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# GEOGRAPHICAL DELINEATION OF SUGAR MARKET BASING ON ELZINGA–HOGARTY METHOD

## Abstract

*The aim of the paper was to define the geographical scope of the sugar market using the Elzinga–Hogarty method. For practical use of this method the authors made three assumptions: 1) sugar market was studied integrally, independently from type of sugar, its origin and kind of customer, 2) the European Union market treated en bloc was the starting point for the analysis, 3) LOFI and LIFO tests were established at the level of 90% ("strong" market). The authors used secondary data on sugar production, consumption, imports and exports on country and the EU level gathered for 2013 by the International Sugar Organization. Sugar market was defined by "adding" to each other subsequent national markets characterised by the highest trade exchange. The markets were added until the requirements for LOFI and LIFO tests were met at the level of 90%. The results of the research allow the authors to define the sugar market as a global market which consists of the EU area and 30 other countries in the world. Such market has production of 114 million tonnes, consumption of 110 million tonnes and small share of import and export at the level of 10.7 million tonnes and 11.4 million tonnes, respectively. The geographical definition of the sugar market determined in the paper is much broader than the ones used by the European Union and the Polish Office of Competition and Consumer Protection. The controversy about the geographical scope of the sugar market suggests the need for further research in the area.*

**Keywords:** sugar market, Elzinga–Hogarty method, market delineation, LIFO test, LOFI test.

## Introduction

The market is the fundamental economic category (Tirole, 1988; Werden and Froeb, 1993), which is determined as a set of sellers and buyers making with each other voluntary trade transactions (Png and Lehman, 2013). Although textbooks may claim that "empirical difficulty of defining a market will be ignored" (Tirole, 1988, p. 13), any attempt at giving practical meaning to the term "a set of sellers and buyers" requires to delineate the geographical limits of the set. Market is the place where enterprises gain or lose their competitive advantage. Accurate market definition in the geographical dimension is an important problem for company managers. It is also a vital issue for politicians and civil servants, who, on the one hand, decide on the scope and forms of industry support and, on the other, on how to protect the consumers and competition against the negative impact of the possible monopoly power[1].

The authors illustrated the practical significance of the accurate market definition on the example of the sugar industry, which is a key segment of agribusiness in Poland, the EU and the world. Sugar is generated from two types of raw materials: sugar cane and sugar beet. Development of the beet sugar industry in Europe took place as a result of reduction in cane sugar import from the English and French colonies, following mutual trade restrictions and harbour blockades started in 1806 (Hryszko and Szajner, 2013; Malec, 2001). Development of beet sugar production in Europe and North America was preconditioned by the protectionist policy which is a long-term characteristic of the industry (Walkenhorst, 1998; Hryszko and Szajner, 2013). It is illustrious that it was policy that caused development of the beet sugar industry and further development and survival of the sector depended and still depends on policy. Sugar market regulation in the European Union started in the 1960s. Liberalisation of the EU regulations in the sugar sector, as from 2006 (more on the issue in: Mucha, 2010; Pietrzak and Mucha, 2014), poses serious challenges to the sugar sector. There emerges a question about the international competitiveness of the sugar sector – and the accurate definition of the sugar market in the geographical dimension becomes a significant element of seeking for the answer.

The protectionist policy is limited, in the context of lowering competitiveness of beet, to cane sugar industry[2]. European sugar enterprises meet with a growing pressure of external competition (cane sugar), intra-EU competition and threats of substitutes such as isoglucose (which will be also released from the restraints of quotas). These companies take steps to improve efficiency and

[1] The issue of spatial aspects of the economic activity is also an important element of the Krugman's spatial equilibrium model. It concerns the economic activity and consists in indication of favourable and unfavourable geographical areas of activity (more on the issue in: Krugman, 2010; Chojnacka, 2014).

[2] This proves the drop in the share of sugar beet in the global market from ca. 48% in 1961 (Hryszko and Szajner, 2013) to ca. 20% in 2013 (Pietrzak and Mucha, 2015).

increase bargaining power in the face of the growing number of recipients from the food sector[3] (often global giants, e.g. Coca-Cola) and increasingly more concentrated retailers. One of such steps is a drive at concentration by mergers and takeovers. Bearing in mind a considerable level of concentration measured at the national level, such steps have to face the barrier of competition law, because of the narrow definition of the geographical market range adopted by the antitrust authorities[4]. On the other hand, the industry representatives consider that the sugar market should be defined more broadly. Pietrzak and Mucha using the LOFI and LIFO tests, which are parts of the Elzinga–Hogarty method, showed that in the light of the data on the flows of goods, the national markets[5] largely fail to meet the criteria of a "strong" market (Pietrzak and Mucha, 2015). If the national markets represent too narrow geographical range, then what is the right definition of the geographical limit of the sugar market? This paper aims at answering the above question with the use of the Elzinga–Hogarty method, to determine the geographical limits of the market through aggregation of subsequent markets failing to meet the LOFI/LIFO tests, until meeting the condition of relative isolation as regards the flows of goods by a sum of geographical market segments thus created.

## Literature review

The problem issue of defining the geographical range of the sugar market, as known by the authors of this paper, has not been directly discussed so far in the literature, except for the paper by Pietrzak and Mucha (2015). Other authors, in their deliberations, did not try to define the geographical limits of the market and in the publications they most often used such terms as "national sugar market", "sugar market in the EU" or "the EU sugar market" and "world sugar market". These terms are, however, used rather freely and the relations between them are not precisely defined (e.g. the authors fail to clarify, which terms define the relevant market and which its segments; which of the terms is an "artificial" aggregate of separate markets used, for instance, on account of joint legal framework).

