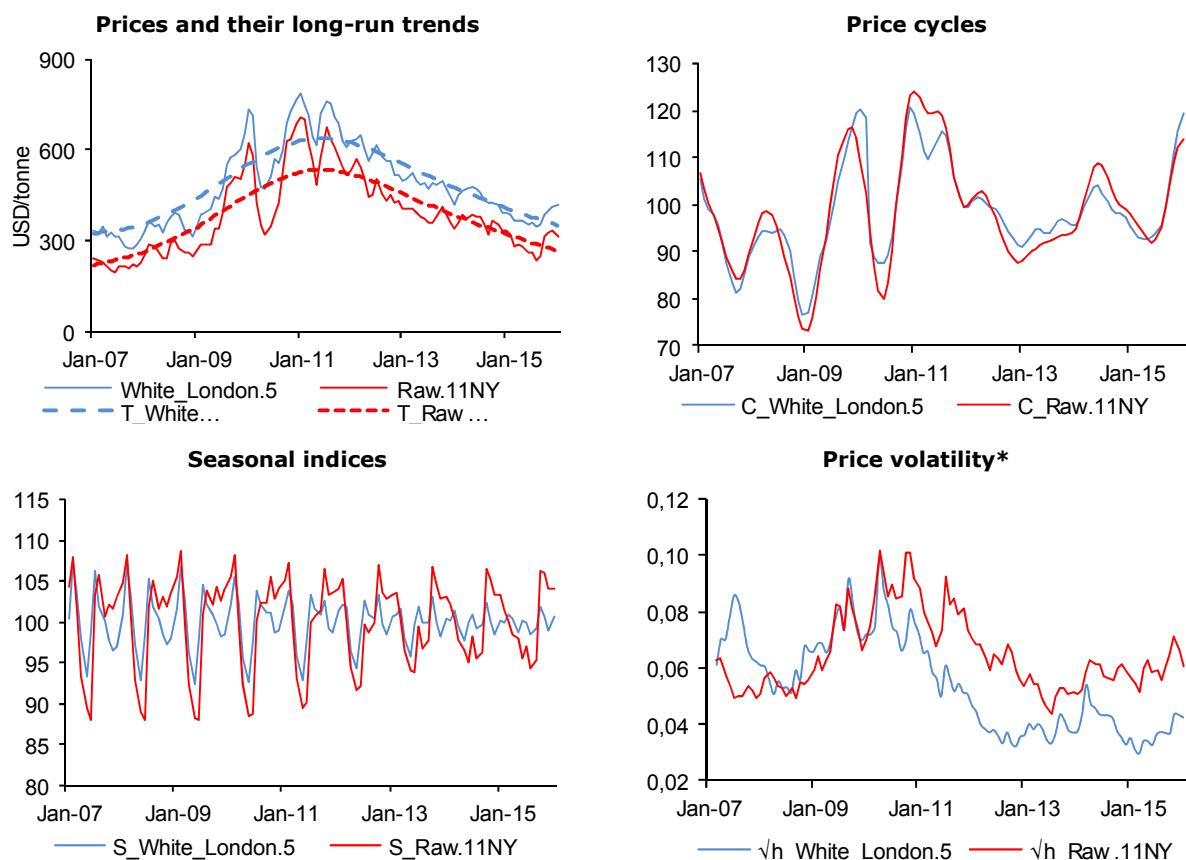
* - √h, standard error from Taylor/Schwert's GARCH(1,1)
Source: Own compilation based on ERS USDA.

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[13] For analysis price dynamics over time the X-12-ARIMA procedure was applied. X-12-ARIMA is the well-known, reliable and widely used seasonal adjustment/decomposition procedure developed by the United States Census Bureau. X-12-ARIMA procedure is divided in two parts. In a first part, RegARIMA models are used to clean the data from non-linearities, such as outliers and calendar effects. In a second part, the X11 algorithm based on set of time domain filters is used to decompose adjusted time series to the trend-cycle, the seasonal fluctuations and the irregular component. More: https://ec.europa.eu/eurostat/sa-elearning/x-12-arima.

3.1.3.2. *The relationship between the prices of raw and white sugar*

World prices for white and raw sugar are **strongly correlated**. Econometric analysis (Johansen co-integration test) confirmed the presence of long-term correlation (co integrate) between the monthly time series of prices for white and raw sugar. The long-term relationship over the period 2007-2015 is strong and is described by the following equation: log_White = 1.36 + 0.85 * log_Raw. Estimates based on the VECM model showed that adjustment to long-term relationships occurs for the price of raw sugar, which means that prices are determined mainly by the demand (white sugar). Adjustments are quite fast, because 31% of the disequilibrium between the prices is corrected within one month. The dominance of the market for white sugar over the market of raw sugar was also confirmed by the analysis of the impulse response and variance decomposition of forecast errors of the VECM model (**Annex 14**), [Tsay, 2010]. They show that shocks in the market for white sugar are quickly transferred to the market of raw sugar and the price of raw sugar in the long run is more than 94% determined by the market shocks of white sugar.The differences between the prices of white and raw sugar (i.e. refining margins) are characterised by **high volatility**, despite the strong links between the above prices. The range of fluctuations in absolute terms amounts to USD 50-150 per tonne. The range of fluctuations in relative prices amounts to 107-164%, or more than 55 percentage points (**Figure 2**). Refining margins are characterised by cyclical and seasonal fluctuations. Generally, the high prices of sugar are regularly accompanied by a decrease in margins and vice versa.

Figure 2: Price differences and price ratio of world white and raw sugar (refining margins)
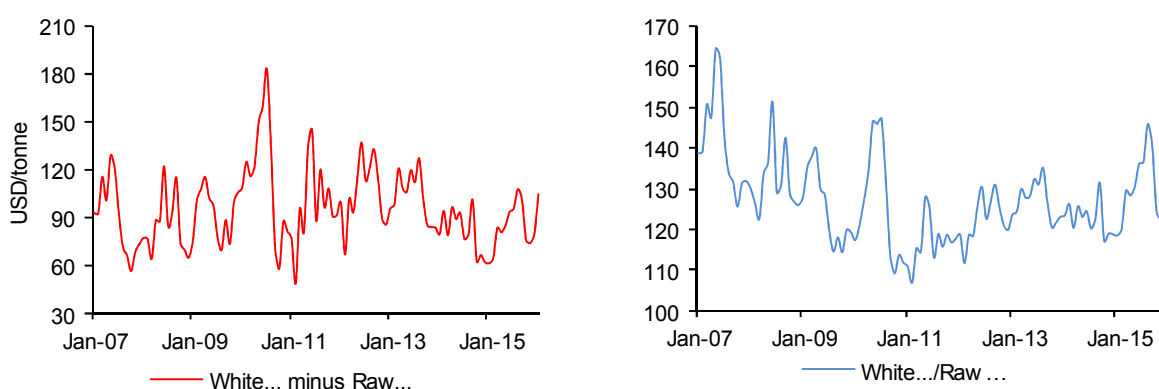
Source: Own compilation based on USDA-ERS data.

3.1.3.3. *Determinants of world prices for sugar*

Demand and supply are the main determinants of global prices of white and raw sugar. **Demand** for sugar is determined by the consumers' income situation and the rules that allow or force non-food use of sugar or sugarcane. These factors in recent years have included the regulation of the production and consumption of biofuels. As regards the **supply**, it is in short periods the result of the reaction by agricultural producers to prices of previous periods and exogenous shocks (weather).This leads to changes in inventories and, as a result, to the reaction of market participants to their level. There is a clear statistical **relationship between prices and stocks**, expressed by the relationship of stocks to consumption (**Annex 13**). In the long term, supply is more elastic. In addition, the price level depends on exchange rates. Graphical analysis does not allow the identification of stable relationships between prices for white sugar, and oil prices, exchange rates and

world economic conditions[14] (**Figure 3**). It seems that among these variables the **exchange rate** has the strongest effect on sugar prices due to the fact that world prices are denominated inUS Dollars. A small positive correlation in sugar prices to **oil prices** should be also noted. Studies show that the increasing use of agricultural raw materials for the production of **biofuels** has led to increased links between energy prices and the prices of agricultural raw materials [Serra, Zilberman 2013]. Similar conclusions can be drawn by analysing the cyclical components of these variables: there is a positive correlation in sugar prices to oil prices and a negative relationship with the USD index.

Figure 3: World prices of white sugar, crude oil prices, broad USD index, world business cycle and their cyclical components

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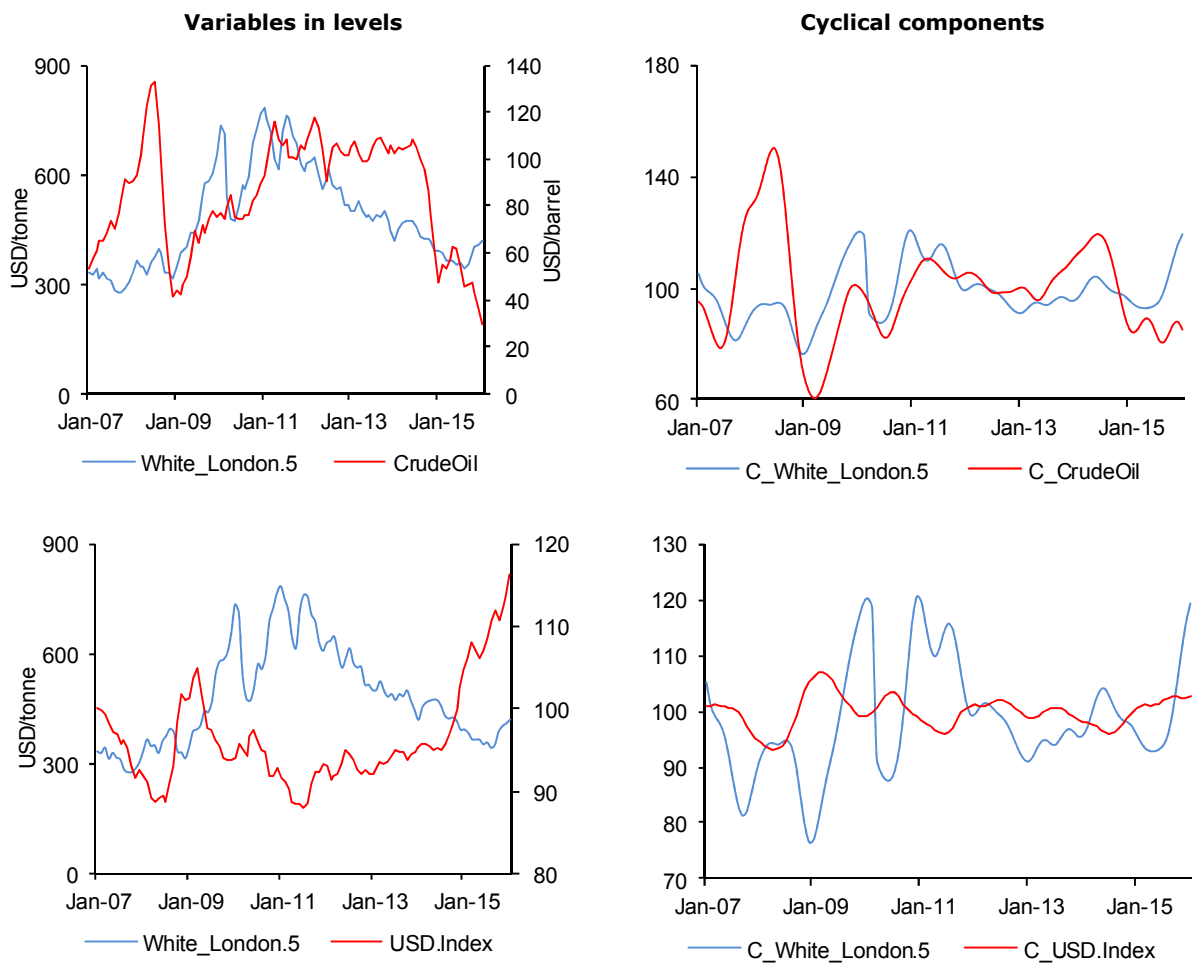
[14]   Crude oil – average crude oil prices according to World Bank; USD Index – Broad USD index according to FRB of St. Louis, Business cycle – GDP for OECD + Major Six NME according to OECD data.
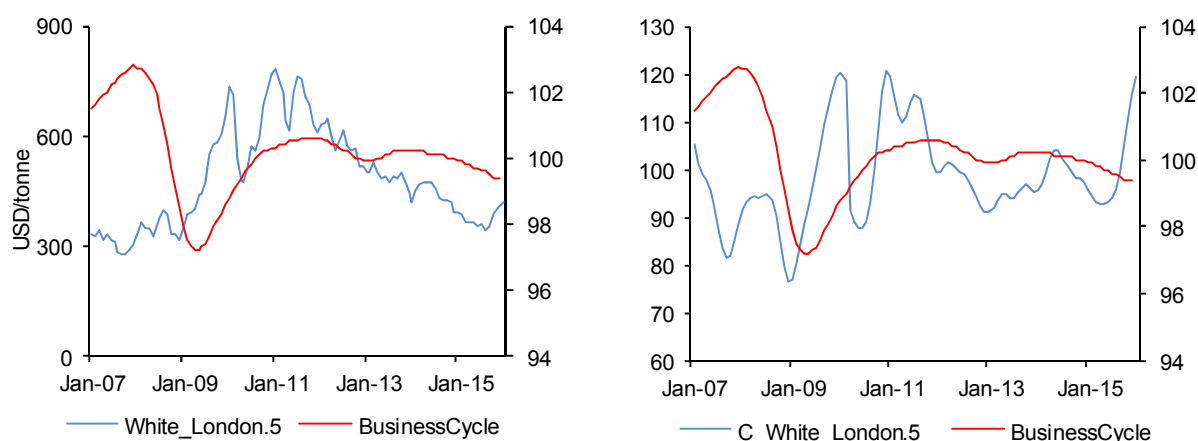
Source: Own calculations based on USDA-ERS, WB, OECD and FRB of St. Louis data.

Box 5: X-12-ARIMA

For analysis price dynamics over time the X-12-ARIMA procedure was applied. X-12-ARIMA is the well-known, reliable and widely used seasonal adjustment/decomposition procedure developed by the United States Census Bureau. X-12-ARIMA procedure is divided in two parts. In a first part, RegARIMA models are used to clean the data from non-linearities, such as outliers and calendar effects. In a second part, the X11 algorithm based on set of time domain filters is used to decompose adjusted time series to the trend-cycle, the seasonal fluctuations and the irregular component.

