IMPORT OF AGRICULTURAL PRODUCTS IN THE CONTEXT OF THE EVOLVING LEVEL OF FOOD SECURITY

Magdalena Jaworska
Poznań University of Life Sciences
Department Economics
St. Wojska Polskiego 28
Poznań, Poland
e-mail: jaworska@up.poznan.pl

Abstract

The main purpose of this paper was to assess the trading activity of agri-food importing countries with reference to changes in food security levels. The study covered agricultural commodities as a group of products involved in international trade. The timeframes for this study are the 1995–2015 period. The research was based on outcomes reported by ten key importers: the European Union, United States, China, Japan, Canada, Russia, Korea, Mexico, Hong Kong (China), Mexico and India. The basic source of data were online databases and reports, including those delivered by UNCTAD, FAO, WTO, WB and OECD. Once collected, the data was analyzed with the use of quantitative and qualitative research methods. Selected statistical methods (measures of dependence, position and variation), indices of structure and dynamics, indicators of the openness of economy, and indicators related to three dimensions of security (availability, access and stability) were used. The analysis resulted in numerous conclusions. In the study period, agri-food imports followed a global growth trend with alternating periods of contrasting developments, resulting in a decrease of the trade growth rate. The import trade openness of countries covered by this study was higher than that of global imports and followed a growth trend. The singularities of the development of agricultural sectors and markets were reflected in decreasing values of the exports-to-imports ratio both for agricultural commodities and foodstuffs, and were decisive for the positive growth rate of per capita agri-food production volumes. According to the analysis of correlation between changes to agricultural commodity imports and selected food security indicators, agricultural imports demonstrate a strong positive correlation with physical and economic availability, and a weak negative correlation with stability. Based on the above, a general conclusion may
be drawn that economic growth resulted in structural changes which contributed to improving access to food.

Keywords: agricultural products, food security, importers, international trade

JEL Classification: F14, F41, Q17, F62

1 Introduction

Agriculture is a national economy branch subject to specific environmental, climate, production and socio-cultural conditions. Therefore, agricultural products traded internationally are considered to be “sensitive” commodity. At the same time, all countries around the world are more or less dependent on the imports and exports of agricultural products which, for many of them, are of strategic importance from the economic and political perspective (as reflected by their commitment to self-sufficiency in basic products and their efforts to generate adequate incomes). This is a kind of “economic weapon” which guarantees the satisfaction of food security needs. That fact gave rise to discussions, considerations and questions regarding global agricultural trade. Having in mind the threats and needs of the globalizing economy, a question should be asked about the evolution of the involvement of specific countries in international trade in agricultural products. Did the key players reduce their trade flows? If so, is the evolution of trade correlated (and to what extent) to the development of food security? This is why the main purpose of this paper was to assess the trading activity of agri-food importing countries with reference to changes in food security levels. To interpret trading activity as a degree of country participation in agriculture products trading or measurable value of import and its fluctuations. To fulfil main target detailed analysis has been performed in a following scope: a comparative assessment of the importance of trade in agricultural products; the intensity of involvement of selected countries in the world agricultural trade; an evaluation of food security levels in three dimensions; and a test of correlation between imports and food security.

1.1 Agri-food trade and food security: a conceptual approach

A country’s capacity to participate in global agricultural trade is primarily determined by the patterns and specifics of the agri-food sector. The strength of their impact on supply and demand depends on the type of goods traded and on their importance both for the importers and for the exporters. The country’s natural and climate conditions are decisive for the spatial distribution, level and
commodity structure of the supply of agricultural products, and for the need to meet the demand through imports. Unequal access to such natural assets as arable land, forests and aquatic resources, as well as geographic location and diverse climate are the co-determinants of agricultural production (Jaworska, 2005). Also, the growing importance of non-natural conditions is noticeable. This partially results from the fact that the same natural environment conditions may be used in different ways depending on the scope and anthropological nature of activities, and on the socio-economic situation. Unlike the structural and technical factors, institutional and economic determinants are subject to frequent changes and are more subjective in nature. Among them, the economic policies (especially including the international economic policy of specific countries and country groups), and the international trade policy are of key importance (Jaworska, 2004).