For example, Budzyńska writes about "the sugar markets in 27 Member States" (2009) or about "the participants of the British, Spanish, Belgian and Dutch sugar market" (2013), which would suggest that the sugar market is captured as a national market in the geographical dimension, but earlier she mentions "the EU market" and "the Community market" (2013), thus indicating the

[3] For example, the share of buyers from the food industry sector amounts to ca. 55-60% of the demand for sugar in Poland and ca. 85-87% of the demand for sugar in Germany (Hryszko and Szajner, 2013).

[4] The research by Pietrzak and Mucha indicates that in the decisions of the European Commission and the Office for Competition and Consumer Protection, the sugar market is, in general, defined as the national market (2015).

[5] The research covered countries representing 98% of the world supply of sugar.

semi-global market, i.e. regional supranational market covering the EU countries. The country perspective of the sugar market is presented in some publications by Artyszak (2010, 2013), but still he sometimes uses the term "the EU sugar market" and even points out in one paper that "the publication aims at characterising the EU sugar market" (2008). Chudoba (2007, 2008) and Kapusta (2011) also describe the sugar market from the national viewpoint, but they still refer to the "sugar market in the European Union" / "the EU sugar market". Judzińska (2013) presents a similar approach in her deliberations on the changes in the Polish sugar industry.

Hryszko and Szajner do not discuss directly the spatial range of the sugar market, but they clearly point to the EU sugar market along with the national one: "foreign trade played a key part in the national and the EU market stabilisation" (2013) and, moreover, they often use the term "the world market". A similar approach appears also in other publications by Szajner (2013, 2014). Although the authors point out that "the national sugar market is increasingly more coupled with the EU market" (Szajner, 2014) and that "The sugar industry is a food economy sector in which the impact of the world market on the local market is evident. The cointegration of the national market with the international market is illustrated by a strong dependency between the international selling prices and the prices in the international commodity exchanges" (Hryszko and Szajner, 2013). It is not, however, clear which of the three terms (the national, EU, world) points to the relevant market system and which to its subsystems (segments) and possibly which of them is rather an assumed aggregate (created by summing up demand/supply in relevant markets).

Walkenhorst (1998) and Purgał (2010) treat the EU as an independent sugar producer/exporter, but they fail to take up the issue of the EU sugar market delineation directly. Lipińska also writes about "the Community sugar market" (2007). Iwan (2007), Nolte and Grethe (2012), and Bugajska and Pajewski (2015) refer to the EU sugar market as well. Then again, Kondrakiewicz (2014) treats the EU sugar market as a separate entity. She emphasises that "the European Union is one of the key world producers of sugar and its market is linked through export and import with the markets of other countries". Since the above-mentioned authors do not refer directly to the issue of delineation of the geographical limits of the market it is not actually known[6] what is the meaning of the term "the EU sugar market" as used by them. Nonetheless, it seems that many of them use the term "the EU sugar market" as explained by Tracy in his approach to the Common Agricultural Policy, who not that much states that the EU area sets the geographical limits of the market *per se*, but that it is rather only an indication of the area of the customs union (Tracy, 1997).

[6] An exception of sorts are the monographs of Iwan in which "the EU market" is most often determined in the context of the common organisation of the sugar market; hence, more with reference to the legal framework of the sector than the market in economic terms (2007).

Pietrzak and Mucha reviewed the decisions of the antitrust authorities regarding sugar market cases taking into account all decisions of the European Commission on the competition protection (state aid decisions were overlooked) and all decisions of the President of the Office of Competition and Consumer Protection regarding the sector. In most of the justifications of the decisions, the relevant national market was defied at the national level (Pietrzak and Mucha, 2015). Additionally, the authors carried out the LIFO and LOFI tests jointly under the Elzinga–Hogarty method for 92 countries (representing 98% of sugar production worldwide) in selected campaigns of 2001-2014. In the 2013/2014 campaign, the LIFO/LOFI tests jointly were not met in case of as much as 94% of countries, which means that only 6% of countries meet the criteria of a "strong" market, and confirms the hypothesis that the sugar market has a supranational geographical range and, simultaneously, contradicts the definitions of the antitrust authorities (Pietrzak and Mucha, 2015).

## Sugar market characteristics

Since the 1960s, there has been a clear growth in the world sugar production, on average by 2.2 million tonnes per year (Hryszko and Szajner, 2013), which is caused by higher sugar demand both in households and the industry. According to the estimates of an analytical company F.O. Licht, the world sugar production in the 2014/2015 season reached nearly 182 million tonnes per raw sugar (Table 1), where over 80% is cane sugar (2014). The share in the production structure of beet sugar, which has been dropping for years, is caused mainly by higher cane crops in South America and Asia (Hryszko and Szajner, 2013).