More : https://ec.europa.eu/eurostat/sa-elearning/x-12-arima

Box 6: VAR-VECM models

Vector autoregression model (VAR) consists of regression of every non-lagged variables on all lagged variables. VAR models are used for stationary data or data which were transformed into stationary series. Its formula is presented below (Tsay 2010):

$$Y_t = \psi D_t + \Gamma_1 Y_{t-1} + \Gamma_2 Y_{t-2} + ... + \Gamma_p Y_{t-p} + \varepsilon_t$$

where Y_t – stochastic processes collected in $n \times 1$ vector, D_t – deterministic variables vector, Ψ – matrix of deterministic variables parameters, Π_i are ($n \times n$) coefficient matrices, p means order of VAR model.

The nonstationary time series are cointegrated if there is a linear combination of them that is stationary I(0). The linear combination is referred to as a long-run equilibrium relationship. To test existence long-term behaviour of series a Johansen cointegration framework was applied. The cointegrating relations become evident if the levels of VAR is transformed to the vector error correction model (VECM) (Tsay 2010):

$$\Delta Y_t = \psi D_t + \Pi Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + ... + \Gamma_{p-1} Y_{t-p+1} + \varepsilon_t$$

where $\Pi = \Pi_1 + ... + \Pi_p - I_n$ and $\Gamma_k = -\sum_{j=k+1}^{p} \Pi_j$, $k = 1,..., p-1$. The matrix Π is called the long-run impact matrix and Γ_j are the short-run impact matrices.

Since the rank of the long-run impact matrix *Π* gives the number of cointegrating relationships in Y_t, Johansen formulates likelihood ratio (LR) statistics for the number of cointegrating relationships as LR statistics for determining the rank of *Π*. Two sequential Johansen procedures used to test for the number r of cointegrating relationships are as follows:

$$LR_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \widehat{\lambda}_i) \text{ or } LR_{max} = -T \ln(1 - \widehat{\lambda}_{r+1})$$

where: LR_{trace} – trace statistic, LR_{max} – maximum eigenvalue statistic, *T* is the sample size and $\widehat{\lambda}_i$ is the *i-th* largest canonical correlation (eigenvalues of the matrix *Π)*. The trace test tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *n* cointegrating vectors. The maximum eigenvalue test tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *r+1* cointegrating vectors.

The correlation of the residuals of the VAR-VECM model equations allows the construction of the so-called structural models. The structural VAR models makes it possible to construct the impulse response function (IRF), determining the distribution in time values of the j-th variable in response to a changes (innovations) of the k-th variable. Most often IRF is presented as a graph showing the change in the reaction of j-th variable a changes (shocks) of the k-th variable equal to one standard deviation of the of k-th variable residuals.

VAR-VECM models allows for testing Granges causality. A variable Y1 is said to Granger-cause Y2 if we can better forecast Y2 using lagged values of Y1 than without them. The modification of Granger causality test, and generalization of this concept, was proposed by Breitung and Candelon (2006). Granger causality analysis in the frequency domain allows answering the question whether causality is the result of the transmission of low or high frequency signals (cycles).

Tsay R.S. (2010) Analysis of Financial Time Series. John Wiley & Sons, New Jersey.
X-12-ARIMA Reference Manual, Time Series Research Staff, Centre for Statistical Research and Methodology, US Census Bureau, 2011,
http://www.census.gov/ts/x12a/v03/x12adocV03.pdf.

Further econometric studies (co-integration Johannes' test) did not indicate any long-term relationship between the prices of white sugar and the index of USD and oil prices. The Granger causality test (based on the model of VAR for 1 difference) and Breitung-Candelon causality test [Breitung, Candelon 2006] (1 differences and data without deterministic trend) did not show that oil prices or changes in the index of USD preceded changes in the world sugar prices (i.e. that they were the cause for them). The lack of identified relationships may arise from the lack of stability of the compounds between sugar prices and these variables. Confirmation of this can be found in **Figure 4**, which shows the correlation coefficients between the moving rows of sugar prices, and the other rows of the 24 months window. Left figure shows the correlation coefficients for the levels and the right for the first differences (seasonally adjusted data and logarithmised). It can be concluded that there is a high probability of structural changes (shocks), of which the most visible are in 2008/2009 and 2012/2013. It may also suggest the presence of non-linearities and threshold effects on the sugar market [Balcombe, Rapsomanikis 2008; Chen, Saghaian 2015]. It is accompanied by increased volatility in certain periods, and low levels in others.

For example, a strong positive correlation between sugar prices and oil prices occurred in 2009-2010, followed by gradual weakening before intensifying again (**Figure 4**).

Figure 4: **24-month rolling correlations between white sugar prices and other variables**
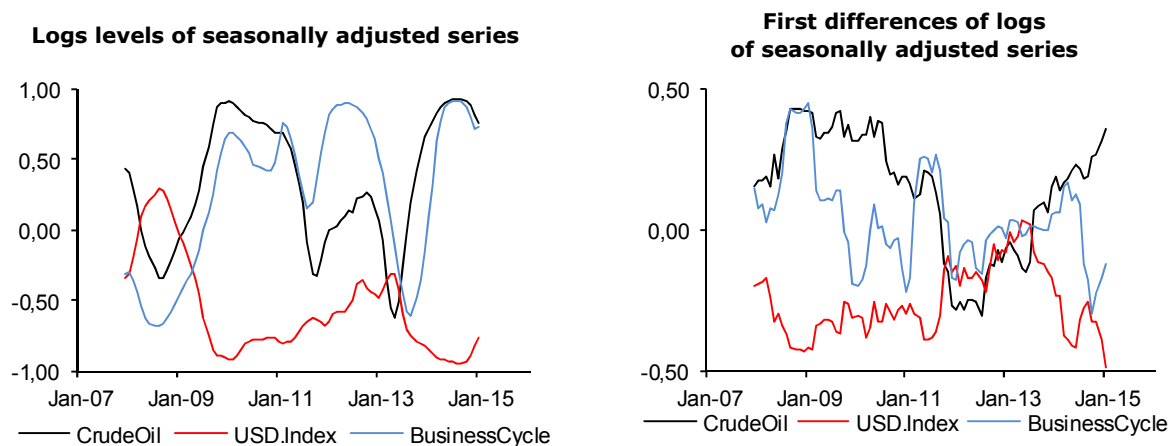
Source: Own calculations based on USDA-ERS, WB, OECD and FRB of St. Louis data.

3.1.4.   Expected development of the world sugar market

The FAO-OECD projections indicate that in the long term the global sugar market may grow at the same rate as previously, assuming similar weather conditions and macroeconomic factors. Until 2025 **production will increase** by an average of 2% per year to 220 million tonnes r.s.e. and will be approximately 38 million tonnes more than at present. The main growth factor will be growing demand, mainly in Asia and Africa, as a result of a growing population, improvement in the income situation and changes in consumption patterns. It is expected that growth in consumption will average 1.7% per year and increase to approximately 214 million tonnes r.s.e. (**Table 4**). In foreign trade there will be no major changes, since it will account for approximately 33% of the production [FAO-OECD, 2016]. The main exporters will remain Brazil (40%) and Thailand (13%). **Imports** will be characterised by a more diversified geographical structure. An important role will be played by India, which has been producing sugar for its own use. Taking the dynamics of production and consumption into account it is expected that the closing stocks will constitute approximately 40% of consumption. A key question is in which regions of the world it is possible to increase production to meet growing demand. The **possibility of increasing production** from sugar cane occurs primarily in Brazil. In Asia, major producers are China, India, Pakistan and Thailand, but production in these regions is fraught with high risks associated with high variability of weather conditions. High potential of production growth characterises Africa, but the process will require huge investments (including infrastructure) and significant socio-political changes. A similar situation exists in the countries of Eastern Europe (Russia, Ukraine), but an increase in the efficiency of production and processing of sugar beet is required. The growing demand in the world in the long term is one of the main arguments for maintaining the sugar production in the EU, both in the context of food security, as well as its possibility to export surplus of supply.

Table 4: Projection of world production, consumption and foreign sugar trade

Items	2015	2025	2015=100	Average annual change [%]
Sugar beet [million t]				
World	255.9	275.6	107.7	0.7
Developed countries	197.9	203.9	103.0	0.3
Developing countries	58.0	71.6	123.4	2.1
Sugar cane [million t]				
World	1,807.8	2213	122.4	2.0
Developed countries	79.1	84.2	106.4	0.6
Developing countries	1,728.7	2,128.8	123.1	2.1
Sugar production [million t r.s.e]				
World	180.6	220.5	122.1	2.0
Developed countries	41.7	45.3	108.6	0.8
Developing countries	138.9	175.2	126.1	2.3
Sugar consumption [million t r.s.e]				
World	181.2	214.3	118.3	1.7
Developed countries	50.0	51.9	103.8	0.4
Developing countries	131.2	162.4	123.8	2.2
Ending stocks [million t r.s.e]	69.0	78.0	113.0	1.2
Stocks / Consumption [%]	38.1	36.4	95.6	-0.5
Price of raw sugar [USD/t]	347.4	434.0	124.9	2.3
Price of white sugar [USD/t]	415.3	479.6	115.5	1.4

Source: Own elaboration based on FAO-OECD data.

3.2. Supply-demand situation in the sugar market in the EU

3.2.1. The cultivation of sugar beet

In the period 2003-2015 there was deep structural change and modernisation in EU sugar beet production, mainly in the years 2006-2010. Growing and processing are concentrated in the regions with the most favourable conditions of soil and climate and structure of agricultural holdings. The **restructuring of production** led to the loss of many sugar factories and growing areas. In 2014, the area of sugar beet cultivation in the EU amounted to 1.64 million hectares and was 30% lower than before the reform (**Figure 5**). In 2015, in connection with a large supply, sugar companies reduced contracting and the area planted fell to approximately 1.39 million ha. **Production is concentrated in five countries** (France, Germany, Poland, the United Kingdom and the Netherlands), which have an approximately. 73% share of the total area of sugar beet cultivation in the EU, compared to 62% in 2004. Five member states have ended sugar beet cultivation: Bulgaria, Ireland, Latvia, Portugal and Slovenia, and many countries have significantly reduced their growing areas (Annex 10). In the period 2003-2014 the **number of sugar beet farmers fell** by approximately 53% to 139.5 thousand. The larger decline in the number of farmers than the growing area meant that the average planting area (10-11 ha) was higher than before the reform (approximately 7 ha). There are very large differences in the concentration of growing between Member States. The **largest plantings** occur in the Czech Republic, Slovakia and Hungary (40-70 ha) and the smallest in Poland, Austria and Spain (5-6 ha).

Concentration of production in the regions with most favourable conditions and large agricultural holdings resulted in a marked increase in the **intensity of cultivation**. In the period 2003-2015, the **average sugar yield increased** to 11-12 t / ha. In recent years, there has been a large variation in yields, primarily as a consequence of variable weather conditions (**Figure 5**).There are large differences between yields in member states, due to differences in soil and weather conditions and natural differences in cultivation technology (use of mineral fertilisers, plant protection products). The highest technological sugar yield occurs in the Netherlands, Denmark and Germany, France (12-13 t / ha) and the lowest in Finland, Greece and Romania (less than 7 / ha).

Figure 5: Production of sugar beet in the EU
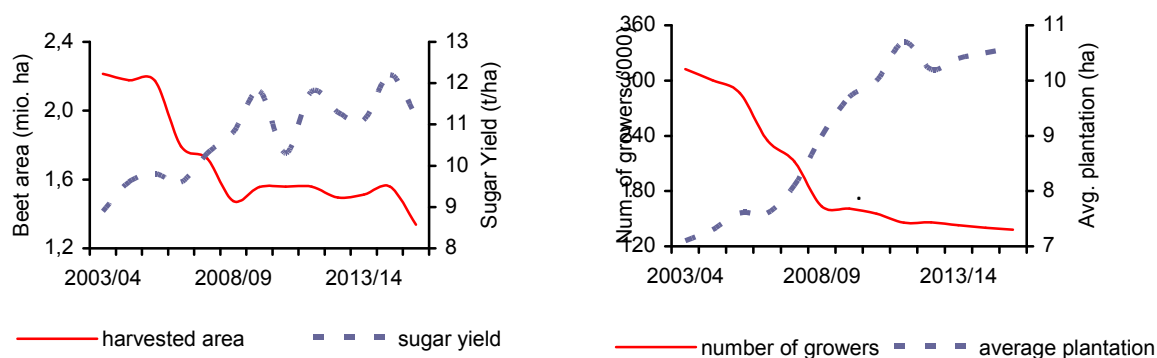
Source: Own elaboration based on CEFS, CIBE, European Commission data.

3.2.2. Sugar industry

Restructuring also affected the sugar industry in the EU, primarily through the growth of production concentration. The most profound changes occurred during the reform of the regulation of the market (2006-2010). In 2014, sugar production and refining raw sugar led 61 companies in 21 member states, down from 76 in 2004. In the period 2004-2014 the **number of sugar companies** fell from 213 to 109. Average output per sugar company has more than doubled to approximately 18 thousand tonnes w.s.e. (**Figure 6**). The sugar industry has an **oligopolistic structure**, as the nine largest manufacturers have an 89% share of the total EU sugar production quota[15] and in the production, their share is even higher. Structural changes and modernisation are also visible in changes in **employment and labour productivity growth**. Withdrawal from production of a large number of factories has reduced employment by half to approximately 30 thousand people (FTE). In the same period, productivity has doubled to approximately 650 t / employee (Annex 11). Sugar production shows a similar concentration as the cultivation of sugar beet. **Five Member States** produce about 75% of the production of sugar, including: France (31%), Germany (22%), Poland (10%) the United Kingdom (7%) and the Netherlands (5%) [European Commission, 2015].

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[15]   http://kzpbc.com.pl/producenci-cukru-w-ue,21,pl.html (14.02.2016).