Therefore, the real scope of farming activities creates barriers to the growth of supply of agricultural commodity which cannot be overcome in short term without additional costs. Also, incurring expenditure to increase food production volumes is only reasonable in countries with a strong agricultural potential; otherwise, it results in enormous opportunity costs (Herrmann, 2009). At the same time, the globalization process contributes to the growth of global production, whereas the development of world trade through the strengthening of links between agricultural and food markets of specific countries enables addressing the demand for the relevant products in a relatively stable and fast way. The above provides grounds for a relationship between trade in agricultural commodity and food security, basically in all of its aspects. As defined by FAO, food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life (FAO, 2017). This definition recognizes the multidimensional nature of food security by emphasizing the existence of its four basic pillars: availability, access, utilization and stability (UNCTAD, 2017b). Note that availability refers to physical supply of food from all possible sources, e.g. all forms of domestic production, commercial imports, food aid, etc. (Aurino, 2014).

However, the relevant literature provides various interpretations of physical availability. According to Zegar (2013), it means the agriculture’s capacity to produce a sufficient quantum of food (agricultural commodity), at least equivalent to the minimum physiological demand. Herrmann (2009) believes that availability does not depend on whether the country is able to cover the domestic food consumption volume with domestic food production; instead, it depends on whether the country is able to generate enough financial resources to finance the required food imports. These different views are the consequence of the
evolution of the “food security” concept. According to some estimations, around 200 definitions and 450 relevant indicators exist (Mechlem, 2004). Pinstrup-Andersen (2009) believe that initially, it described the country’s access to a sufficient quantity of food which enables meeting the demand for energy. Seen from this perspective, food security was believed by some authors to be equivalent to self-sufficiency. Note that food sovereignty was (and still is) used to measure the level of access to food, whether produced domestically or imported. Therefore, the “food security” concept focuses on the supply side, both in the national and global context. Panagariya (2002) makes a distinction between food self-sufficiency (which only requires the production of food in quantities corresponding to domestic demand) and food sovereignty which requires domestic availability. In this approach, self-sufficiency excludes imports as a source of supply whereas sovereignty takes this option into consideration. The supply process should be continuous and reliable which is a reason for maintaining stocks and establishing emergency food stocks to be released in the event of natural disasters. In turn, the economic availability of food is a “micro” aspect related to ensuring adequate quantities of food to households with various financial capabilities, whereas health and quality properties of food are related to safe consumption (Michalczyk 2012).

1.2 Trade openness vs. food security

While international trade is necessary to align the production and supply of agri-food products with domestic demand, it also enables balancing the local instability of production (UNCTAD, 2017b). Trade openness improves each dimension of food security. The flows from surplus to deficit areas improve the availability of food and increase the incomes of exporters (who charge higher prices in the market than it would be possible without trade) and importers (who make purchases at lower prices). Furthermore, production facilities are located in areas characterized by a relatively efficient use of resources. This contributes to higher incomes and faster economic growth, as confirmed by a research conducted by the World Bank in countries who liberalized their trade policies (Wacziarg & Welch, 2008).

Also, open trade may improve the balanced nutrition patterns through product diversification while helping make availability more stable, because the total production risk across international markets is lower than domestic production uncertainty (Brooks & Matthews, 2015). Authors of “Food Security, Farming, and Climate Change to 2050” (Nelson, Rosegrant et al., 2010) conclude that the negative effects of climate change on food security can be counteracted by economic growth, improved agricultural productivity and robust international trade in agricultural products. The observations conducted by FAO (2005) also confirm the
existence of a generally positive relationship between market openness and food security. Tallard, Liapis and Pilgrim (2016) clearly state that it is not the lack of available food that is the fundamental problem, but rather effective access to that food; and that trade plays an increasing role in ensuring food availability. Therefore, it could be assumed that importers (mainly net importers) of agricultural commodity increase their involvement in international trade in an effort to progressively improve the levels of domestic food security. Due to lack of comparative advantages in food production, food shortages are offset mainly by increased import volumes. The consequence is the reallocation of resources in line with the competitive advantage. However, there is a risk that import changes are related to a collapse of domestic production, economic development problems or a market distorting policy.

It is also important not to underestimate the events that took place in the last one or two decades, primarily including the 2007-2008 food crisis, which made the governments worry about trade openness and its consequences, and forced them to change their approach due to food security reasons. Importing countries realized that although dumped imports were a problem, the absolute shortage of supply in international markets could be even worse and more likely, considering the developments taking place in the global economy. These included a strong surge in demand for agricultural commodity produced by the biofuel sector, the increasingly frequent extreme weather conditions caused by climate change, and the rise in prices (Chatterjee & Murphy, 2014). Factors which particularly affected food security and agriculture (including agricultural trade) also include: higher prices of energy, the main determinant of production costs; decline in agricultural productivity (green revolution technologies fail to ensure a considerable increase in productivity anymore while genetic engineering is still in its infancy and faces a series of political, technical and regulatory complications); the improper regulation of futures markets; and the increased number of speculative transactions. Therefore, although primarily a national challenge, food security requires a robust, properly regulated international trade system which strengthens the internal economic policy (Chatterjee & Murphy, 2014)