Asia ranks first in the world sugar output producing one-third of sugar in global terms (66 million tonnes in raw sugar equivalent). It is followed by South America, where 44 million tonnes of sugar are produced, which stands for 24% of the share in the global volume of sugar; Europe is third producing a total of 29.50 million tonnes, out of which 18.6 million (10% globally) falls to the EU countries. Currently, sugar is produced in 127 countries worldwide, in 79 out of them sugar is made of cane sugar and in 48 of sugar beets. The largest producers of sugar beets include: Russia, the United States and the European Union, which in total produce ca. 45% of the world volume of sugar from sugar beets. The largest cane sugar producers are Brazil, India and Thailand, in total they produce over half of the world's sugar cane output.

From the 1990s, the global demand for sugar increases yearly by ca. 2% and now it amounts to nearly 180 million tonnes (Table 1). According to the newest estimates, the demand growth rate will continue at the level of ca. 2% per year, e.g. because of the growth in sugar consumption, especially in the Asian countries (OECD-FAO, 2014). Sugar is consumed in large quantities, mainly in processed products, direct consumption in households is less significant. At present, the highest sugar consumption is in Asia, as its residents consume

ca. 82 million tonnes, which accounts for nearly half of the world consumption; it is followed by Europe where sugar consumption has been stable for years and amounts to ca. 30 million tonnes, out of which ca. 19 million tonnes falls to the EU. The main sugar consumers are: Russia, Germany and France. The average per capita sugar consumption worldwide is, today, at the level of ca. 20 kg.

Table 1

*Global sugar balance (million tonnes per raw sugar)*[a]

| Specification | 2009/2010 | 2010/2011 | 2011/2012 | 2012/2013 | 2013/2014 | 2014/2015[b] |
|---|---|---|---|---|---|---|
| Opening stocks | 60.2 | 56.9 | 58.2 | 64.6 | 72.5 | 77.5 |
| Output | 159.1 | 165.4 | 174.8 | 184.3 | 182.2 | 181.7 |
| Import | 62.6 | 59.9 | 60.6 | 63.4 | 63 | 62.4 |
| Consumption | 162.3 | 162.8 | 168.4 | 172.8 | 176.4 | 179.7 |
| Export | 62.7 | 61.3 | 60.6 | 67.0 | 64 | 64.3 |
| Closing stocks | 56.9 | 58.2 | 64.6 | 72.5 | 77.3 | 77.6 |

[a] Season from 1.10 to 30.09 of the following year.

[b] Estimate.

Source: *Rynek cukru*, no. 42/2015.

Both raw sugar and white sugar are traded internationally. Due to technology constraints some countries cannot produce white sugar, they only produce raw sugar. It is subsequently sold to sugar refineries that after proper treatment obtain white sugar. The international trade deals with ca. 35% of the global sugar production which represents ca. 2.8% in the global agri-food trade. Currently, the share of raw sugar in the global trade amounts to ca. 60%. Brazil continues to be the largest world exporter with global sugar export at the level of 40%, it is followed by Australia and Thailand. The largest sugar importers are now China, Indonesia, the US and the European Union (*F.O. Licht*, 2014).

Sugar market is a market of continued margins (Kondrakiewicz, 2014). Sugar stocks amount to ca. 35-45% of its consumption (Table 1). It can be partly explained by the fact that sugar production is of seasonal nature and it is strongly dependent on weather conditions. This has a large impact on the level of supply which in turn causes high fluctuations in the global sugar prices. However, it has to be kept in mind that the sugar market is historically a regulated market – state intervention is used in all major sugar-producing countries (official prices, import duties, tariff quotas, etc.). This distorts market mechanisms contributing, as a result, to significant, fixed margins as well as to market destabilisation and price fluctuations. Significant changes in the sugar prices and large-scale state intervention have been features of the sugar market for a long time (Walkenhorst, 1998).

## Research methodology

To verify the geographical range of the sugar market, the authors used secondary data on sugar production, consumption, import and export on the country and the EU level, gathered by the International Sugar Organization – ISO (Sugar Year Book, 2014). On their basis, the Elzinga–Hogarty method was used (Elzinga, 1981; Elzinga and Hogarty, 1973, 1978) to determine the geographical range of the sugar market.

The E-H method belongs to the quantitative methods applied to geographical market delineation, which are divided into two key groups: price-based methods and methods based on the flows of goods[7]. The Elzinga–Hogarty method is considered as the most important among those defining the market limits, which analyse the flows of goods (Crane and Welch, 1991; Hay, Hilke and Nelson, 1988; Scheffman and Spiller, 1987). According to Crane and Welch, only such an approach can give reliable results on market limits (1991). The idea behind the method is that the areas which trade with each other at a significant level belong to the same market. Whereas the flows of goods between them reflect the shifts in demand and supply that affect the prices (Elzinga and Swisher, 2011; Wårell, 2005). Therefore, to define the market it is necessary to gather data on the volume of production, consumption and import and export of a product, whose market is subject to geographical delineation (Wårell, 2007).