Figure 6: Sugar industry in the EU
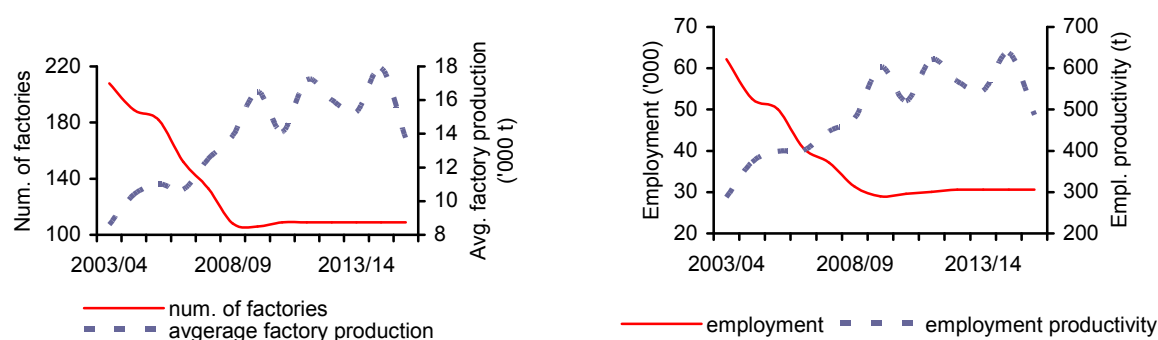
3.2.3. Sugar balance in the EU

In 2010-2014 sugar production in the EU ranged from 15.9-19.4 million tonnes w.s.e. and was higher than the current amount of production (13.5 million tonnes w.s.e.). Consumption of sugar, including for non-food purposes, shows a small change and is approximately 19 million tonnes w.s.e. (**Table 5**). Average sugar intake per capita is approximately 40 kg. The **structure of consumption** is dominated by the food industry (approximately 70%), while household consumption is approximately 30% of the total [Gocht, 2012]. Large differences between production, production quota and consumption resulted in it being necessary to develop non-quota sugar that was exported and consumed for food purposes and classified by the producers to the quota production in the next season. Large **stocks** starting in 2015, which contained part of the sugar quota from the previous season, resulted in less contraction of sugar beet and a large drop in sugar production to 13.8 million tonnes w.s.e.

As a result of the reform of market regulation and structural changes in the cultivation of sugar beet and the sugar industry, the **EU is not self-sufficient in sugar**. The self-sufficiency rate in the sugar market was 84-90% in the years 2010-2015. Production could meet demand in the internal market only in the high yielding years (2011, 2014). Since the amount of production is less than consumption, and the rules on disposal of non-quota sugar were restrictive, it was necessary to import large quantities (3-4 million tonnes). As a result, the EU has become a net importer. Moreover, the imports were the result of multi- and bilateral trade agreements. The share of imports in the market supply, measured by the import penetration[16], averaged approximately 20%. At the same time exports decreased to approximately 1.5 million tonnes, which largely resulted from the export limit of non-quota sugar. Exports accounted for approximately 9% of production, and in periods of high supply its share in production increased to approximately 12%. The EU is a net importer of sugar (an average of approximately 2 million tonnes per year).

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[16]   Import penetration ratio is the relationship of imports to production minus the balance of foreign trade.

Table 5: EU sugar market balance

Items	2010	2011	2012	2013	2014	2015
	'000 tonnes w.s.e.					
Beginning stocks	1.6	1.2	2.4	3.2	2.6	4.0
Production	15.9	18.0	17.3	16.6	19.4	13.8
Imports	3.9	3.6	4.0	3.5	2.7	3.5
Total available	**21.4**	**22.8**	**23.7**	**23.3**	**24.7**	**21.3**
Consumption	19.1	18.2	19.0	19.1	19.2	18.7
Exports	1.0	2.2	1.5	1.5	1.5	1.6
Ending stocks	1.2	2.4	3.2	2.6	4.0	1.0
Total outlets	**21.3**	**22.8**	**23.7**	**23.2**	**24.7**	**21.3**
Self-sufficiency [%]	83.2	98.9	91.1	86.9	101.0	73.8
Import market penetration [%]	20.7	18.6	20.2	18.8	13.1	22.3
Export production specialisation [%]	6.3	12.2	8.7	9.0	7.7	11.6

Source: European Commission data.

3.2.4. Prices for sugar

The sugar market in the EU was one of the most regulated agri-food markets and was quite poorly integrated into the global market. The prices of white sugar in the EU in the last twenty years were significantly higher (often more than twice) than world prices and were not correlated with them. Average prices of white sugar in the EU, in contrast to world prices, show **no seasonal fluctuations and are characterised by lower volatility**.

This image was only partially changed after the reform of the system of regulation in the EU, since the intervention price of EUR 631.9 per tonne has been replaced by a reference price of EUR 404.4 per tonne. After the reduction of the reference price in 2008-09, sugar prices in the EU and the world remained at a similar level for about a year (**Figure 7**). This **short-term convergence** seems to have been more as a result of the increase in world sugar prices than of a reduction in reference prices. Especially since the second half of 2011 disparities between prices in the EU and on the London Stock Exchange again increased. The fall in sugar prices in the EU in the period 2013-2015 meant that once again the difference between EU prices and world decreased. Therefore, the effect of the reform of market regulation was not a significant increase in integration with the world market as evidenced by a rolling correlation coefficient (**Figure 7**). Large fluctuations in coefficients of correlation in time and the fact that throughout the period negative factors dominated do not confirm a strong correlation between prices in the EU and world prices.

Figure 7: Average white sugar prices in the EU and in the world as well as 24-month rolling correlations between EU and world prices
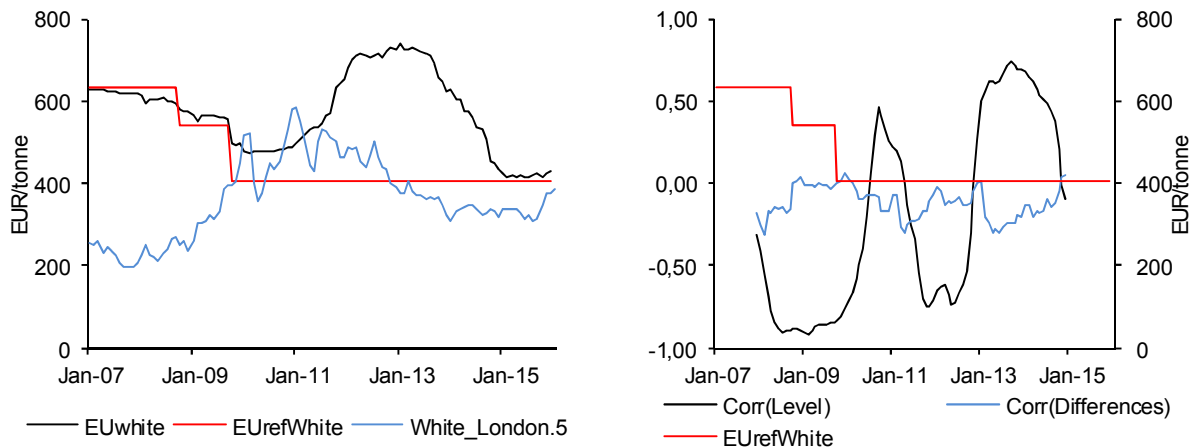
Source: Own calculations based on European Commission and USDA-ERS data.

Tests carried out to evaluate the relationship between EU and global prices using time series models (VAR, VECM) for the ranks of the years 2007-2015 and for the period 2010-2015 also did not affect the conclusions. No long-term dependency and statistically significant causality (Granger) occurred regardless of the period.

The **prices of industrial sugar** are linked strongly with world prices, which is a form of managing surplus of supply (non-quota sugar). Prices in the EU are similar, or even lower than world prices (**Figure 8**). The direction of trends is similar – the dominance of positive correlation coefficients calculated on the price levels. These compounds also have not changed with the reduction of the reference prices. Reductions in the price differences occurred since mid-2011 with the intensification of trade: a big production in the EU and the need for non-quota sugar exports and a large share of imports in the supply of the market.

Johansen co integration tests for the series from the period 2007-2015 were not conclusive (model with unlimited free expression showed a long-term relationship and a model with limited intercept a lack thereof). In the light of estimates, VECM model with unlimited free expression may be considered that the prices of industrial sugar in the EU adapt over long periods to the world price of white sugar. Causality tests (VECM model on price levels, which the VAR model for the first differences) did not confirm the presence of Granger causality between prices in London and prices of industrial sugar in the EU.

Figure 8: Average EU price for industrial white sugar and the world prices as well as 24-month rolling correlations between EU and world prices
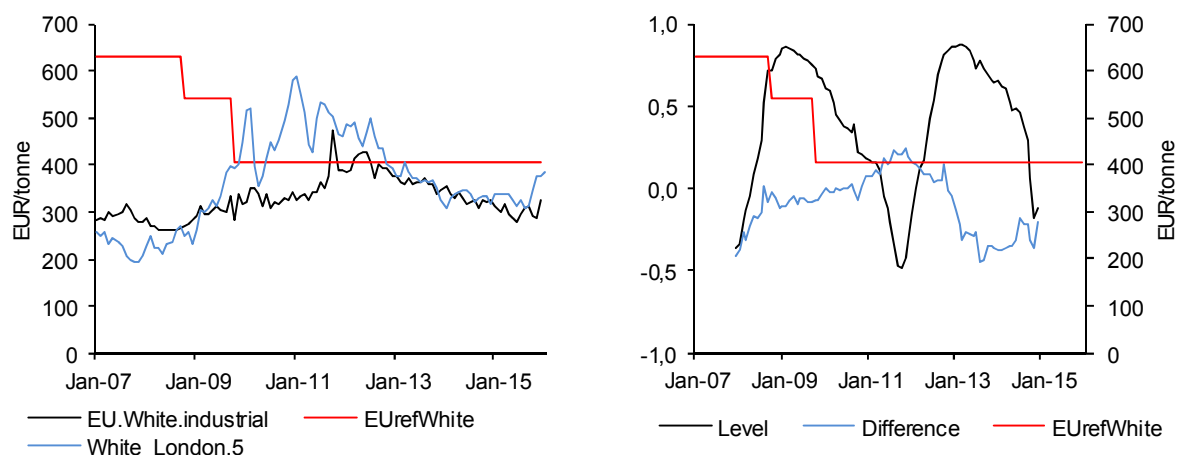
Source: Own calculations based on European Commission and USDA-ERS data.

Prices of imported sugar from ACP and LDCs result from trade agreements and production costs. Preferential import is a form of economic aid to these countries. Therefore, import prices are similar to the prices of white sugar in the EU and are not tied to world prices (**Figure 9**). Import prices for raw sugar account for approximately 75% of the prices of white sugar in the EU, as raw sugar is subjected to a refining process which involves certain costs. It is worth noting that both import prices for white and raw sugar significantly exceed the level of world prices.

Figure 9: Average EU import prices on the background of EU white sugar prices and the world raw sugar prices
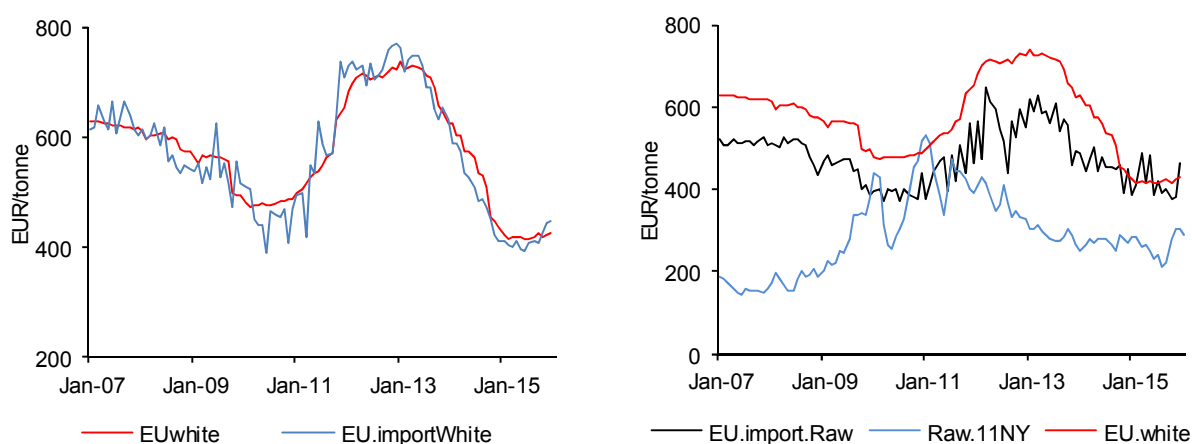
Source: Own calculations based on European Commission, ERS USDA data.

4. SCENARIOS OF DEVELOPMENT OF THE SUGAR MARKET IN THE EU AFTER 2017

4.1. The effects of changes in the system of market regulation

4.1.1. The effects of the elimination of sugar production quotas in September 2017

Elimination of sugar production quotas fundamentally changes the conditions of competition in the EU. Manufacturers will be more able to compete with each other with volume production. Production quotas are allocated to Member States, which then assign quotas to producers. The EU sugar market is dominated by several large manufacturers (oligopoly), who have factories in different member states. Elimination of quotas and a possible decline in the profitability of production may cause an increase in the concentration of production in the most efficient and competitive regions of the Member States[17] at the expense of other regions of the Member States (e.g. in the EU-13 countries). The concentration of production in certain regions can be beneficial in terms of efficiency, but it may also encourage the growth of monopolistic practices. Ending of production in certain regions would have adverse economic, social and agro-environmental effects. **Transformation, restructuring and modernisation of the sugar industry are necessary**, but production should only be stopped in the least competitive regions that do not have a big impact on the balance of sugar in the EU.

Changing market regulation does not provide **financial support for restructuring**. This is justifiable, as support for restructuring processes could provide an incentive for removing from production factories and growing areas that could operate in the future. Another issue is the financial means to support such a programme. During the 2006-2010 reform, support for restructuring processes came from the restructuring fund, which was provisioned by contributions from the sugar producers. This mechanism was not effective, because in some countries (e.g. Poland) producers have paid higher fees than they received in restructuring aid.

Elimination of production quotas on 30 September 2017will have a big impact on the functioning of the EU sugar market in the context of the balance sheet. The primary change is that the current production quota of 13.5 million tonnes w.s.e. is less than the market demand (19 million tonnes w.s.e.) and production capacity (18-19 million tonnes w.s.e.). So far, the market demand has only to a small extent been covered by production, as non-quota sugar was exported, counted against the quota production in the next season or in exceptional cases sold on the internal market. Imports played an important role in supplying the market (13-22%). Elimination of quotas will mean that domestic demand is to a large part covered by the EU production. The situation is more complicated because of trade agreements on preferential imports, which is likely to remain at the current level. In a market situation, a surplus of supply should be exported. In conditions of low prices on the world market, exports will bring financial losses to producers in the EU and there will be a need for their reduction.

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[17] The most effective and competitive Member States there are: Germany, France, Denmark, Belgium, the Netherland and United Kingdom.