2 Data and Methods

The study covered agricultural commodity as a group of products traded internationally, divided into food and agricultural raw materials in accordance with SITC. The timeframes for this study are the 1995-2015 period. The research was based on the outcomes of ten key importers selected by average value of imported agricultural products. This group included the European Union, United States,
China, Japan, Canada, Russia, Korea, Mexico, Hong Kong (China), Mexico and India. The basic source of data were online databases and reports, including those delivered by UNCTAD, FAO, WTO, OECD and WB. Once collected, the data was analyzed with the use of both quantitative and qualitative research methods. To describe the structure of phenomena under consideration, selected statistical methods were used, including: measures of dependence (Pearson correlation coefficient), measures of position, measures of volatility and structural and dynamic indicators. The comparative assessment of the importance of trade in agricultural products, and of the intensity of involvement of selected countries in the world agricultural trade was enabled by purposefully selected measures, such as: trade openness rate, import rate, import penetration index, import intensity index, share in total imports, and Trade Coverage internal comparative advantage measurement index.

Food security results may be analyzed at multiple levels, from the global and national level of food availability, through the assessment of the households’ access to food, to individual nutrition performance. For various reasons, it is difficult to reach a consensus on a common framework for food security monitoring on a national and global basis. This ultimately boils down to selecting the most adequate database for the assessment of the global level of food security (Aurino, 2014). Therefore, in this paper, the progress in improving the importers’ food security was assessed based on five indicators: value of agri-food production per capita; GDP per capita; share of agri-food imports in total exports. The selection of indices was determined by the multidimensionality of food security and the macroeconomic nature of this analysis. The indices refer to three dimensions of security: availability, access and stability.

3 Results and Discussion

The globalization process results in profound changes to the global economy. Increased use of resources, technological improvements and progressing specialization have led to strengthening the economic links between countries and to enhancing the scope of international trade flows (Jaworska, 2012). Trade globalization has progressed despite crises, natural disasters or geopolitical tensions which are also responsible for price instability and changes in the group of leading trading partners (WTO, 2015). From 1995 to 2015, in real terms, the total volume of global trade flows tripled while that of global production nearly doubled. The growth rate varied over the years (data: WTO, 2017). Major events that affected the levels of international trade include: the 1995-2001 Mexican peso crisis, the 1997 Asian financial crisis and the bursting of the dot-com bubble in 2001. Other
notable events with particularly significant impacts were the accession of China to WTO in December 2001, the adoption of euro at the beginning of 2000, the increase in oil prices resulting from a strong demand for natural resources in China, and the political instability in oil-producing countries (the so-called Arab Spring). The last decade was determined by the consequences of the 2008 financial crisis caused by the collapse of the US subprime mortgage market, leading to a global recession in 2008-2011. Since 2011, the European debt crisis has considerably affected the growth of global trade. Combined with the growing geopolitical tensions, it resulted in a commercial slowdown in 2014 (WTO, 2015). The 2015 trade statistics were conflicting not only with previous trends but also with the general condition of the market environment, indicating the weakening of economic interdependence (UNCTAD, 2017a).

The presented external shocks have left their imprint in the general trends of world trade flows in the agricultural sector (Aksoy & Ng, 2010; Josling, Anderson, Schmitz & Tangermann, 2010; Trostle, 2008). During the 21-year study period, the volume of agri-food trade flow grew by more than 2.5 times. The following contrasting fluctuations around the global growth trend were recorded: boom years (2003-2004, 2007-2008, 2010-2011), relative stagnation (1995-1996, 2001-2002, 2005-2006, 2013-14) and regression (1997-2000, 2009, 2012, 2015). In these sub-periods, compared to global commodity trade trends, changes in agricultural trade volumes were less dynamic and relatively highly convergent (Jaworska 2012). The growth in global trade volumes was accompanied by relatively small structural changes (Aksoy, 2005) which affected imports more than exports and agricultural raw materials more than food. As regards exports, the index of structural changes remained below 0.196 from 1995 to 2015, and the concentration index was barely 0.137. The respective figures for imports were 0.173 and 0.270. In the total world trade, these levels were higher for exports (by 0.02) and lower for imports (by 0.01 and 0.09) (UNCTADstat, 2018).