The Elzinga–Hogarty method consists in verification of two tests: LOFI and LIFO. The LOFI test refers to the supply side of the market and its positive verification means that "companies in a hypothetical geographical market execute only a slight part of their turnover outside the area of the market" (Elzinga and Hogarty, 1973). Conversely, the LIFO test refers to the demand side and its positive verification happens "when only a small part of the product used in a hypothetical geographical market is «imported» to the outside area". Positive verification of both tests points to the existence of a separate geographical market (Elzinga and Hogarty, 1973). The cut-off values of the LOFI and LIFO tests are represented by thresholds arbitrarily defined by the method authors. The so-called strong market means a geographical area, where at least 90% of the product sold is in the hypothetical market (LOFI test) and at least 90% of purchases in the area comes from companies from this area (LIFO test). Then, "weak" market requires meeting the conditions at a more "liberal" level, i.e. 75% (Elzinga and Hogarty, 1978). If at least one of the analysed tests fails to exceed the required percentage threshold, the area of the hypothetical market needs to be extended by "adding" an area having the greatest impact on not meeting the given test. The procedure has to be repeated until reaching the cut-off thresholds for both tests. As pointed out by Crane and Welch, the range of the market defined in the geographical dimension does not have to be composed

[7] More on the issue in (Pietrzak and Mucha, 2015).

only and exclusively from areas adhering to each other, but can also encompass more remote areas[8]. This situation is caused, e.g., by major differences in production costs between regions and non-linear character of transport costs[9] (Crane and Welch, 1991).

In order to practically use the E-H method to define the geographical range of the sugar market, it was **necessary to adopt certain assumptions**. Each of them can be considered questionable which, clearly, is not without effect on the final results obtained by the authors.

**Firstly**, before starting to determine the geographical limits of the market, it needs to be defined in supply dimension, i.e. as regards sellers offering products of high level of substitutability, and demand dimension, i.e. buyers having specific needs (Bourgeois, 1979; Pietrzak, 2014; Sleuwaegen, 1999). The authors assumed that the sugar market should be considered independently from the sugar type, sugar origin and type of consumer, because these are highly substitutable. The authors talking about sugar and its type, refer to sucrose, both in the form of white sugar and raw sugar – assuming that arbitration mechanism is in place between the white and raw sugar sectors, which is evidenced by a strong dependency between sugar prices in both segments[10].

**Secondly**, the authors assumed as the starting point the European Union market treated *en bloc*, i.e. as a market of a single country. Such an approach was, on the one hand, necessitated by the structure of the available data and, on the other, methodically justified. As noted by Elzinga and Hogarty, in order to use their method it is necessary to gather detailed data on the place of origin and destination of the flows of goods between researched areas, which data are often not readily available (Elzinga and Hogarty, 1973). One of the available data sources allowing for such accounts for sugar is the *Sugar Year Book* (2014), developed by the International Sugar Organization. In its comparisons the ISO treats the EU as a single country and it is not possible to carry out an analysis broken down by Member States. Other comparisons fail to provide sufficiently detailed data on foreign trade.

The research results of Pietrzak and Mucha (2015) indirectly support the ISO approach in methodical terms. In the light of the research carried out in the 2013/2014 campaign none of the EU countries met the LOFI/LIFO tests at the level of a "strong" market[11] (Pietrzak and Mucha, 2015). This points to the existence of a broader sugar market in geographical terms than the markets of respective Member States. Does it prove that there exists a single sugar mar-

[8] Creating discontinuities in the geographic area of the defined market.

[9] For example, costs of sea freight linked to import from a remote continent can be in certain circumstances lower than transport by land from a country situated on the same continent.

[10] A broader discussion on the assumption is in (Pietrzak and Mucha, 2015).

[11] Only 2 countries met the test of the "weak" market (Pietrzak and Mucha, 2015).

ket that has the same borders as the EU? Of course not – and that is exactly the source of the controversy linked to adopting the EU, treated *en bloc*, as the starting point in the E-H method. These results make such a possibility more probable, though. Apart from that, it needs to be noted that the below-mentioned individual features of the Common Agricultural Policy in the sugar sector can be used as arguments for considering it as a market with the same geographical borders as the European Union borders:

- the system of official prices covering the reference price of sugar and the minimum price for sugar beets;
- free (duty-free/border-free) transport and sales of sugar in the single economic area of the EU;
- extended system of tariff protection against sugar import from third countries and system of export subsidies (presently suspended);
- quality requirements set at the EU level;
- trade agreements concluded by the EU and concerning access to the EU market;
- central management (most of the regulations are taken at the EU level);
- commitments to the WTO, in practice the WTO export limit for non-quota sugar adopted for the entire EU area.

**Thirdly**, the authors adopted as the cut-off value for the LOFI and LIFO tests a more "restrictive" threshold of a "strong" market (i.e. 90%). Still, as noted by the very creators of the method, a more "liberal" threshold may lower the actual market range (Elzinga and Hogarty, 1973). Also Wårell, in her research on the definition of the geographical range of the carbon market, adopted a threshold typical for a "strong" market (2005).

## Research results

As already mentioned, the EU-27, treaded *en bloc*, was taken as the starting point for the definition of the geographical market range. The newest available data were from 2013. Because in 2013 Croatia accessed the EU, the authors adjusted the data, so as to treat the EU market as a whole, i.e. EU-28 (EU-27 plus Croatia). Next, the starting market was extended by adding subsequent countries, where the trade exchange was the greatest, until the required percentage threshold was achieved (at the same time in both LOFI and LIFO tests) termed as the "strong" geographical market.