4.1.2. The effects of the liquidation of production quota of isoglucose

Changes in market regulations also provide for the elimination of the production quota for isoglucose. This is a big change in the context of competition in the market of sweeteners. The isoglucose production quota in the EU amounts to 0.72 million tonnes of dry matter. Production and consumption are at the limit of production, and its share in the consumption of sweeteners in the EU is currently estimated at approximately 3.5%. Elimination of production quotas will result in the **possibility of an increase in production**, because producers have greater potential than the current limit of production. The barrier to production growth may be in demand, because isoglucose can only be used in certain sectors of the food industry (e.g. in the production of soft drinks), and practically is not used in households. For the production of sweetened beverages the largest amounts of sugar (approximately 20%) are consumed [Gocht, 2012]. The possibility of substitution of sugar with isoglucose in the production of beverages will provide a boost to its production and cause a drop in demand for sugar. It is expected that isoglucose production and consumption may increase three times by 2025, and its share in the consumption of sweeteners may increase to approximately 11% [European Commission 2015]. In the United States the share of isoglucose from maize in the sweeteners market is approximately 50% [Zimmer, 2013].

4.1.3. Elimination of the minimum price of the purchase of sugar beet

Apart from the elimination of production quotas, a very significant change in the control system will be the elimination of the minimum purchase price of sugar beet (EUR 26.29 per tonne). In 2006-2010 the minimum price was reduced by 40%, and until 2014 the decline in growers' revenue was partially compensated by 'sugar payments' not linked to production[18]. In the Member States applying the SPS direct payments scheme[19] '*sugar payments'* were not separated as individual support as they had been included in the payment to the agricultural holding. Inclusion of those payments into the general pool of support made the assessment of their impact on the profitability of production difficult. In the SAPS system 'sugar payments' were shown as separate support which allowed precise assessment of their impact on the profitability of the crop. Comparative analysis of direct payments and the sugar payments in France, Germany and Poland showed that in Poland support for sugar beet growers accounted for 5-10% of the value of direct payments, higher than in France (2-3%) and Germany (3-5%). In Poland in 2009-2013, sugar payments amounted to approximately EUR 840 per ha of sugar beet cultivation, higher than in Germany (EUR 760 per ha) and France (EUR 705 per ha) (**Annex 12**)[20]. This comparison shows the differences in the level of support for sugar beet and the role it has played in supporting the profitability of production. In the period 2015-2020 it is possible to support growers with direct payments linked to production, but not all member states benefit from this solution.

Elimination of the minimum purchase price will have a big impact on the functioning of the entire industry, because it was a form of guarantee of the profitability of the crop and significantly strengthened the position of growers in the marketing chain. Its elimination will mean that the sugar industry will not be obliged to pay a certain price level. Low

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[18] Council (EC) No Regulation 319/2006, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R0319&from=EN.

[19] SPS direct payment scheme and SAPS direct payment scheme are the two direct payments schemes used in the EU. SPS scheme is based on payment entitlements allocated to active farmers by the competent national authorities. Theese entitlement can be sold or leased. SAPS scheme is used by most of the new Member States. There are no payment entitlements and farmers receive support based on the number of hectares of UAA.

[20] The analysis concerong the period after 2013 is presented in the section 5.2.3.

purchase prices and the sharp decline in profitability may cause growers to abandon the cultivation of sugar beet. As a result, the supply of raw materials will be lower and the sugar industry may have serious problems with the use of production potential and a thorough restructuring would be needed, which will have many adverse economic, social and environmental effects.

At this point, there are two key questions: What is the **cost of sugar beet cultivation in the EU?**. And, **Should the minimum purchase price cover the production costs (guaranteed profitability)?** Another issue is to compare the profitability of sugar beet production with that of other crops. If the profitability of wheat, maize and oilseed rape will be larger and there will be outlets, the farmers will abandon the cultivation of sugar beet. Individual EU member states are different in terms of growing conditions, which include the conditions of soil and climate and farm structures. Soil quality, the length of the growing season and the amount of precipitation affect crop yields and production costs. In the EU-15 the natural conditions are different from conditions in the EU-13. Another issue is the concentration and scale of production, which have a clear impact on the effectiveness of cultivation (economies of scale), in particular the cost. In this regard, there are big differences, which reflect the differences in the area of the average planting in the member states.

A **comparative analysis of the cost of sugar beet production** among Member States is not a simple matter because of the differences in the conditions and the possibility of using different research methods (e.g. the way of eligibility of the various cost items). It is possible to use a universal analytical method, but in this case the problem is the availability of statistical data from different member states, which affects the representativeness of the results. Assessment of the costs of sugar beet cultivation in some countries was carried out on the basis of the available analyses and studies, and on this basis the conclusions were drawn.

According to the FAO analysis, the cost of sugar beet cultivation in non-competitive regions of the EU amounted to EUR 30-40 per tonne compared to EUR 20-30 per tonne in competing regions [FAO 2009]. Following the reform, some of the non-competitive regions in the EU abandoned their cultivation because the costs exceed the purchase price. The results of studies in various EU member states confirmed the **differences in the level and structure of production costs**. According to a study by Czech scientists in 2011, the lowest total cost of production occurred in Poland (EUR 22.0 per tonne), the UK (EUR 24.7 per tonne) and France (EUR 26.3 per tonne). The cost was high level on Czech (EUR 30.8 per tonne) and German (29.3 EUR per tonne) farms. In all surveyed countries, variable costs accounted for approximately 83% of total costs. The only was in France, where the share of variable costs amounted to approximately 70% [Řezbová, 2013]. Research conducted in Germany showed that in 2011 the costs of sugar beet cultivation amounted to approximately EUR 20 per tonne [Latacz-Lohmann, 2011]. Similar results were reported by another study published in 2016. Production costs differ depending on the crop and by region. With a yield of 80 t / ha, costs amounted to approximately EUR 21 per tonne, and for a yield of 65 t / ha costs amounted to EUR 23 / t [Riedel, 2016]. In Belgium, the cost of production in 2011 fluctuated within the range EUR 26.5-28.0 per tonne [Stijn, 2013]. IAFE-NRI studies have shown that in 2011-2013 the cost of sugar beet in Poland amounted to EUR 23.8-26.6 per tonne [Skarżyńska, 2014]. The reason for the different levels of cost could be the selection of the sample of holdings from which data were collected and the method of analysis. Comparison of production costs and the minimum purchase price of sugar beet clearly show that the **minimum price in some countries did not guarantee the profitability of the crop**.

In connection with the elimination of the minimum purchase prices there is a real risk that the purchase price will fall below EUR 26.29 per tonne. Farms that want to maintain

production of sugar beet, can pursue two **strategies**. The first is an increase in productivity (yields) while maintaining a stable level of total costs. As a result, marginal cost will be lower. The second strategy is the reduction of total costs while maintaining productivity (yield) at a stable level. Different strategies will be implemented in the different regions depending on the possibility of increasing the yield. In the literature it is suggested that the sugar sector within the EU can be competitive on the international market if the technological sugar yield is 15 t / ha, and variable costs amount to approximately EUR 15 per tonne [Řezbová, 2013]. It should be noted, however, that such high sugar yields can be reached only the most efficient agricultural holdings in the regions with most favourable soil and climate conditions. Variable costs of cultivation substantially exceed EUR 15 per tonne. Growers' decisions regarding the maintenance of sugar beet production will depend also on the profitability of the production of wheat, rapeseed and maize that can become a replacement for growing sugar beet.

4.2. Expected development of the EU sugar market

A projection of the market situation in the sugar industry in the EU is prepared, among others, by the European Commission [European Commission, 2015]. The **area of sugar beet** cultivation in 2025 may amount to approximately 1.5 million hectares, but the average yield in the EU-15 will have increased to 80 t / ha, and in the EU-13 to EUR 60 / t. Annual **sugar production** may vary between 17.1 and 17.7 million tonnes and the demand will decrease to 17.1 million tonnes (Figure 10). The reason for the **lower demand** will be unfavourable demographic trends and changing consumption patterns (e.g. health aspects). An important factor in the decline in demand for sugar is the increasing consumption of other sweeteners (e.g. isoglucose). Development of the supply-demand situation indicates that the **EU will become self-sufficient in sugar**. The result will be significant changes in the foreign trade. International trade agreements oblige the EU to import under preferential quotas from economically developing countries, and it is necessary to import raw sugar to supply the traditional refineries. Elimination of production quotas will result in an increase in production in the EU and as a result import demand will be reduced. Imports will be limited to the duty-free quotas, and the surplus supply will be exported. The barrier may be low import prices for white sugar, which may fall to EUR 400 per tonne and will be approximately EUR 70 per tonne higher than world prices. Long-term **projections of global prices** of white sugar by the European Commission are in line with the forecasts of the OECD-FAO (USD 430-450 per tonne) [OECD-FAO, 2015]. The fall in prices on the EU market will result in a deterioration of the profitability of growing and processing of sugar beet, but also will be a barrier to imports, even on preferential terms. Therefore, it is expected that in the long run **imports** can be reduced by 50% to 1.8 million tonnes. Given the large supply of production plus imports, export growth to approx. 2.5 million tonnes will be necessary. The **EU will again be a net exporter** of sugar.

Figure 10: Production, consumption and sugar price in the EU
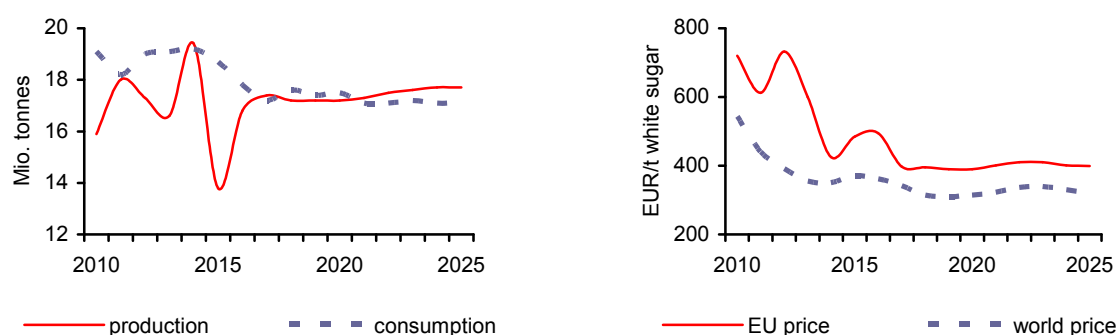
Source: Own elaboration based on European Commission data.

4.3. Scenarios of development of the sugar market in the EU after 2017

Projections prepared by the European Commission and the OCED-FAO-assume that the world and the EU sugar market in the long term will be characterised by evolutionary development and relative stability. This is a relatively optimistic scenario, because the experience of recent years clearly indicates that the **business cycle** in the global sugar industry takes approximately five years. These fluctuations are the result of the cyclical nature of the cultivation of sugar cane. As a result of a deep decline in global prices of sugar from sugar cane, manufacture with relatively high costs will leave the market. As a result, the supply of raw material and the production of sugar will decline, as will the closing stocks, as world consumption increases and the business cycle enters a phase of growth [Hryszko, Szajner, 2013]. The proposals for changes in the system of regulation of the sugar market in the EU relate primarily to the elimination of production quotas and minimum purchase prices. Other market policy instruments, in particular the regulation of foreign trade, will not be much changed.

The **market will still be protected** by high tariffs and imports will be possible only within the framework of preferential quotas. The WTO allows EU sugar exports with subsidies, but as in recent years, these will not be realised. Conditions for foreign trade may change, if negotiations in the **WTO Doha Round** are completed [Smit, Helming, 2012] and if the EU and the US sign a **TTIP agreement**[21]. In 2016 the trade part of the association agreement with Ukraine will be implemented, but in the coming years it will not affect the balance of sugar in the EU.

In terms of intervention, private storage aid, market monitoring and subsidies associated with sugar beet production, there will be no major changes. The reference price of sugar will remain as currently EUR 404.4 per tonne. The production levy (EUR 12 per tonne) will be eliminated, which will contribute to a slight reduction in fixed costs (**Table 6**).

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[21]   Risks and Opportunities for The EU Agri-Food Sector in a Possible EU-US Trade Agreement, Directorate-General for Internal Policies Policy Department B: Structural and Cohesion Policies, Agriculture and Rural Development
http://www.europarl.europa.eu/RegData/etudes/STUD/2014/514007/AGRI_IPOL_STU(2014)514007_EN.pdf.

Table 6: Sugar market regulations in the EU

Market regulations	Current	Proposed
Production quotas	YES	NO
Development of non-quota sugar	YES	NO
The reference price for sugar	EUR 404.4 /t	EUR 404.4 /t
The minimum buying-in price for beet sugar	EUR 26.29 /t	NO
Production levy	EUR 12.00 /t	NO
Buying-in price monitoring	YES	YES
Imports	Prohibitive duties Preferential quotas LDC, ACP, CXL, Balkan countries.	Prohibitive duties Preferential quotas: LDC, ACP, CXL, Balkan countries.
Exports	YES	YES
Intervention	YES	YES
Private storage aid	YES	YES
Direct payments coupled with production of beet	YES	YES

Source: Own elaboration based on European Commission data.

The current situation on the world and the EU markets and a proposal for regulation of the market were the bases for the preparation of possible scenarios for the development of the sugar sector. Elimination of quotas and maintenance of the existing regulations on foreign trade will make the EU market more influenced by the situation on the world market. It was assumed that the WTO Doha negotiations will not be completed and the EUR USD exchange rate will show slight fluctuations. Therefore, **three possible scenarios** for market developments were adopted, which differ from each other as to the level of world prices (Annex 15):

- **Scenario I**: assuming the maintenance of world prices for white sugar at the current level of approximately EUR 350 per tonne and the low prices of energy resources,
- **Scenario II**: assumes a large supply of sugar on the world market, which will be expressed by an increase of the closing stocks and relatively low prices of energy resources, as a result of which global prices of white sugar will drop to approximately EUR 250 per tonne,
- **Scenario III**: assumes an increase in world prices for white sugar to 500 EUR per tonne, and the reasons for this may be a fall in the sugar supply, growing demand and high prices for energy.

4.3.1. Scenario I based on current world prices

The scenario can be also specified as the **status quo scenario** as it expects that the world and EU prices for white sugar will show relatively little change from the current level. The reason for this will be an evolutionary development of the global market, as production and **consumption** will be characterised by similar dynamics [OECD-FAO, 2015]. As a result, closing stocks will be maintained at approximately 40% of consumption.