In 1995, the nominal value of agricultural imports reached USD 617,793 million, representing 11.91% of total imports. In 2015, that amount was USD 1,606,640 million, i.e. 9.74% of global imports (Fig:1). Foodstuffs prevailed (80%) in the commodity structure. In the study period, over 40% of global demand originated from the European Union, including 2/3 addressed as a part of internal trade. Ranked next in the group of main agricultural importers were: the United States with an average share of 9.34%, Japan (6.76%), China (6.54%), Russia (2.28%), Canada (2.30%), Korea (1.98%), Mexico (1.72%), Hong Kong (China) (1.58%) and India (1.20%). The agricultural commodity trade flows to/from the countries considered are of crucial importance for the global market (a share in excess of 76.14%). However, in most of these countries, products of agricultural
origin are not a decisive component in their international trade volume. In the period considered, the highest average share was reported by Japan (14.5%) and Russia (18.37%). From 1995 to 2015, 9 out of 10 of the economies covered by this study recorded a decline in the share of agricultural imports. The largest drops were reported by Japan, Russia, EU28 extra and Korea. Meanwhile, Canada saw a growth of that share.

Figure 1 **Structure of global agricultural imports in 1995-2015**

![Figure 1](image)

*Source: Own study based on UNCTADstat. (2018). *International trade in goods and services, 1995-2015.*

The induction does not sufficiently support the generally recognized pattern of decreasing importance of agricultural trade in commodity trade flows. Although the average yearly pace of changes in import shares was negative in all countries except Canada, opposite trends could be observed in some periods. There was a backsliding in 2001-2003, 2007-2009 and 2013-2015. The highest decline was reported in 2009 by all 10 importers (Fig: 1). As regards nominal values, the agricultural imports followed a general trend. Despite the impasse in 1997-2000 and 2009, 2012 and 2015, the average annual growth rate of imports reported by the countries considered was 4.44%. The highest rate was recorded in China (12.15%) where the value of purchased agricultural commodity increased nearly tenfold from 1995 to 2015. Ranked next were India, Mexico and Canada. In 2015, only the Japanese spent 5% less on food and agricultural raw materials than in 1995.

In the group of countries considered, Canada, India and the US were not net importers of agricultural commodity over the 1995-2015 period. As regards the other seven economies, the average ratio of agricultural imports to agricultural exports ranged from 1.06 to 3.09. The peak value (the reciprocal of the Trade Coverage internal comparative advantage measurement index; Misala, 2003) was recorded in Japan which also demonstrated a clear downward trend. The analysis
of variation of TC levels provided some ambiguous information. While it allows to conclude that the instability of the imports-to-exports ratio tends to grow over time (from 2008), it does not suggest any coincidence between the evolution of that ratio and the world’s macroeconomic situation.

A country’s vulnerability to economic shocks largely depends on its trade openness. The higher the imports in relation to gross domestic product, the greater is the economic impact of the condition of international markets. In import-dependent countries, especially in those relying on imports of raw materials with strategic importance to economic development, high economic openness poses a threat in the case of a sharp upward movement in prices in global markets (Białowąs, 2013). As regards global imports, trade openness measured by taking account of the profitability of global economy was very low, reaching an average level of 2% of GDP and 1.93% of GNI. A downward trend was recorded until 2000, followed by an upward trend (except for 2009 and 2015). In turn, the imports in countries covered by this study had a greater contribution to their incomes (an average level of 2.50% of GDP and 2.39% of GNI); that share decreased steadily throughout the period from 1995 to 2006. Steady growth has been recorded from 2007, and therefore the shares observed in 2015 were higher than in 1995, except for Russia and China (Tab: 1). It was the opposite for the openness of the agricultural sector. The contribution of agricultural commodity imports to the agricultural GDP was above 55%, with the highest levels being observed in 2006-2008. In the group of importing countries, it was even higher and more differentiated, and followed an upward trend. The leaders of this ranking were Hong Kong, EU, Canada and Japan. However, caution should be exercised when making conclusions about economic openness based on the above indicator because it is largely determined by the size of the economy itself (Radło & Kowalewski, 2008).

The penetration index, which informs of the proportion of domestic demand satisfied with imported products, is particularly important when assessing a country’s involvement in international trade. The global agricultural imports covered 2.01% of demand and grew over the study period, especially in the years prior to the regression. However, contrary to the global trend, the contribution of imports declined in the group of countries considered; also, it was more diversified and lower by 7.92% on average. Hong Kong and Russia saw a relatively high degree of dependence of their domestic demand on imports (primarily as regards agricultural raw materials).