For example, the EU-28 market failed to meet the LIFO test (Table 2), which follows from major imports of sugar to the EU (the EU is a net importer). In 2013, sugar production in the European Union was at the level of 15.93 million tonnes, while consumption – 18.62 million tonnes. The Community countries exported 1.44 million tonnes of sugar, primarily to Israel, Algeria, Switzerland and Norway. Whereas the EU imported 4.14 million tonnes of sugar, $^1/_4$ from Brazil. Consequently, the first country which was added to the starting market

was Brazil (Figure 1)[12] – the largest supplier of sugar to the EU market. Upon adding Brazil – the largest sugar producer in the world – the value of respective variables in the E-H method changed considerably. Sugar production in the EU-28+Brazil market was at the level of 53.42 million tonnes and consumption only at the level of 30.49 million tonnes. The import dropped, but the export grew to the level of 27.55 million tonnes. Hence, despite the increasing value of the LIFO test index, the LOFI test index fell considerably (the EU-28+Brazil market is a net exporter – Table 2). The joined EU-28+Brazil market exports the most to China (ca. 3.5 million tonnes), thus China was added to the analysed market (Figure 2). The EU-28+Brazil+China market still failed to meet both tests, but the LOFI test to a greater extent (the EU-28+Brazil+China market is a net exporter – Table 2). The combined EU-28+Brazil+China market exports the most to the United Arab Emirates, thus the UAE was added to the analysed market, etc. The countries added next traded to the greatest extent with the analysed market, until Ghana was added and the required percentage thresholds for both indices of the E-H test were reached (Table 2, Figure 3).

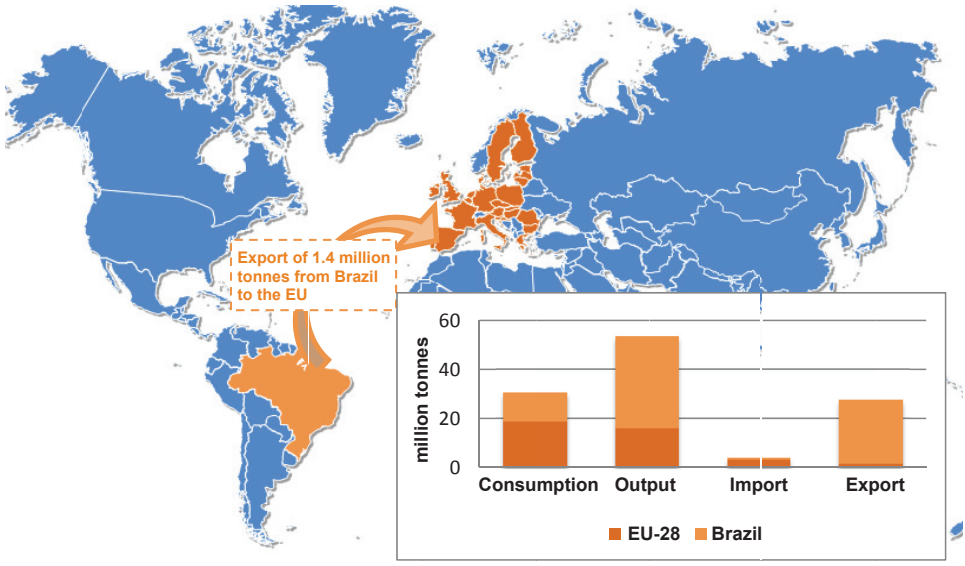


*Fig. 1.* Sugar market in the EU-28+Brazil.

Source: own study on the basis of (*Sugar Year Book*, 2014).

[12] It should be noted that, as emphasised by Crane and Welch, the market does not have to create a continuous area in a geographic space (1991) – in case of the sugar market the cost advantage of Brazil is large enough to offset the transport costs (which do not have to grow in a linear manner in relation to distance).

Table 2 presents data on subsequent stages of using the procedure of market definition according to the Elzinga–Hogarty method. Table 2 presents separate results, after each step, for LOFI and LIFO tests and interpretation of the overall Elzinga–Hogarty test for the 90% threshold, i.e. "strong" market (E-$H_{90\%}$), and "YES" means that LOFI and LIFO tests are met simultaneously and "NO" means that one or two tests are not met; hence, another country has to be added to the starting market. Furthermore, after each step basic values were determined that characterise the market defined at a given step (consumption, production, import, export[13]).

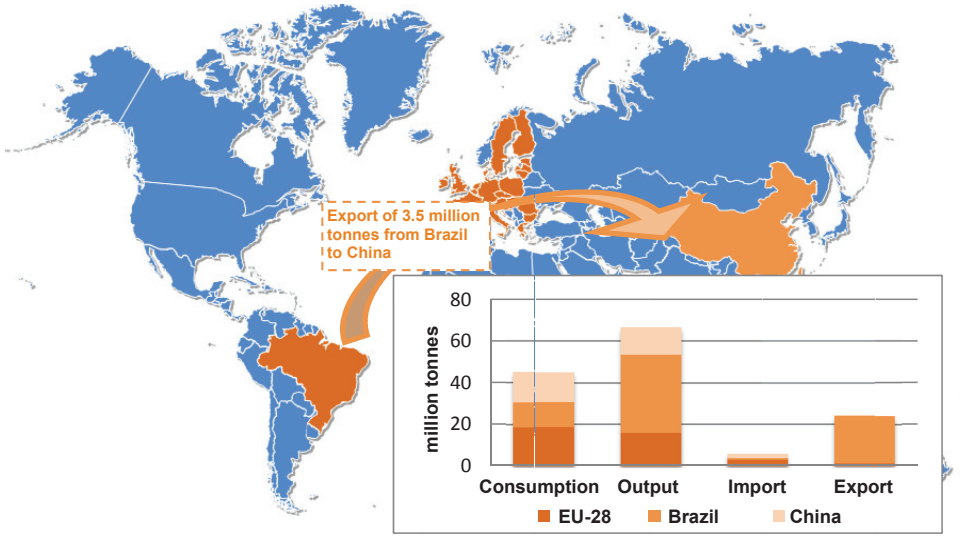


*Fig. 2*. Sugar market EU-28+Brazil+China.