The second factor determining small changes in prices of agricultural products in the world, including sugar, are **low energy prices**. As a result, less sugar cane and sugar beet will be processed into bioethanol.

As the EU market will be more influenced by the situation on the world market, the **price of sugar in the EU will be low** (approximately EUR 400 per tonne). Sugar production will be profitable only in the efficient and competitive regions. Therefore, it is expected that the sugar industry in the EU will be forced to restructure.

The **area of sugar beet** cultivation will decrease by 2025, but this decline will be offset by an **increase in yields**. The decrease in area in the EU-13 will be greater than in the EU-15. In the EU-15 sugar production will be concentrated in the regions with most favourable soil and climate conditions, and will exclude the production of the least efficient plants. In Germany, France, UK, Belgium, Denmark and the Netherlands sugar yields per hectare are higher, and the climatic conditions will allow the extension of the sugar campaign. In addition, the low price of sugar will be translated into low prices for sugar beet and growers will give up cultivation seeking higher incomes (e.g. from maize and rapeseed).

Production of sugar beet will remain at approximately 112 million tonnes, and low fuel prices will mean that smaller amounts will be processed into bioethanol. As a result, during the period 2020-2025 sugar production in the EU will increase slightly to approximately 17 million tonnes. In the EU-15 production will increase by 5%, while in the EU-13 it will fall by 18% (**Table 7**).

Significant changes will occur in the **balance of sugar**, because production will be at the level of consumption, which will show a slight downward trend to 17.1 million tonnes. Imports will decrease to 1.8 million tonnes and will take place only under the terms of duty-free. The reason for this will be a **small difference between prices on the EU market and the world market prices**. Imports, despite the drop, will result in an increase in supply. It should be noted that there will still be **stocks** of sugar in the market from previous seasons. As a result, an increase in exports to 2.5 million tonnes will be necessary, but low world prices will negatively affect their profitability. The EU will again be a net exporter, the self-sufficiency ratio will increase to approximately 99% and the share of imports in the market supply will be reduced to 11% (**Table 8**).

Table 7: Scenario I - sugar beet and sugar production in the EU

	2016	2020		2025	
			2016=100		2016=100
Harvested area ['000 ha]	**1,600.0**	**1,540.0**	**96.3**	**1500.0**	**93.8**
EU-15	1,280.0	1,240.0	96.9	1220.0	95.3
EU-13	320.0	300.0	93.8	280.0	87.5
Yield [t/ha]	**70.0**	**73.0**	**104.3**	**75.0**	**107.1**
EU-15	74.0	77.0	104.1	79.0	106.8
EU-13	53.0	57.0	107.5	57.0	107.5
Sugar beet production [million t]	**112.0**	**112.0**	**100.0**	**112.0**	**100.0**
EU-15	95.0	95.0	100.0	96.0	101.1
EU-13	17.0	17.0	100.0	16.0	94.1
For ethanol [million t]	12.5	12.0	96.0	11.5	92.0
For sugar [million t]	99.5	100.0	100.5	100.5	101.0
Sugar production [million t, w.s.e.]	**16.8**	**17.0**	**101.2**	**17.0**	**101.2**
EU-15	14.0	14.5	103.6	14.7	105.0
EU-13	2.8	2.5	89.3	2.3	82.1

Source: Own calculations.

Table 8: Scenario I - EU sugar market balance [million tonnes, w.s.e.]

Items	2016	2020	2025
Opening stocks	1.0	2.2	1.7
Production	16.8	17.0	17.0
Imports	3.7	2.0	1.8
Consumption	17.8	17.5	17.1
Exports	1.5	2.0	2.5
Ending stocks	2.2	1.7	0.9
Self-sufficiency	94.4	97.1	99.4
Export production specialisation	8.9	11.8	14.7
Import market penetration	19.5	11.8	11.0
World white sugar [EUR/t]	350	340	330
EU white sugar price [EUR/t]	400	400	400

Source: Own calculations.

4.3.2.   Scenario II based on low world prices

This scenario can be described as **pessimistic**, because it assumes that, due to the large supply (e.g. as a result of favourable weather conditions) and the deterioration of the overall economic situation in the world, **growth of demand will slow down**. As a result, closing inventories will increase, which will account for approximately 45% of global consumption. **Low energy prices** will also be an expression of the worsening global economy. In these market conditions the global **price of white sugar** may fall to approximately EUR 250 per tonne. Low world prices will have a negative impact on the situation and will put pressure on prices in the EU (EUR 340 per tonne).

In conditions of low prices the profitability of sugar production will fall and sugar industry will be forced to carry out a **major restructuring**. Sugar production will be carried out only by the most efficient and competitive enterprises, which will be supplied with raw material from regions with the most favourable conditions of soil and climate and farms with large-scale production.

The result of the restructuring process will be a fall in the **area of sugar beet** cultivation to approximately 1.4 million hectares, which will be partially offset by an increase in yields per hectare.

Production of sugar beet in the EU will decrease by approximately 5% to 106 million tonnes. In the EU-15 production the decline will be small but in the EU-13 it will be profound: approximately 33%. In conditions of low buying-in prices sugar beet will be processed only into sugar because bioethanol production will be unprofitable. EU sugar production may fall to 16 million tonnes. In the EU-15 it will be 14 million tonnes but in the EU-13 production will decline steeply to 1.9 million tonnes (**Table 9**).

Table 9: Scenario II – sugar beet and sugar production in the EU

	2016	2020		2025	
			2016=100		2016=100
Harvested area [million ha]	**1,600**	**1,450**	**90.6**	**1400**	**87.5**
EU-15	1,280	1,230	96.1	1200	93.8
EU-13	320	220	68.8	200	62.5
Yield [t/ha]	**70**	**74**	**105.7**	**76**	**108.6**
EU-15	74	77	104.1	79	106.8
EU-13	53	57	107.5	57	107.5
Sugar beet production [million t]	**112**	**107**	**95.8**	**106**	**95.0**
EU-15	95	95	99.7	95	99.8
EU-13	17	13	73.8	11	67.1
For ethanol [million t]	12.5	-		-	
For sugar [million t]	99.5	95.8	96.3	92.7	93.2
Sugar production [million t, w.s.e.]	**16.8**	**16.2**	**96.4**	**16.0**	**95.2**
EU-15	14	14.1	100.7	14.0	100.0
EU-13	2.8	2.1	75.0	1.9	67.9

Source: Own calculations.

The decline in sugar production will have a significant impact on **market balances**. Production will be lower than consumption and self-sufficiency will be approximately 92%. Low world prices and relatively higher prices in the EU and preferential import quotas will be a stimulator, which may amount to approximately 3.5 million tonnes. The share of imports in the supply market will be approximately 20%. The decrease in production and consumption in the internal market and the relatively high level of imports will result in a slight increase in exports to approximately 2 million tonnes, and the share of production will increase to approximately 12.5% (**Table 10**). In conditions of low prices an increase in the consumption of sugar is also possible because it will improve its price competitiveness with respect to isoglucose. In this case, **major changes in foreign trade** are possible because increased imports will be necessary and a decrease in exports can occur. Regardless of changes in demand in this scenario, the EU will stay a **net importer of sugar**.

Table 10: Scenario II - EU sugar market balance [million tonnes, w.s.e.]

	2016	2020	2025
Opening stocks	1.0	1.0	1.0
Production	16.8	16.2	16.0
Imports	3.7	3.5	3.5
Consumption	17.8	17.5	17.1
Exports	1.5	2.0	2.0
Ending stocks	2.2	1.2	1.4
Self-sufficiency	94.4	92.6	93.6
Export production specialisation	8.9	12.3	12.5
Import market penetration	19.5	19.8	20.0
World white sugar [EUR/t]	250.0	250.0	250.0
EU white sugar price [EUR/t]	350.0	340.0	340.0

Source: Own calculations.

4.3.3. Scenario III based on high world prices

This scenario can be described as **optimistic** because it assumes an increase in world sugar prices to EUR 500 per tonne. The assumption for the **growth of world prices** is due to the five year cyclical changes in world sugar prices [Isermeyer, Kleinhanβ, 2005]. In the period 2008-2011 world prices showed an upward trend and in the period 2012-2015 they fell steadily. Therefore, it cannot be ruled out that the global prices will increase in the long term. The driver of this growth will be the increasing global demand and increasingly more frequent adverse weather conditions that cause a drop in production. However, there are also other opionion concerning the future world food prices. According to Baldos and Hertel the food prices are going to continue they long-term downward trend [Baldos, Hertel, 2016].

The increase in demand will require **more production**. The potential of increasing production occurs in South America, Asia and Africa. In Asia, production is highly dependent on weather conditions, which in recent years have been characterised by sudden and adverse changes. In Africa, the growth in production requires large capital expenditure and major changes in economic policy in many countries that in the first period will decrease profitability.

Therefore, the upturn in the global market would create **an opportunity for the sugar industry in the EU**, but it would need to maintain its current production capacity. It is possible to increase the area under sugar cultivation by approximately 3% to 1.65 million ha, but under higher yielding conditions the production may increase by 11% to 124.5 million tonnes (**Table 11**).

The cultivation of sugar beet will, however, see **important structural changes**. Production in the EU-15 will increase by approximately 12.5% but its growth rate in the EU-13 will be only approximately 3.0%. **High energy prices** and the growing interest in renewable energy sources will stimulate increased interest in the cultivation of sugar beet for bioethanol production, which may rise to approximately 14.5 million tonnes. A large supply of sugar beet will mean that sugar production will increase by 11% to 18.7 million tonnes. In the EU-15 production will increase by 14.3% and in the EU-13 it will decrease by 3.5%. The reason for the decline in sugar production in the EU-13 will be increased consumption of **sugar beet for bioethanol** (e.g. in the Czech Republic).

The economic recovery and growth in production will have a big impact on the **balance of sugar in the EU**. Production will be about 4-9% higher than the demand. As a result, a surplus of supply will occur which will be exported. Exports may increase to 3.2 million tonnes, and imports will be implemented only within the framework of duty free quotas. The barrier to imports will be high world prices, developing countries will sell sugar economically on the international market. The **EU will become a net exporter** and the share of exports in production will increase to between 16.5 and 17.5%. At the same time the share of imports in the market supply will be reduced to 9% (Table 12).

Table 11: Scenario III - sugar beet and sugar production in the EU

	2016	2020		2025	
			2016=100		2016=100
Harvested area [million ha]	**1,600.0**	**1,650.0**	**103.1**	**1,650.0**	**103.1**
EU-15	1,280.0	1,350.0	105.5	1350.0	105.5
EU-13	320.0	300.0	93.8	300.0	93.8
Yield [t/ha]	**70.0**	**74.0**	**105.7**	**75.0**	**107.1**
EU-15	74.0	77.0	104.1	79.0	106.8
EU-13	53.0	58.0	109.4	58.0	109.4
Sugar beet production [million t]	**112.0**	**121.5**	**108.5**	**124.5**	**111.2**
EU-15	95.0	104.0	109.5	107.0	112.6
EU-13	17.0	17.5	102.9	17.5	102.9
For ethanol [mio. t]	12.5	14.0	112.0	14.5	116.0
For sugar [mio. t]	99.5	107.5	108.0	110.0	110.6
Sugar production [million t, w.s.e.]	**16.8**	**18.2**	**108.3**	**18.7**	**111.3**
EU-15	14.0	15.6	111.4	16.0	114.3
EU-13	2.8	2.6	92.9	2.7	96.4

Source: Own calculations.

Table 12: Scenario III - EU sugar market balance [million tonnes, w.s.e.]

	2016	2020	2025
Opening stocks	1.0	1.0	0.2
Production	16.8	18.2	18.7
Imports	3.7	1.5	1.5
Consumption	17.8	17.5	17.1
Exports	1.5	3.0	3.2
Ending stocks	2.2	0.2	0.1
Self-sufficiency	94.4	104.0	109.4
Export production specialisation	8.9	16.5	18.7
Import market penetration	19.5	9.0	9.0
World white sugar [EUR/t]	500.0	480.0	500.0
EU white sugar price [EUR/t]	600.0	570.0	610.0

Source: Own calculations.

5. PROPOSALS FOR FUTURE SUGAR MARKET REGULATIONS IN THE EU

Taking into account the planned discussions on the multiannual financial framework and the CAP, in this section we consider the possibility of supporting the sugar sector on the basis of existing regulatory and budgetary constraints, and proposals for solutions based on the current regulations which could be implemented in a crisis situation in the agricultural market. Solutions are also proposed that could be introduced along with a review of the CAP on changes in the structure and nature of support used by the EU for agriculture. At the same time it should be emphasised that the multiplicity and complexity of solutions that would be applied to the sugar sector make it difficult to propose such a range of instruments that lead to achieving all targets. It should also be remembered that in recent years the CAP has decreased the range of market support in favour of direct income support for farmers.

This was a fundamental change in agricultural policy. Therefore, the analysis of the package used in relation to the sugar market and the instruments of the CAP was based on the following **assumptions**:

- owing to the need to ensure the food security of the EU and to maintain biodiversity and crop diversification, the scale of cultivation of sugar beet should be maintained at a level similar to the current situation,

- it should not be expected that the cultivation of sugar beet will be taken up by farmers who have not conducted such activities because of the difficulty of reaching a market – i.e. the need to conclude a contract with the sugar factory, from which the current group of suppliers will benefit first due to their previous experience of cooperation,

- maintaining the current scale of production of sugar beet is only possible while ensuring income levels similar to the current situation,

- maintenance of the sugar industry in order to exploit the economic potential and ensure the development of local communities.

Maintenance of sugar beet growing and sugar production is associated with the **implementation of the policy of multifunctional and sustainable development of agriculture and rural areas**. This means that the simultaneous implementation of economic, social and environmental policy objectives.

In **economic terms**, the behaviour of the sugar sector at local or regional level will help to ensure the income of farmers, sugar factory workers and the cooperating service sector, and tax revenues at both local and central level. Income related to the sugar sector indirectly obtained by agricultural producers and employees will be the instrument stimulating and creating the demand at the local level.

In the **social dimension**, maintaining an efficient sugar sector will help to preserve jobs in the agriculture, manufacturing and services sectors. The increase in unemployment, especially in regions that are dependent on agricultural production or one employer (i.e the processing plant), often far from urban centres, brings with it all the negative consequences including the threat of social exclusion.