The assessment of the activity of importing countries is supplemented by the analysis of the import intensity index. Globally, over the 1995-2014 period, the share of agricultural commodity in the final domestic production of
the agricultural sector ranged from 50% to 60%, with the highest levels being recorded in 2001-2008. The average absorption of imported agricultural commodity by the production of the economies under consideration was much higher, and followed an upward trend. In 1995, the import intensity index was close to 60%; 21 years later, it was higher by 32 percentage points. However, these levels were not characteristic for all countries. The scope of the globalization process of trade in agricultural commodity was disproportionately low in Canada and China (Tab: 1).

The analysis of per capita imports sheds some objective light on the assessment of importance and intensity of trade in agricultural commodities at the level of key global importers. That index is extremely sensitive to the number of population and to the lack of diversity in trade flows to/from the country concerned (Jeliński, 2003). Over the 1995-2015 period, its values reflected the general trends because of a relatively small population growth in most of the countries. The average value of agricultural imports per capita was USD 156, i.e. nearly 4 times more than in the group of countries covered by this study. In 2015, the highest amount was recorded in Hong Kong, EU and Canada. These economies were also top-ranked in terms of imports per agricultural employee. Note that China and India recorded the lowest values of the above index while enjoying a twice higher average annual growth rate.
## Table 1: Average annual growth rate of selected indices in the group of main agricultural importers in 1995-2015 (%)

| Indicator of the involvement of importers in the world of agricultural trade | World | EU 28 | United States | Republic of Korea | Japan | Mexico | Russian Federation | China | Hong Kong (China) | India | Canada |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | 4.89 | 3.79 | 5.87 | 3.50 | 11.42 | 12.15 | 3.86 | 8.47 | 10.62 | 10.62 | 10.62 |
| (2) | -1.00 | -0.85 | 1.03 | -1.24 | -1.78 | -1.31 | -1.81 | -1.06 | -1.85 | -0.99 | -1.24 |
| (3) | 0.42 | 1.07 | 0.99 | -2.10 | -0.36 | 1.94 | 1.05 | -0.49 | 1.06 | -2.48 | 1.14 |
| (4) | 0.38 | 1.06 | 0.87 | -2.18 | -0.39 | 1.94 | 1.05 | -0.54 | 1.00 | -2.42 | 0.97 |
| (5) | 0.42 | 1.09 | 0.90 | -2.13 | -0.41 | 1.92 | 1.04 | -0.48 | 1.05 | -2.38 | 1.12 |
| (6) | 0.42 | 2.49 | 1.62 | 4.62 | 0.72 | 5.05 | 3.22 | 3.89 | 3.11 | 1.94 | 1.56 |
| (7) | 3.59 | 3.54 | 4.80 | 8.00 | 11.19 | 11.30 | 2.65 | 9.70 | 9.11 | 3.55 | 6.14 |
| (8) | Food Security Indicators | 3.95 | 1.88 | 3.70 | 2.43 | 7.59 | 2.43 | 5.02 | -2.73 | 0.18 | 3.79 | 4.10 |
| (9) | -0.59 | -0.85 | 1.03 | -2.13 | -0.41 | 1.92 | 1.04 | -0.48 | 1.05 | -2.38 | 1.12 |
| (10) | -1.05 | -0.86 | 1.03 | -2.13 | -0.41 | 1.92 | 1.04 | -0.48 | 1.05 | -2.38 | 1.12 |
| (11) | -0.52 | -0.37 | 2.71 | -1.38 | -1.02 | 2.05 | 0.96 | -0.87 | 0.36 | -4.01 | 6.34 |
| (12) | 3.16 | 2.44 | 3.77 | 13.87 | 3.02 | 7.61 | 1.14 | 4.06 | 5.03 | 6.34 | 3.41 |

(1) agricultural imports, (2) share of agricultural imports, (3) economy openness degree, (4) imports ratio, (5) import penetration, (6) import intensity, (7) agricultural imports per capita, (8) agricultural production per capita, (9) food production per capita, (10) share of agricultural imports in total exports, (11) share of food imports in total exports, (12) GDP per capita