Source: own study on the basis of (*Sugar Year Book*, 2014).

As a result of applying the Elzinga–Hogarty method, a sugar market covering the EU-28 and 30 countries from all continents, excluding Australia (Figure 3), was defined. Thus defined EU-28+30 market, represents production at the level of 114 million tonnes and consumption at the level of 110 million tonnes of sugar, with foreign trade at the level of 11 million tonnes. The data point to a very high share of an isolated market in a global supply (70%) and demand (67%) for sugar. At the same time, the defined market has a disproportionally small share in the global export (18%) and import (17%), which proves that in terms of flows of goods it constitutes a quite homogenous and relatively closed entirety.

[13] Note: the given values might not add up because there are major stocks in the sector.

Table 2

*Determination of the geographical range of the sugar market with the use of the LOFI/LIFO tests (2013)*

| Order of adding subsequent countries | Country | Consumption (million tonnes) | Production (million tonnes) | Import (million tonnes) | Export (million tonnes) | LOFI test | LIFO test | E-$H_{90\%}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | European Union + Croatia | 18.62 | 15.93 | 4.14 | 1.44 | 91.1% | 78.0% | NO |
| 2 | + Brazil | 30.49 | 53.42 | 3.90 | 27.55 | 48.4% | 87.2% | NO |
| 3 | + China | 45.12 | 66.56 | 5.98 | 24.10 | 63.8% | 86.7% | NO |
| 4 | + United Arab Emirates | 45.32 | 66.56 | 6.12 | 24.13 | 63.7% | 86.5% | NO |
| 5 | + Algeria | 46.64 | 66.56 | 6.00 | 22.59 | 66.1% | 87.1% | NO |
| 6 | + Bangladesh | 48.41 | 66.67 | 6.06 | 21.12 | 68.3% | 87.5% | NO |
| 7 | + Russia | 54.03 | 71.09 | 6.06 | 20.16 | 71.6% | 88.8% | NO |
| 8 | + Iran | 56.63 | 72.34 | 6.21 | 18.74 | 74.1% | 89.0% | NO |
| 9 | + Nigeria | 58.12 | 72.35 | 6.23 | 17.35 | 76.0% | 89.3% | NO |
| 10 | + Malesia | 59.67 | 72.36 | 6.76 | 16.34 | 77.4% | 88.7% | NO |
| 11 | + Indonesia | 65.51 | 74.91 | 8.94 | 15.08 | 79.9% | 86.3% | NO |
| 12 | + Thailand | 68.27 | 84.71 | 7.14 | 19.84 | 76.6% | 89.5% | NO |
| 13 | + Saudi Arabia | 69.35 | 84.71 | 7.24 | 18.84 | 77.8% | 89.6% | NO |
| 14 | + Egypt | 72.43 | 86.63 | 7.24 | 17.97 | 79.3% | 90.0% | NO |
| 15 | + India | 95.30 | 109.60 | 7.16 | 17.99 | 83.6% | 92.5% | NO |
| 16 | + Canada | 96.52 | 109.70 | 7.30 | 17.04 | 84.5% | 92.4% | NO |
| 17 | + Morocco | 97.73 | 110.06 | 7.34 | 16.16 | 85.3% | 92.5% | NO |
| 18 | + Sudan | 99.45 | 110.75 | 8.17 | 15.64 | 85.9% | 91.8% | NO |
| 19 | + South Korea | 100.98 | 110.75 | 9.02 | 14.96 | 86.5% | 91.1% | NO |
| 20 | + Japan | 103.18 | 111.42 | 9.69 | 14.23 | 87.2% | 90.6% | NO |
| 21 | + Cambodia | 103.42 | 111.47 | 9.62 | 13.97 | 87.5% | 90.7% | NO |
| 22 | + Yemen | 103.97 | 111.47 | 9.62 | 13.39 | 88.0% | 90.7% | NO |
| 23 | + Venezuela | 105.17 | 112.00 | 9.79 | 12.85 | 88.5% | 90.7% | NO |
| 24 | + Israel | 105.65 | 112.00 | 9.85 | 12.37 | 89.0% | 90.7% | NO |
| 25 | + Iraq | 106.41 | 112.00 | 10.18 | 11.93 | 89.3% | 90.4% | NO |
| 26 | + South Africa | 108.44 | 114.36 | 10.23 | 12.10 | 89.4% | 90.6% | NO |
| 27 | + Georgia | 108.57 | 114.36 | 10.26 | 11.98 | 89.5% | 90.6% | NO |
| 28 | + Angola | 108.87 | 114.36 | 10.29 | 11.72 | 89.8% | 90.5% | NO |
| 29 | + Sri Lanka | 109.22 | 114.41 | 10.53 | 11.60 | 89.9% | 90.4% | NO |
| 30 | + Mauretania | 109.37 | 114.41 | 10.58 | 11.51 | 89.9% | 90.3% | NO |
| 31 | + Ghana | 109.62 | 114.41 | 10.70 | 11.39 | 90.0% | 90.2% | YES |

Source: own study on the basis of (*Sugar Year Book*, 2014).