The cultivation of sugar beet also offers the opportunity to diversify sources of income on the agricultural holding by combining it with animal production (use of by-products) or production of non-food purposes (biofuels), which brings immediate effects in the economic social and environmental dimensions. In the latter, its maintenance also contributes to the improvement of soil quality and promotion of environmentally-friendly agricultural

practices. Through the implementation of the policy, assumptions of multifunctional and sustainable development **objectives for future policy** in the sector should indirectly lead to:maintaining efficient and competitive sugar beet growing and sugar production,

- guarantee of security of supply on the European market,

- ensure competitive prices and price stability for producers and consumers,

- ensure equal conditions of competition in the single market,

- reduce budgetary costs, including administration of a system of regulations,

- sustainable development.

The proposed **policy instruments** for the sugar sector are compatible with the **EU single market**, i.e.:

- uniformity, that is, equal treatment of the origin and movement of goods,

- a common foreign policy and trade,

- unitary intervention mechanisms,

- solidarity of all the member states in the financing of the CAP

- shared responsibility of producers for the effects of price fluctuations within the competition rules.

5.1. Instruments of sugar market regulations in the EU

5.1.1. Instruments governing foreign trade

Article 196 of Regulation (EU) No 1308/2013 provides for the possibility of introducing export refunds for sugar producers, but in the future it is planned to withdraw from all forms of export subsidies. It should be noted that during the 10th WTO Ministerial Conference a declaration countries that have jointly submitted a proposal for elimination of export support in the form of agricultural subsidies (both export refunds and loans) was agreed. The document indicated that export subsidies should disappear by the end of 2018 in the policy of developing countries, while in developed ones should be eliminated at the date of adoption of this Decision.[22] Support for exports, especially to new markets, can be done with the use of the following **indirect instruments**:

- subsidies on interest on export credits,

- warranties and guarantees of repayment of loans allocated to the implementation of export contracts,

- post-funding export letters of credit or documentary collection,

- shared responsibility of producers for the effects of price fluctuations within the competition rules[23],

- support for the promotion of the EU agricultural products, including food products containing sugar.

The foreign trade regulations also cover imports. The EU market should be protected by high tariffs and non-tariff trade policy tools. As a result of trade agreements, a group of countries (e.g. ACP, LDCs) will be able to export sugar to the EU under preferential

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[22]   https://www.wto.org/english/thewto_e/minist_e/mc10_e /nairobipackage_e.htm.
[23]   This may require implementation of new regulations concerning competion. The issue of strenghening the barganing power of the EU farmers is discussed in the study by Sorrentino et al. [2016].

conditions[24]. Regulations concerning imports must also take into account the supply of traditional refineries with raw sugar. Sugar should be entered on the list of sensitive products, as this is a strategic industry of high economic, social and environmental importance.

5.1.2.   Aid for private storage

In article 17 of Regulation (EU) No 1308/2013, sugar is listed among the products covered by aid for private storage. In the event of a crisis in the market, it is possible to implement instruments to support the maintenance of market prices. They can take form of:

- simple subsidies for storage e.g. paid to a tonne of sugar stored for a determined period of time,

- warranties and guarantees of repayment of loans allocated to the implementation of sugar storage contracts.

Each of these forms of intervention should be conducted in a contest to choose the most advantageous offer (i.e. to choose the lowest subsidies to one tonne per day). The actions of an intervention must be carried out effectively. It should be borne in mind that after a period of storage, sugar will be gradually introduced to the market by increasing supply. This means that in the intervening period other measures should be carried out to reduce supply.

5.1.3.   Monitoring of the market situation

In connection with the expected higher volatility in prices, the establishment of an **observatory** on analysing the situation of the sugar market is justified. An example of such a solution may be a European Milk Market Observatory. The purpose of the observatory would be monitoring changes in prices, crop area and yields on sugar market and on the markets of other crops used for the production of bioethanol. The observatory should implement a **mechanism of early warning and crisis prevention** and develop a rating system that specifies the current market situation. This would allow a set of assistance instruments and the scale of support to be better matched to the current needs of the market. Access to current and reliable market information is essential for creating competition strategies by manufacturers and forms the basis for decision making by the administration.

5.1.4.   Promotional activities in the EU market and in third countries

Given the increasing involvement of the EU in activities of an environment-friendly nature and its support for sustainable and local development, it is advisable to take action to promote the "*EU brand product*". Using the potential of creating positive associations with the region of origin or export specialty, it seems possible to create (also on the principles of call for proposals) an industry programme for promotion. An important role in the marketing of agricultural products play information concerning the country of origin of the product and the sugar sector entities should intensify such promotional activities [Regulation (EC) No 1169/2011]. Promotional activities of food products containing sugar may contribute to the growth of exports and, indirectly, to an increase in sugar consumption in the EU.

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[24]   ACP perspectives on the Implementation of EPA-EBA Sugar Arrangements, FIJI/FAO (2012), Asia Pacific Sugar Conference,
http://www.fao.org/fileadmin/templates/est/meetings/sugar_fiji_2012/Nidhen_Singh__ACP_suga r_WG_.pdf.

5.1.5.   Measures to resolve specific problems

In order to prevent rapid changes in buying-in prices of sugar beet, it is possible to introduce, according to art. 221 of Regulation (EU) No 1308/2013, a solution that ensures the maintenance in the next campaign period of the average cultivation prices over, for example, a three-year period preceding the current production campaign. This instrument will help to maintain the next year's crop structure of sugar beet, to ensure the continuity of supply for processors, maintain sources of income for agricultural producers and to stabilise prices on the internal market.

Article 222 of Regulation (EU) No 1308/2013 states that "*During periods of severe imbalance in markets, the Commission may adopt implementing acts to the effect that article 101(1) TFEU is not to apply to agreements and decisions of recognised producer organisations, their associations and recognised interbranch organisations in any of the sectors referred to in article 1(2) of this Regulation, provided that such agreements and decisions do not undermine the proper functioning of the internal market, strictly aim to stabilise the sector concerned and fall under one or more of the following categories:*

- *market withdrawal or free distribution of their products;*

- *transformation and processing;*

- *storage by private operators;*

- *joint promotion measures;*

- *agreements on quality requirements;*

- *joint purchasing of inputs necessary to combat the spread of pests and diseases in animals and plants in the Union or of inputs necessary to address the effects of natural disasters in the Union;*

- *temporary planning of production taking into account the specific nature of the production cycle"*.

The EC in the implementing act must specify the geographical scope and the material and the time of the application of such solutions. These solutions may temporarily reduce the scale of the crisis, but it is an **instrument of extraordinary nature**, and not an item that should be a permanent part of the policy[25]. Article 219 of Regulation (EU) No 1308/2013 also gives possibilities for counteracting strong distortions in the market.

5.2.   Strengthening the position of growers in the food supply chain

5.2.1.   The contract farming of sugar beet

Contractual negotiations are now operating in the sugar market. Organisations of growers and the sugar industry conclude agreements The introduction of a **mandatory conclusion of agreements** may constitute some kind of element to stabilise the sector. It should be noted that Regulation (EU) No 1308/2013 lays down the purchase conditions of sugar beet after the elimination of quotas. At the same time, the EC is empowered by article 125, paragraph 4, to adopt delegated acts concerning, among others, the purchase conditions of sugar beet.

It would be useful if for sugar beet there were similar provisions within the Regulation (EU) No 1308/2013 as the once for other sector – articles 169, 170 and 171. Moreover, there

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[25]   This instrument was activated in March 2016. See: http://europa.eu/rapid/press-release_IP-16-806_en.htm.

are special guidelines how to apply these articles[26]. In the case of sugar beet the cooperation within POs and APOs can concentrate on: joint use of equipment, joint management of waste – by-product (leaves) directly related to production, joint procurement of inputs or joint transportation. Given the specificity of sugar sector the volume of the product which is covered by the contractual negotiations by a particular PO should probably be determined at regional level, instead of national level as in the sectors covered by articles 169-171 of the Regulation No 1308/2013.

A formalised cultivation contract is in accordance with the principles of respect for equal conditions of competition in the common market. At the same time it brings, both to the producer and the processor, benefits in terms of improved stability and market transparency and fosters the development of various forms of cooperation between the contracting parties.

Under the contract, the **manufacturer** undertakes to produce and deliver to contracting party specific quantities of sugar beet in a particular types and species. The amount of these products may be specified by weight or may be determined in such a way that they will result from the area in which the sugar beet will be harvested. The cultivation contract bears the hallmarks of a contract agreement of an outwork.

Agricultural producers responsible for the quality of delivered products to contracting party are given the opportunity to obtain technological assistance, and the contracting party gains the right to control and supervise the production process to obtain a product of the highest quality.

Inclusion in the agreement of provisions on pre-financing of payments towards the cultivation contract will contribute to improvement of the liquidity of farmers and reduce the occurrence of "*bottlenecks*" in sugar factories. On the benefits of cultivation, contracts must also undoubtedly mention sales assurance (purchase of raw materials), the guaranteed price, the possibility of production planning and determination of the date of sale (purchase).

5.2.2.   Producer Organisations and Producer Groups

There are many organisations of sugar beet producers. It seems that this is not an arrangement that will provide significant support to farmers after the elimination of quotas. The very existence of these organisations will not provide either the concentration of supply or adaptation of production to market requirements. Yet, there is still much room for increasing the activity of Producer Organisations (POs) and creating Association of Producer Organisations (APOs).

Support for professional organisations from public funds should lead to the acquisition by their representatives of skills to support their members in both price negotiations with suppliers of machinery and other production inputs as well as sugar beet consumers. There is therefore a need to set up training systems that raise awareness among members of such organisations of these opportunities, training programmes and workshops aimed at developing negotiation skills, and training providing general knowledge about the market.

Support for public sector organisations could also lead to the emergence of specific "*innovation brokers*" to support members of organisations in achieving the above-mentioned objectives. Another way to stimulate business organisations is to build on the model of the **Enterprise Europe Network information centre** for sugar beet growers. With the centre's help it became easier to exchange experiences on unfair commercial

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[26]   Commission Notice — Guidelines on the application of the specific rules set out in Articles 169, 170 and 171 of the CMO Regulation for the olive oil, beef and veal and arable crops sectors (OJ EU C431, 2015)

practices and to use financial and hedge instruments as forward contracts, futures markets, etc. Sugar is used mainly as a sweetener in the food industry. The integration of the sugar industry and secondary food processing (confectionery industry, beverage industry etc.) will bring benefits from economies of scale and increased added value. Such integrating activities should be supported if they do not affect the conditions of competition. The oversight by competent authorities is necessary to "ensure that competition is not curtailed and consumers' interests preserved" [Bardají et al., 2016].

5.2.3. Direct payments related to the production

As part of the CAP in the period 2015-2020 Member States can voluntarily support incomes of sugar beet growers via **payments linked to production.** It should be noted, however, that the allocation of funds for payments related to production reduces the national ceiling on. Production related payments in specific sectors are a special form of income support for farmers, because direct payments are generally decoupled from production (*decoupling*). According to assumptions, the support related to production can be directed to sectors which are important economically, socially and environmentally and experience difficult situation. The main objective of the support is to create incentives for farm households to maintain production at a certain level.

The sugar industry is a strategic sector of the food economy, and its foundation is the cultivation of sugar beet. In this context, the cultivation of sugar beet satisfies the condition to apply for support linked to production. Sugar payments have a large share in the income of growers and their elimination will contribute to the deterioration of profitability. Payments related to the production of sugar beet became a part of the direct payment schemes in **ten Member States**: the Czech Republic, Croatia, Finland, Greece, Spain, Poland, Romania, Slovakia, Hungary and Italy. France and Germany, which are the largest producers of sugar beet in the EU, have not benefited from them because these are countries characterised by the highest efficiency of production.

Table 13: Total amount for coupled payments to sugar beet (in EUR mio

Member State	2015	2016	2017	2018	2019	2020
Romania	17.58	17.87	18.17	18.46	18.75	18.90
Spain (spring payments)	14.47	14.47	14.47	14.47	14.47	14.47
Hungary	8.00	7.99	7.98	7.98	7.98	7.54
Slovakia	7.98	8.03	8.09	8.16	8.22	7.18
Poland	81.20	81.60	82.00	82.46	82.93	73.58
Spain (autumn)	2.37	2.37	2.37	2.37	2.37	2.37
Italy	17.21	16.99	16.76	16.55	16.34	16.34
Czech Republic	16.67	16.67	16.67	16.67	16.67	16.67
Grecee	5.00	6.92	6.84	6.76	6.68	6.68
Croatia	2.77	3.06	3.63	4.21	4.79	4.61
Finland	1.00	1.00	1.00	1.00	1.00	1.00
TOTAL	**174.24**	**176.97**	**177.97**	**179.09**	**180.20**	**169.34**

Source: Confédération Internationale des Betteraviers Européens.

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2015:431:TOC.

5.2.4.   Investment support

In the framework of **rural development policy (Article 17 of the Regulation (EU) 1305/2013)** it is possible to indicate sugar beet producers as a group which gets wider access to investment support. This will help to improve the efficiency of production or change the direction of production, depending on the analysis of the situation of the agricultural holding.

Preferences for investments may also include support for local development by subsidies to maintain the multi-profile farm with livestock, production of beet and using beet leaves in animal feed or organic fertilisation.

This type of good agricultural practice will help to maintain the improvement of soil fertility, and thus preserve it for future generations. With regard to entrepreneurs and processors, it is possible to run investment programmes aimed at the diversification of economic activities for the production of bioethanol, biogas, sugar etc.

5.3.   Production charge

Article 128 of Regulation (EU) No 1308/2013 states that the amount of sugar, isoglucose and inulin syrup are subject to a production charge, which is a kind of direct tax imposed on manufacturers. In accordance with article 232 of this Regulation, article 128 and articles 127-144 and articles 192 and 193 shall be applied to the end of the 2016-2017 marketing year for sugar, that is, until 30 September 2017.

This means the liquidation of the production charges, and thus the fixed costs of production will fall. However, this will not affect the competitiveness of the sugar to isoglucose, as the abolition of the production charge also applies to isoglucose.