Source: calculations and the author’s study based on: UNCTADStat (2018). International trade in goods and services, Economic trends, 1995-2015 and FAOSTAT (2018). Food and agriculture data: Production. Population, Macro-Statistics, Food Security, 1995-2015.
When considering the availability and stabilization dimensions of food security at national and global level, particular attention should be paid to the ability to provide enough resources to finance the required food imports, and to the domestic production per capita. The singularities of the development of agricultural sectors and markets were reflected in the values of the exports-to-imports ratio both for agricultural commodities and foodstuffs. Because of the relatively small importance of these products for the total trading volume, the average value of that ratio did not exceed 10% and demonstrated slight fluctuations (±0.82). In the group of leading agricultural importers, the average value of the above ratio was barely 0.05 percentage points higher and was less variable. The highest exports-to-agricultural-imports ratios were recorded in Japan and Russia, while a general downward trend was evident (Tab: 1). Interestingly, the index doubled between 1995 and 2015 in countries other than net importers, i.e. Canada, India and the US. Similar changes were observed for the exports-to-food-imports ratio. Note that with its growing economic potential and relatively favourable production conditions, China was ranked last among the importing countries, reporting a ratio of 3.84%.

A more complete picture may be presented by assessing the agricultural production value per capita. However, the level and structure of that index is still determined by natural and climate conditions. Over the 1995-2014 period, it evolved consistently with the general trends. Only twice, in 2005 and 2014, a decline was reported. Globally, in 2014, the index reached nearly USD 425 with an annual growth rate of 3.9%. Because of negligible agricultural production per capita in Hong Kong, the value of the index for the 10 countries covered by this analysis was higher by just one half (Tab: 1). As foodstuffs represent a fundamental part of agricultural production, the changes to and the level of food production per capita were only several percent lower. Undeniably, import activities of selected economies depend on their production potential. The higher the intensity of agricultural production and the higher the concentration of agricultural production on a relatively large privately held agricultural area, the weaker is the willingness to develop agricultural imports irrespective of global changes. Most of these characteristics can only be found in agricultural sectors of highly developed countries, primarily including the US, EU or Canada. This is exactly where one of the highest levels of agricultural production per capita were recorded. In other countries, production remains at a relatively low level and strongly depends on the area of agricultural land.

The analysis of correlation of changes to agricultural imports value and selected indices that enable monitoring the food security levels over the 1995-2015 period allowed to specify the correlation between agricultural imports and the
development of food security. As shown by the results, at the global level, a strong positive correlation exists between agricultural imports and the physical and economic availability, and a weak negative correlation exists between agricultural imports and stability (Fig: 2). The coefficient of correlation for agricultural production per capita, food production per capita and GDP per capita was 0.991, 0.992 and as much as 0.993, respectively. Similar levels (0.988, 0.988 and 0.991) were recorded in the group of economies covered by this study. Based on the above, a general conclusion may be drawn that economic growth resulted in structural changes which contributed to improving access to food. Values of the coefficient of correlation between imports and GDP per capita, as calculated for specific economies, showed only minor variations and ranged from 0.983 to 0.949, except for Japan where a clearly lower value (0.832) was reported. Together with Korea, Japan demonstrated a moderate positive correlation as regards physical availability of food. In other countries, these values ranged from 0.923 to 0.992.

**Figure 2 Correlation between changes in the value of agricultural imports and food security levels over the 1995-2015 period**

(1) agricultural production per capita, (2) food production per capita, (3) share of agricultural imports in total exports, (4) share of food imports in total exports, (5) GDP per capita

*Source: Calculations and the author’s study based on: UNCTADstat (2018). International trade in goods and services, Economic trends. 1995-2015 and FAOSTAT (2018). Food and agriculture data: Production. Population, Macro-Statistics, Food Security. 1995-2015.*

Important information is provided by the analysis of relationships for food security stability indices. Though the relationship is clear, it is relatively weak both at global level and in the entire group of importing countries considered. The increase in agricultural imports was accompanied by a decline in food security levels measured with the total-exports-to-agricultural-imports ratio (-0.495; -0.567) and the total-exports-to-food-imports ratio (-0.307; -0.400) (Fig: 2). The
correlation between these characteristics varied extremely strongly from one country to another. A significant negative correlation for agricultural commodity was recorded in India, Korea and Russia whereas a positive correlation was discovered for foodstuffs in Mexico and US. In the case of food, a low negative correlation was demonstrated by Japan, India and Korea. While practically no correlation was found in China and Hong Kong, remarkably strongest correlation levels were reported in Canada.

4 Conclusion

The theoretical and empirical analysis performed in this paper answered the research question asked in the introduction and enabled the implementation of the main research plan which was to assess the trade activity of agri-food importing countries in relation to the changing level of food security. The discussion resulted in the following conclusions and generalizations.