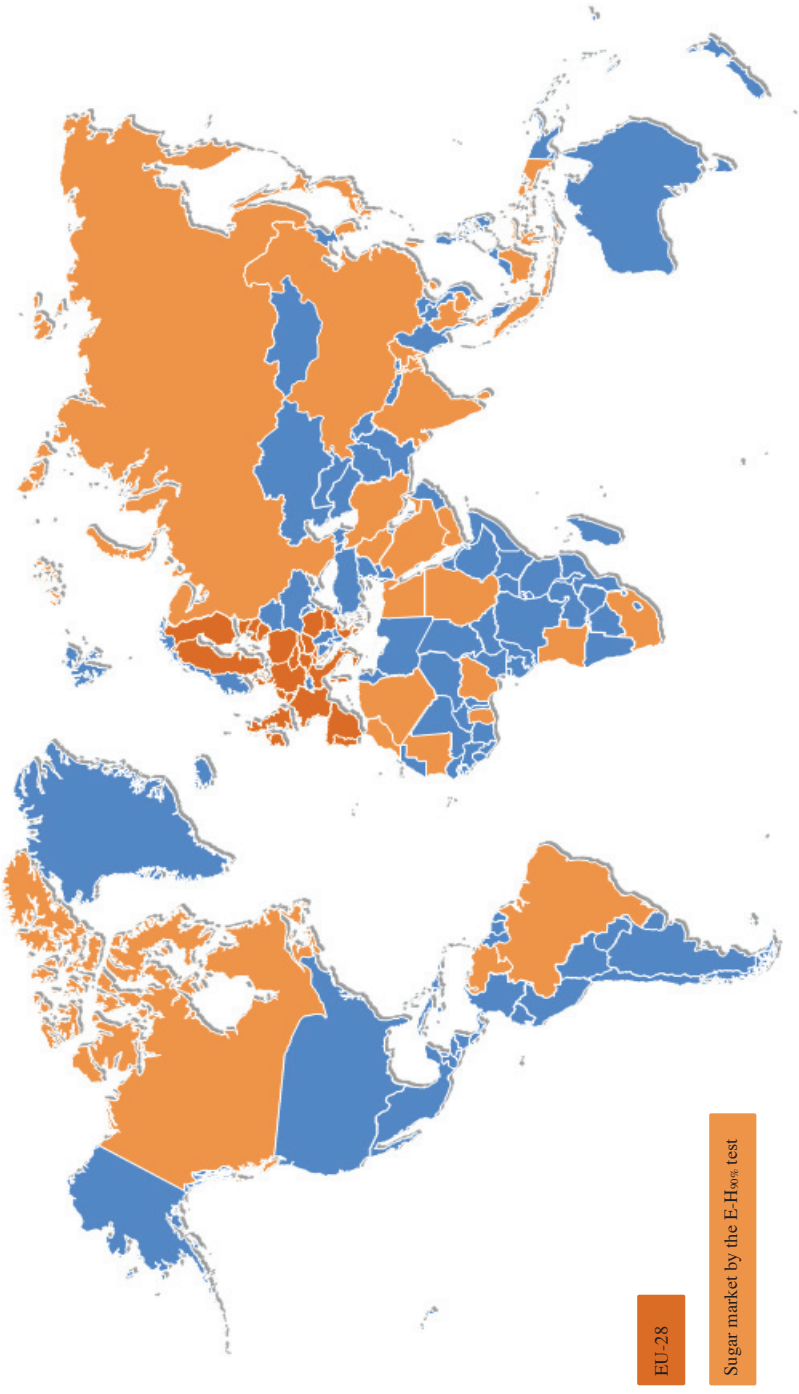


*Fig. 3.* Geographic range of the sugar market in 2013.
Source: own study on the basis of (*Sugar Year Book*, 2014).

Pietrzak (2014) suggested the following gradation of geographical market range: local[14], regional (intra-national)[15], country-wide, semi-global (regional in supranational understanding), global. Although the defined sugar market does not cover the whole world, it would be difficult to term it as semi-global because it covers dispersed markets that do not maintain spatial continuity typical for the region in its supranational understanding (e.g. the EU, the NAFTA). Bearing in mind its spatial characteristics and the fact that it represents almost $^2/_3$ of the global demand/supply, it seems expedient to term it as global. Hence, the spatial definition of the sugar market resulting from the use of the Elzinga–Hogarty method is definitely wider than the aforementioned decisions of the European Commission and the Office of Competition and Consumer Protection. It is even wider than as presented in the discussion with the antitrust authorities of companies aiming at mergers/takeovers, which see the geographical borders of the sugar market more at the level of the European Economic Area than the global one.

## Discussion of the results

The obtained research results can be criticised, basically, on account of two reasons. Firstly, from the perspective of assumptions taken in the research, secondly, from the position of the criticism of the applied method.

The adopted assumption that the sugar market should be considered as composed of two segments: white and raw sugar, can be questioned. The geography of production and foreign trade differs considerably in case of the two segments, thus suggesting the possibility of getting quite different results should this assumption be overruled. However, the authors are positive that this assumption is strongly justified by substitution of the two types of sugar. Moreover, according to the best knowledge of the authors there are no statistics that would allow for separation of consumption of white and cane sugar at the level of countries, thereby practically preventing the use of the E-H method, if these products are treated as separate markets.