5.4.   Risk management instruments

Few member states have decided to introduce risk management instruments. As indicated by the analysis prepared before the adoption of the final version of Regulation (EU) No 1305/2013, the income stabilisation tool would be too expensive for potential participants [Pigeon, 2012], however some Member States implement it (i.a. Italy). The remaining elements of risk management refer only to the situation related to the occurrence of adverse weather events and may not constitute the basic element of the safety net associated with the liquidation of production quotas (market liberalisation). The instrument for income stabilisation refers to losses in growers' income arising from the climate-science adverse effects, which applies to a systematic risk. This means that mutual funds are not in this case a good solution, as the risk covers equally all farmers of the area. When there is a loss of agricultural income over 30% of the average of three or five years, excluding the highest income, 70% of lost income is compensated for. A better solution is "Combining all farms' insurable risks into a single contract provides a more efficient coverage than sorting them out into separate contracts when farm's risks do not perfectly covariate" [Mahul and Wright, 2003; Diaz-Caneja and Garrido, 2009][27]. Bardají, Garrido et al. [2016] recommend granting "farmers vouchers that could be used for contracting risk management instruments (mutual funds, ISTs, Insurance)".

From a comparison between the United States and the EU on the structure of agricultural support, that in the US: 60% of spending from the federal budget is dedicated to insurance, 40% for activities in the field of safety net, and 0% on income support through direct payments. In the EU, this structure is as follows: 1% insurance, 39% safety net,

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[27]   http://www.ft.com/cms/s/0/283688e8-ee6a-11e4-98f9-00144feab7de.html#axzz40DvxGVVe.

60% of income support through direct payments. Safety nets and direct payments are the specific ex-post instruments of reacting to changes at the level of income, and insurance is rather a mechanism to respond with an anticipatory nature or ex-ante. This different approach to support means that US policy may be called a dynamic-integrated policy, and CAP static-segmented policy. Undoubtedly, the US agricultural policy cannot be implemented in the EU (here we abstract from its defects), since the level of budgetary expenditure is pre-determined, and funds not used in a given year cannot be transferred to subsequent years [Cordier, 2015].

5.5. The agri-environment measures

Sugar beet is a plant well place to be an exemplary in the implementation of the concept of **circular economy and Climate Smart Agriculture (CSA approach)**. It is used not only to produce sugar or bioethanol, but its by-products also have economic importance. As a result, the farmers growing their crops based on the principles of integrated production can be supported under agri-environmental programmes with a view of the importance of maintaining sugar beet production for biodiversity.

It is also possible to introduce instruments for the introduction of agriculture to the economic system of closed circuit by rewarding farmers for providing sugar beet leaves for feed or fertiliser. There is also the possibility of bonusing the investment programmes of rural development in the production that connects the rearing of ruminants with plant production, including the use of sugar beet on the agricultural holding.

5.6. Others

In connection with the expected higher volatility of sugar and sugar beet prices, the possibility of using the following instruments is well founded:

- earlier payment of direct payments or other benefits is only the current support for the improvement of the current financial liquidity of agricultural holdings, but does not affect the actual achieved level of income. Therefore it cannot be considered as an instrument of income stabilisation, and this is a necessary part of maintaining sugar beet production,

- earlier payment of certain payments under the RDP - area payments and for animals (including LFA, agri-environment),

- mechanism for the allocation of the EU support to producers who voluntarily reduce their production when prices fall[28].

- domestic support within the de minimis - e.g. for liming the soil. The proposed increase in the current ceiling of de minimis aid from EUR 15 to 30 thousand of national aid granted to the farmer in a period of three years will significantly increase the possibility of supporting farmers.

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[28] A proposal for such a mechanism in regard to the milk market was presented to the European Milk Board in the form of the Market Responsibility Programme. Firstly, the programme determines the scale of the crisis, using an index covering milk prices, production costs and production levels. Secondly, the European Milk Board determined the levels of this index that characterises early warning phase (fall of this index by 7.5%), crisis phase (fall by 15%) and obligatory cutback phase (fall by 25%). A package of anti-crisis measures was adopted on 14th March 2016: http://europa.eu/rapid/press-release_IP-16-806_en.htm.

6. RECOMMENDATIONS

Elimination of sugar and isoglucose production quotas and the minimum purchase price of sugar beet while maintaining the current rules of international trade will cause a significant change in market conditions. This applies both to the production and distribution of sugar, and the conditions of competition between sugar producers and beet growers, as well as leading to greater price volatility and requiring increased risk management. The **future market policy should mitigate these risks** by introducing solutions (i.e. a safety net) for maintaining the cultivation of sugar beet and sugar production in the EU. These should include, among others, in random order:

- implementation of a **system of long-term risk management** in terms of sugar production and agricultural income. Such a system is necessary in the face of increasing volatility of agricultural markets and increasing price volatility. It should enable the EU institutions, in direct response to the rapid changes in the situation in the sugar market, to maintain aid for private storage and active trade and promotional policy. The EU market should be protected by customs and quasi and out-of-tariffs instruments and imports should be allowed only within the framework of duty free quotas, which should not be increased. Sugar should be classified as a group of sensitive products. In the event of a large supply on the EU market, direct export support should be considered. Promotional activities should relate to the acquisition of new markets, information about the qualities of sugar production in Europe (respecting standards of environmental protection, occupational safety, etc.) or general export support;

- instruments indirectly **stabilising farm incomes**. These should include direct payments linked closely to the area of the cultivation of sugar beet. Not all EU member states in which sugar beet is grown use this form of support. It should be noted, however, that their adoption will mean a reduction in the overall pool of available payments to farmers engaged in other agricultural activities;

- instruments directly **limiting the volatility of the income** of farmers. These can include: countercyclical payments, income insurance, or combinations of these instruments. Their aim is to make the farmers' gains more stable;

- linking sugar beet with **environmental and climate change objectives** (crop rotation, cropping livestock production etc.). The policy towards the sugar sector should take into account, therefore, the ability to support growers with environmental payments. The alternative for these instruments is to allow the cultivation of genetically modified varieties in the EU. In effect, this means a reduction in the cost of chemical protection of sugar beet cultivation, fewer weeds, higher yields and improvement of efficiency and competitiveness of production;

- **support for investments** in agricultural holdings and linking them to activities aimed at local, multi-functional and sustainable rural development; preference in granting support for producer groups.

- measures aiming at **strengthening the position of growers** in the food supply chain. For this purpose, a key role is played by solutions such as the obligation of **written contracts** between growers and sugar producers, maintaining the ability to support the creation of professional organisations (producer organisations – POs, associations of producer organisations – APOs and intrerbranch organisations) and producer groups, and any steps to integrate (the capital) growers with the sugar industry;

- a condition for an effective market policy is access to information and the ability to anticipate change, to take timely effective action. A modern and effective **system of monitoring the market situation** is necessary which will provide businesses and governments access to market information;

- adoption of an **income risk management** toolkit in which the farmer and the state are involved financially in the implementation of an income stabilisation programme, whose design is based on Canadian AgriStability programme. It should be noted, however, that such a system requires full knowledge of the costs and revenues generated by individual farms, which is not common in the EU. The implementation of similar solutions in the EU needs time to gather the relevant data on the financial situation of individual agricultural holdings.

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ANNEXES

Annex 1: Impact of production quotas on market functioning
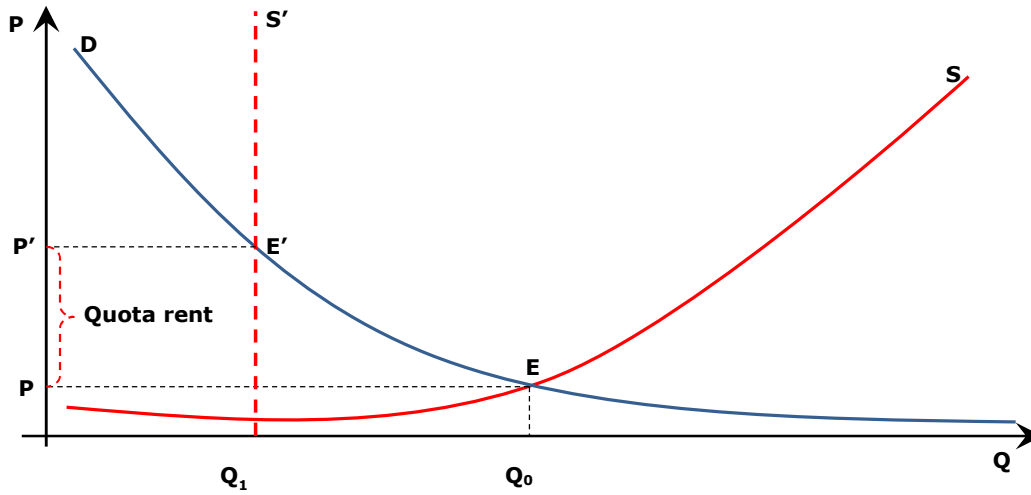
Source: Own elaboration.

Annex 2: Production possibility frontier in the context of production quotas
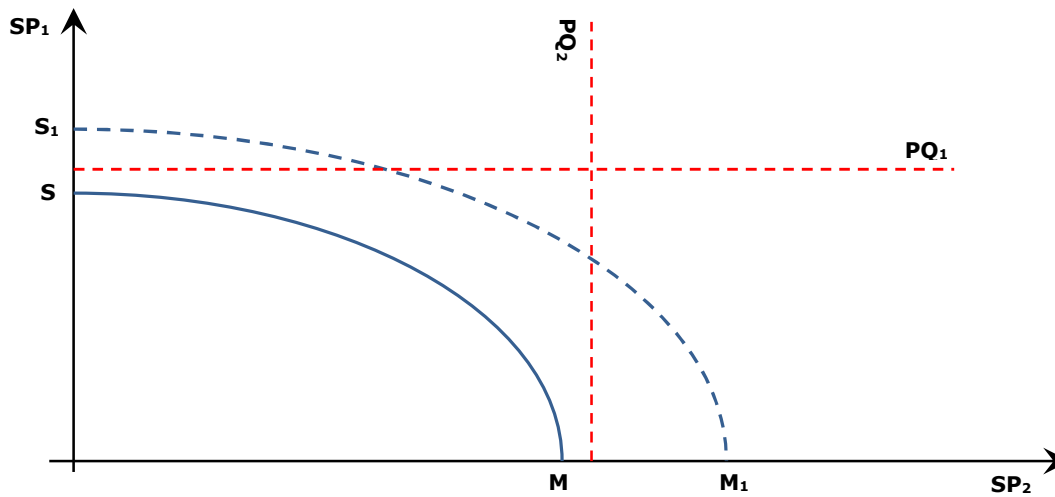
Source: Own elaboration.

Annex 3: Impact of the reduction of tariffs on the market situation
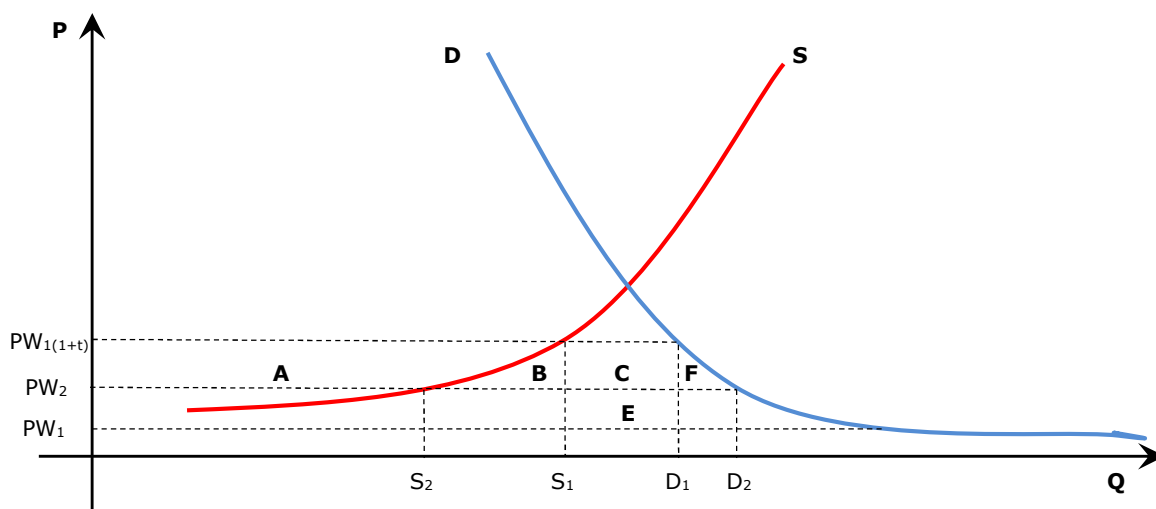
Source: Own elaboration.

Annex 4: Competition intensity forces in the sugar sector
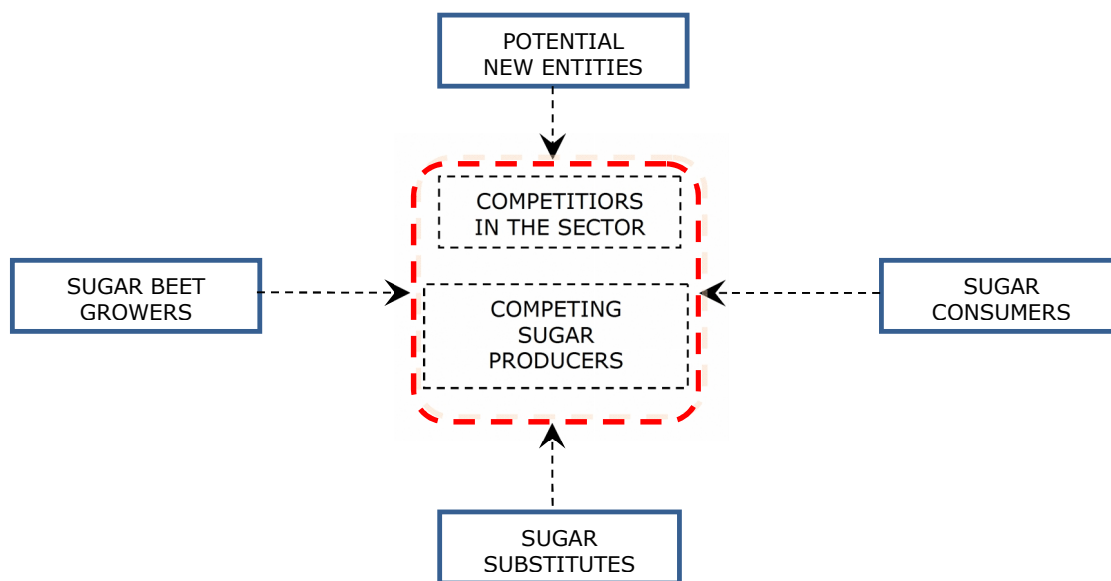
Source: Own elaboration.

Annex 5: Global sugar balance [million tonnes, r.s.e.]