Over the 1995-2015 period, agri-food imports grew by more than 2.5 times while their share in total imports consistently followed a downward trend (except for 2009). The following contrasting fluctuations around the global growth trend were recorded alternately: boom years, relative stagnation and regression. Especially as regards the last type of events, there was an inhibiting effect on trade flows. In the group of countries considered, Canada, India and the US were not net importers of agricultural commodity. While the variation of the imports-to-exports ratio allows to conclude that the instability of the imports-exports relationship tends to grow over time (from 2008), it does not suggest any coincidence between these changes and the world’s macroeconomic situation.

As regards global imports, trade openness measured by taking account of the profitability in the global economy was very low. In the countries covered by this study, imports had a greater share in incomes and followed a downward trend. Conversely, the contribution of agricultural commodity imports to the agricultural GDP was much higher and followed an upward trend. The singularities of the development of agricultural sectors and markets were also reflected in the decreasing values of the exports-to-imports ratio both for agricultural commodities and foodstuffs. That ratio doubled in countries other than net importers. The level of agri-food production per capita was driven by natural and economic determinants. In the study period, the ratios listed above demonstrated a positive growth rate.

According to the analysis of correlation between changes to agricultural commodity imports and selected indicators for the monitoring of food security levels, agricultural imports demonstrate a strong positive correlation with physical and
economic availability, and a weak negative correlation with stability. This was true both on a global basis and for the agricultural importers covered by this study. Based on the above, a general conclusion may be drawn that economic growth resulted in structural changes which contributed to improving access to food.

The final conclusion is that the above assessments and results allowed to specify the trends and identify the basic relationships while revealing a process of cumulative changes. On the other hand, this is the starting point for further research because this paper provides information at a relatively high level. Also, the results do not provide a complete unambiguous recommendation as to the evaluation of relationships between economic openness and food security levels. The evidence shown in this paper is relatively soft. Therefore, a need emerges for a more in-depth study which takes into consideration the analysis of price instability impacts and more indices, including those related to trade policy activities.

References

1. AKSOY, M. A. (2005). The Evolution of Agricultural Trade Flows. In M. A. Aksoy, J. & C. Beghin (Eds.), Global Agricultural Trade and Developing Countries (pp. 17-36). Washington, DC: The International Bank for Reconstruction and Development/The World Bank.

2. AKSOY, M. A., NG, F. (2010). The Evolution of Agricultural Trade Flows (Policy Research Working Paper WPS 5308). (pp. 35). Washington, DC, MA: World Bank. Retrieved January 11, 2018, from https://openknowledge.worldbank.org/bitstream/handle/10986/3793/WPS5308.pdf?sequence=1&isAllowed=y.

3. AURINO, E. (2014). Selecting a Core Set of Indicators for Monitoring Global Food Security – a Methodological Proposal (ESS Working Paper 14-06). (pp. 17). Rome, MA: FAO. Retrieved (January 9, 2017) from http://www.fao.org/3/a-i4095e.pdf.

4. BIAŁOWAŚ, T. (2013). Otwartość handlowa i dywersyfikacja eksportu a wzrost gospodarczy w latach 1995-2011. Annales UMCS. Sectio H, Oeconomia 47(2), 17-27. Retrieved (January 4, 2018) from http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171252433.

5. BROOKS, J., MATTHEWS, A. (2015). Trade Dimensions of Food Security (Food, Agriculture and Fisheries Papers No. 77). (pp. 45). Paris, MA: OECD Publishing. doi: 10.1787/5js65xn790nv-en.

6. CHATTERJEE, B., MURPHY, S. (2014). Trade and Food Security. E15Initiative. Strengthening the Global Trade System. (pp. 10). Geneva, MA: International Centre for Trade and Sustainable Development and World Economic
7. FAO. (2005). *The State of Food and Agriculture 2005: Agricultural trade and poverty Can trade work for the poor?* Rome: Food and Agriculture Organization of the United Nations. Retrieved (December 9, 2015) from http://www.fao.org/docrep/008/a0050e/a0050e00.htm#TopOfPage.

8. FAO. (2017). *Food Security Statistics.* Retrieved (December 9, 2017) from http://www.fao.org/economic/ess/ess-fs/en/.

9. FAOSTAT. (2018). *Food and agriculture data: Production. Population, Macro-Statistics, Food Security. 1995-2015.* Retrieved (Jan. 7, 2018) from http://www.fao.org/faostat/en/#data.