The assumption treating the EU market *en bloc*, as a market of a single country, is also controversial. However, it seems that the presented arguments allow for adoption of such an assumption as highly probable. Also in this case, rejection of the assumption – in the light of available statistics – would prevent the use of the Elzinga–Hogarty method to delineate the sugar market.

The subsequent contentious assumptions cover adoption of the "strong" market threshold (90%), i.e. a more "restrictive" approach. Although this is suggested by the very authors of the Elzinga–Hogarty method and it is also present in its practical applications, it needs to be admitted that the adoption of the "weak" market threshold (75%) would result in a conclusion that the borders of the EU-28 are sufficiently broadly delineated as geographical limits of the sugar

[14] Gminas, poviats.

[15] Voivodeships and macroregions.

market. With a more "liberal" threshold the EU-28 market would meet both the LOFI and LIFO tests simultaneously (Table 2).

The second group of arguments against the obtained research results may be drawn from the criticism of the Elzinga–Hogarty method as such. Warden indicates two cases, in which the E-H method may yield flawed results. Firstly, if there are no flows of goods between areas it may be wrongly interpreted that the areas are separate markets, while high cross elasticity of demand may attest to a likely competition between areas and this competition will materialise, if differences in prices appear between the areas (Werden, 1981 as in: Wårell, 2005). The fallacy concerns too narrow market definition, therefore, it does not apply to the obtained results which suggest a very broad market definition. Secondly, there is a risk of too broad market definition, which will overlook an undiscovered market existing as part of a defined area (Werden, 1981 as in: Wårell, 2005). A specific type of a too broad market definition in the E-H method is the so-called silent majority fallacy, as descried by Capps et al. (2001). The fallacy refers in particular to services, in case of which the research covers the flows of consumers (and not goods) seeking for services (e.g. medical services). A travelling "minority" of consumers may be characterised by very different preferences and behaviours than the "silent majority" of consumers that does not travel in search for services. Consequently, drawing conclusions based on the "minority" flows may lead to faulty suppositions on the "silent majority" and too broad market definition (Capps et al., 2001). The risk of such a fallacy appears in the case of highly differentiated services and products – as regards location and other dimensions (Capps et al., 2001) – thus the case does not pertain to the sugar market, which is a typical good, not a varied product. To sum up, the results obtained by the authors seem to be hard to question if one bases only on the criticism of the E-H method as such.

Although, as already mentioned, the literature does not clearly define the geographical range of the sugar market, the results obtained by the authors with the use of the Elzinga–Hogarty method are at least partly supported by the findings of Hryszko and Szajner (2013). On the basis of price-based methods (analysis of correlation and cointegration of prices), they indicate that the Polish sugar market is increasingly more related to the international market (Hryszko and Szajner, 2013).

## Conclusions

The use of the Elzinga–Hogarty method, extensively used in the merger analysis in the United States, resulted in the sugar market definition surprisingly broadly delineated by the geographical borders (i.e. a *de facto* global market). Interpreting the research results obtained by the authors, the questionable research assumptions adopted by them need to be kept in mind. Given the important controversy as regards definition of the geographical range of the sugar market, the authors call for continuation of research within the scope. In particular, it should be worthwhile to apply alternative, as regards E-H, methods of sugar market delineation both of quantitative and qualitative character.

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# OKREŚLANIE ZASIĘGU GEOGRAFICZNEGO RYNKU CUKRU Z WYKORZYSTANIEM METODY ELZINGA–HOGARTY

## Abstrakt

*Celem artykułu było określenie zasięgu geograficznego rynku cukru z wykorzystaniem metody Elzinga–Hogarty. Do praktycznego zastosowania metody przyjęto trzy założenia: 1) rynek cukru rozpatrywany był całościowo niezależnie od rodzaju cukru, pochodzenia cukru i rodzaju odbiorcy, 2) punktem wyjścia analizy był rynek Unii Europejskiej traktowany en bloc, 3) graniczna wielkość testów LOFI i LIFO na poziomie 90% („silny" rynek). W artykule wykorzystano dane wtórne dotyczące produkcji, konsumpcji, importu i eksportu cukru na poziomie państw i UE gromadzone przez International Sugar Organization za rok 2013. Rynek cukru został określony poprzez „doklejanie" do siebie kolejno rynków krajowych charakteryzujących się największą wymianą handlową. Rynki były dodawane do momentu, aż zostały spełnione założenia dwóch testów LOFI i LIFO na poziomie 90%. Uzyskane wyniki badań pozwoliły na określenie rynku cukru rynkiem globalnym obejmującym obszar UE i 30 krajów na świecie. Tak zdefiniowany rynek charakteryzował się produkcją na poziomie 114 mln t, konsumpcją prawie 110 mln t oraz małym udziałem importu i eksportu, odpowiednio na poziomie 10,7 mln t i 11,4 mln t. Określona w artykule definicja przestrzenna rynku cukru jest znacznie szersza w porównaniu z definicjami Komisji Europejskiej i polskiego Urzędu Ochrony Konkurencji i Konsumentów. Istniejąca kontrowersja w definiowaniu zasięgu geograficznego rynku cukru wskazuje na potrzebę kontynuacji badań w tym obszarze.*

**Słowa kluczowe:** rynek cukru, metoda Elzinga–Hogarty, delimitacja rynku, test LIFO, test LOFI.

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