Items	2000-2003	2004-2007	2008-2011	2012-2015
Beginning stocks	62.2	65.1	61.4	73.1
Production	141.4	156.3	162.8	181.3
Imports	46.7	51.5	59.5	64.0
Consumption & disappearance	136.9	151.7	163.9	177.6
Exports	49.1	55.4	60.2	65.7
Ending stocks	64.2	66.6	59.7	75.8
Ending stocks/Consumption	46.9	43.9	36.4	42.7

Source: Own elaboration based on F.O. Licht's World Sugar Balances.

Annex 6: Global sugar production [million tonnes, r.s.e.]

Items	2000-2003	2004-2007	2008-2011	2012-2015
World	**141.4**	**156.3**	**162.3**	**181.3**
Asia	**47.5**	**55.0**	**56.7**	**67.9**
India	19.2	23.5	22.9	27.8
China	9.6	12.1	12.3	13.4
Thailand	6.7	6.5	8.8	11.2
Pakistan	3.8	3.7	4.1	5.7
South America	**30.7**	**39.0**	**45.5**	**46.5**
Brazil	23.3	30.9	37.8	39.0
Europe	**27.3**	**27.9**	**26.8**	**27.9**
EU	20.6	19.3	17.0	17.2
France	4.5	4.2	4.3	4.4
Germany	4.4	4.2	4.1	4.1
Russia	1.8	3.1	4.0	4.9
North & Central America	**20.7**	**19.4**	**19.2**	**22.9**
USA	7.6	7.2	7.2	7.9
Others	**15.3**	**15.1**	**14.6**	**16.2**

Source: Own elaboration based on F.O. Licht's World Sugar Balances.

Annex 7: Global sugar consumption [million tonnes, r.s.e.]

Specification	2000-2003	2004-2007	2008-2011	2012-2015
World	**136.9**	**151.7**	**163.9**	**177.6**
Asia	**56.7**	**66.2**	**73.9**	**82.6**
India	18.6	21.4	23.8	26.3
China	9.9	12.9	15.0	16.2
Europe	**31.3**	**31.2**	**30.9**	**31.2**
EU	18.6	18.7	18.9	19.3
South America	**16.3**	**18.4**	**20.5**	**21.2**
Brazil	9.9	11.4	12.6	12.8
North & Central America	**18.5**	**19.4**	**19.6**	**20.7**
USA	9.0	9.4	10.1	10.9
Others	**14.1**	**16.5**	**19.1**	**21.8**

Source: Own elaboration based on F.O. Licht's World Sugar Balances.

Annex 8: Main sugar exporters and importers in 2014/2015 [mio. t, r.s.e.]

Importers	Mio. ton	Exporters	Mio. ton
China	3.8	Brazil	25.3
Indonesia	3.4	Thailand	7.3
USA	3.2	France	2.1
United Arab Emirates	2.5	Guatemala	2.1
Malaysia	2.1	United Arab Emirates	1.9
Saudi Arabia	1.7	India	1.8
Nigeria	1.6	Mexico	1.5
Egypt	1.5	Cuba	1.0
Italy	1.5	Pakistan	0.7
United Kingdom	1.2	Germany	1.0

Source: Own elaboration based on F.O. Licht's World Sugar Balances.

Annex 9: Quotas for the production of sugar and isoglucose

Items	Sugar ['000 tonnes whit sugar]		Isoglucose ['000 tonnes dry matter]	
	1261/2001	1308/2013	1261/2001	1308/2013
Austria	387.3	351.0	-	-
Belgium	819.8	676.2	56.1	114.6
Bulgaria	-	-	15.4	89.2
Croatia	-	192.9	-	-
Czech Republic	454.9	372.5	-	-
Denmark	420.7	372.4	-	-
Finland	146.1	80.9	11.9	-
France & Overseas Departments	3,769.1	3,437.0	19.8	-
Germany	3,416.9	2,898.3	35.3	56.6
Greece	317.5	158.7	12.9	-
Hungary	401.7	105.4	137.6	250.3
Ireland	199.2	-	-	-
Italy	1,557.4	508.4	20.3	32.5
Latvia	66.5	-	-	-
Lithuania	103.0	90.3	-	-
Netherlands	864.5	804.9	9.1	-
Poland	1,671.9	1,405.6	26.8	42.9
Portugal & Region of Azores	79.6	9.9	9.9	12.5
Romania	-	104.7	-	-
Slovakia	207.4	112.3	42.5	68.1
Slovenia	53.0	-	-	-
Spain	997	498.5	82.6	53.8
Sweden	368.3	293.2	-	-
United Kingdom	1,138.6	1,056.5	27.2	-
European Union	**17,440.4**	**13,529.6**	**507.4**	**720.5**

Source: Own elaboration based on Regulation (EU) No 1260/2001, Regulation (EU) No 1308/2013.

Annex 10: Sugar beet cultivation in the European Union

Items	Number of growers	Harvested area	Average plantation	Sugar yield
	'000**	'000 Ha*	Ha*	t/Ha*
Austria	7.4	45.0	6.1	10.2
Belgium	2.6	53.7	20.7	12.6
Croatia	1.0	16.8	17.0	6.8
Czech Republic	0.8	58.2	72.8	8.3
Denmark	1.3	24.0	18.5	12.7
Finland	0.8	12.0	15.0	6.2
France***	26.0	350.5	13.5	11.5
Germany	30.7	294.7	9.6	11.1
Greece	1.9	4.7	2.5	6.9
Hungary	0.2	14.7	73.5	7.4
Italy	9.5	38.3	4.0	7.0
Lithuania	0.4	15.0	37.5	8.6
Poland	35.0	171.6	4.9	9.6
Romania	1.2	23.9	19.9	5.8
Slovakia	0.2	27.4	137.0	8.6
Spain	6.8	37.7	5.5	12.8
Sweden	1.9	19.3	10.2	10.7
The Netherlands	8.2	60.5	7.4	12.9
United Kingdom	3.6	74.2	20.6	11.6
European Union	**139.5**	**1342.2**	**9.6**	**11.2**

* Season 2015/2016, ** season 2013/2014, *** production: France Overseas Departments (280 thousand tonnes), Portugal Azores (800 tonnes)
Source: Own elaboration based on CEFS, European Commission.

Annex 11: Sugar production in the European Union

Items	Sugar production	Number of factories	Production per factory	Employment	Employment productivity
	'000 t*	'000	'000 t	'000**	t/employer
Austria	433	2	217	0.8	533
Belgium	700	3	233	0.7	1069
Croatia	112	3	37	0.7	158
Czech republic	493	7	70	1.4	349
Denmark	299	2	150	0.6	541
Finland	72	1	72	0.3	236
France	4,597	25	184	6.7	682
Germany	3,267	20	163	5.1	636
Greece	32	3	11	0.9	37
Hungary	120	1	120	0.3	373
Italy	343	4	86	1.2	277
Lithuania	116	2	58	0.3	405
Poland	1,340	18	74	5.2	256
Romania	110	4	28	0.4	276
Slovakia	187	2	94	0.5	416
Spain	510	5	102	1.8	280
Sweden	195	1	195	0.5	407
The Netherlands	765	2	383	0.8	967
United Kingdom	980	4	245	1.3	730
European Union	**14,670**	**109**	**135**	**29.5**	**497**

* Season 2015/2016, ** season 2013/2014
Source: Own elaboration based on CEFS, European Commission.

Annex 12: Direct payments and sugar payments and in France, Germany and Poland

| Items	2006	2007	2008	2009	2010	2011	2012	2013
National ceilings – so called sugar payments [mln EUR]								
Poland	99.1	122.9	146.7	159.4	159.4	159.4	159.4	159.4
Germany	154.8	203.3	252	277.9	277.9	277.9	277.9	277.9
France	151.2	196.1	245	270.1	270.1	270.1	270.1	270.1
National ceilings – direct payments in total[mln EUR]								
Poland	981	1,264	1,573	1,877	2,192	2,477	2,788	3,045
Germany	5,647	5,695	5,744	5,770	5,772	5,772	5,853	5,853
France	7,382	8,289	8,336	8,408	8,421	8,421	8,521	8,521
Sugar payments relations to direct payments in total [%]								
Poland	10.1	9.7	9.3	8.5	7.3	6.4	5.7	5.2
Germany	2.7	3.6	4.4	4.8	4.8	4.8	4.7	4.7
France	2.0	2.4	2.9	3.2	3.2	3.2	3.2	3.2
Sugar payments per ha of sugar beets cultivation [EUR/ha]								
Poland	419.9	534.3	784.5	834.6	830.2	838.9	825.9	861.6
Germany	438.5	540.7	775.4	785	805.5	705.3	705.3	794.0
France	504	597.9	653.3	726.1	708.9	692.6	701.6	699.7

Source: Own elaboration based on Council Regulation (EC) No 319/2006, Council Regulation (EC) No 73/2006.

Annex 13: Global sugar prices and closing stocks, 2000-2015
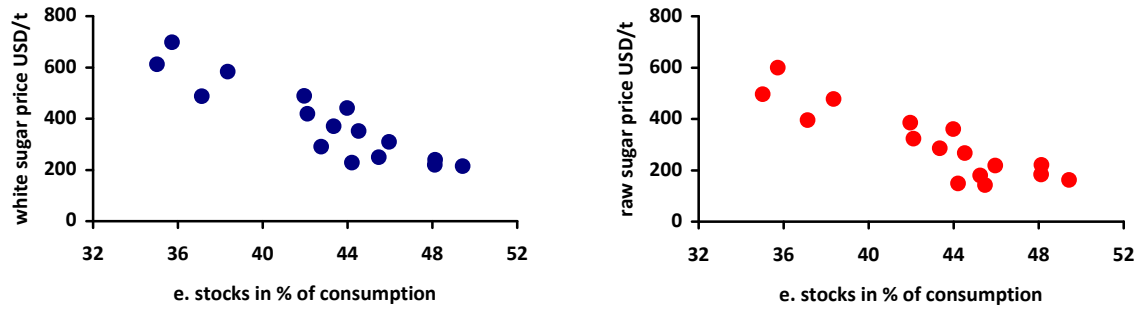
Source: Own elaboration based on, ERS USDA, F.O. Licht.

Annex 14: Errors variance decomposition of forecast of sugar prices (%) and analysis of impulse response (from the VECM model) (%)
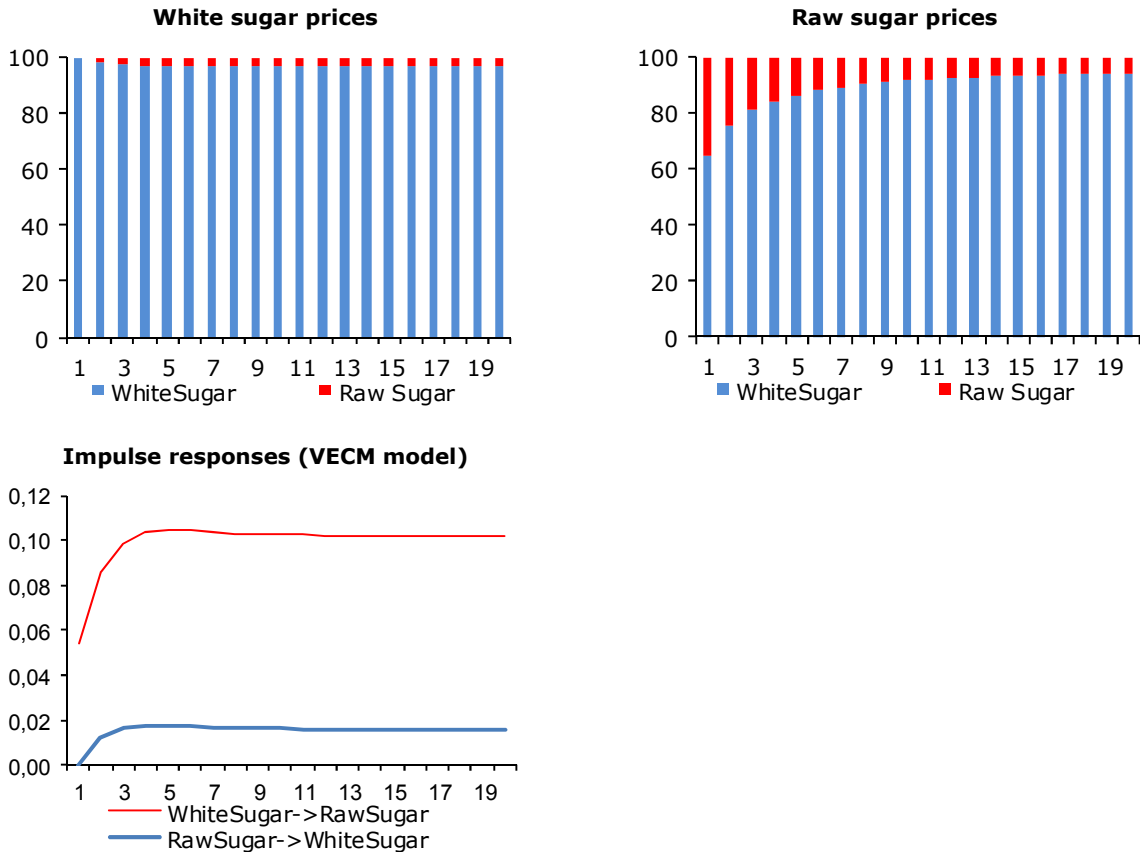
Annex 15: Parameters for scenario modelling

The bases for the analysis of scenarios of development of the EU and world sugar market situation were the FAO/OECD and European Commission's projections. The European Commission's projection served as the (baseline scenario) as it includes most of the market parameters related to:

- sugar beet growing: cultivation area, yield, production and distribution between sugar and bioethanol;

- sugar: production, stocks, consumption and foreign trade.

Using the price dependencies between the EU and world markets, the EU price trends were assessed and extrapolated. The analysis of price elasticity enabled the assessment of the impact of sugar prices changes on the scale of its production.

Changes in the volume of sugar production resulted in significant changes in the market balance, which mostly applied to foreign trade and stock volume. EU sugar consumption is characterised by low volatility as the demand is inelastic in relation to the price.

The scenario projection was based on an analysis of market balance that was a simple partial equilibrium model of the EU sugar sector ($S_o+P+M=C+X+S^e$)[29] and the baseline methodology. In the study, change dynamics analysis was applied in the case of each of the market balance components. The extrapolation of the trend function was conducted using a simple linear regression function with moving averages. The results of the statistical analysis were also assessed using expert methods.

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[29] S_o – opening stocks, P – production, X exports, C consumption, M imports, S_e – ending stocks.

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