10. HERRMANN, M. (2009). *Food Security and Agricultural Development in Times of High Commodity Prices* (UNCTAD/OSG/DP/2009/4). Genewa, MA: UNCTAD Discussion Papers. (pp. 33). Retrieved (January 21, 2017) from http://unctad.org/en/Docs/osgdp20094_en.pdf.

11. JAWORSKA, M. (2004). Zróżnicowanie regionalne współczesnego handlu międzynarodowego artykułami rolnymi. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu, 6*(2), p. 103-109.

12. JAWORSKA, M. (2005). Pozycja międzynarodowa głównych eksporterów artykułów rolnych. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu, 7*(2), p. 95-102. Available at: http://rn.seria.com.pl/rn/category/77-07-2.html?download=3829:7-2-jaworska.

13. JAWORSKA, M. (2012). Kontekst globalny zmian w światowym handlu artykułami rolnymi. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu, 14*(1), 198-202. Retrieved (January 21, 2017) from http://rn.seria.com.pl/rn/category/29-14-1.html?download=1392:14-1-jaworska.

14. JELIŃSKI, B. (2003). *Polska polityka handlu zagranicznego w warunkach członkostwa w Unii Europejskiej.* (pp. 456). Gdańsk, MA: Wydawnictwo Uniwersytetu Gdańskiego.

15. JOSLING, T., ANDERSON, K., SCHMITZ, A., TANGERMANN, S. (2010). Understanding International Trade in Agricultural Products: One Hundred Years of Contributions by Agricultural Economists. *American Journal of Agricultural Economics, 92*(2), p. 424-446. doi: 10.1093/ajae/aaq011.

16. MECHLEM, K. (2004). Food Security and the Right to Food in the Discourse of the United Nations. *European Law Journal, 10*(5), p. 631-648. doi: 10.1111/j.1468-0386.2004.00235.x.

17. MICHALCZYK, J. (2012). Główne przesłanki bezpieczeństwa żywnościowego Polski i próba jego pomiaru. *Prace Naukowe Uniwersytetu Ekonomiczne-
go we Wrocławiu: Integracja i kryzysy na lokalnych i globalnych rynkach we współczesnym świecie, 315(1), p. 577-591.
18. MISALA, J. (2003). Współczesne teorie wymiany międzynarodowej i zagranicznej polityki ekonomicznej. (pp. 419). Warszawa, MA: Szkoła Główna Handlowa w Warszawie.
19. NELSON, G. C., ROSEGRANT, M. W., PALAZZO, A., GRAY, I., INGERSOLL, C., ROBERTSON, R., TOKGOZ, S., ZHU, T., SULSER, T. B., RINGLER, C., MSANGI, S., YOU, L. (2010). Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options. (pp. 131). Washington, D.C., MA: International Food Policy Research Institute. doi: 10.2499/9780896291867.
20. PANAGARIYA, A. (2003). Trade and Food Security Conceptualizing the Linkages. Presentation at the Conference on Trade, Agricultural Development and food Security: The Impact of recent Economic and Trade Policy reform, FAO, Rome (July 11-12, 2002). International Trade, EconWPA. Retrieved (December 9, 2017) from http://econwpa.repec.org/eps/it/papers/0308/0308012.pdf.
21. PINSTRUP-ANDERSEN, P. (2009). Food Security: definition and measurement. Food Security. The Science, Sociology and Economics of Food Production and Access to Food, 1(1), p. 5-7. doi: 10.1007/s12571-008-0002-y.
22. RADŁO, M. J., KOWALEWSKI, O. (2008, December). Wpływ globalizacji na polską gospodarkę (Materiały i Studia, Zeszyt nr 230). (pp. 112). Warszawa, MA: Narodowy Bank Polski. Retrieved (January 3, 2018) from http://annahles.umcs.lublin.pl/tt_p.php?rok=2013&tom=47&sectio=H&numer_artiku- lu=02&zeszyt=2.
23. TALLARD, G., LIAPIS, P., PILGRIM, G. (2016). The Implications of Agricultural Trade and Market Developments for Food Security (Food, Agriculture and Fisheries Papers No. 95). (pp. 27). Paris, MA: OECD Publishing. doi: 10.1787/5jl579rkqw-k-en.
24. UNCTAD. (2017a). Key Statistics and Trends in International Trade. A Bad Year for World Trade? (UNCTAD/DITC/TAB/2016/3). Geneva, DC: United Nations. (pp. 29). Retrieved from http://unctad.org/en/PublicationsLibrary/ditctab2016d3_en.pdf.
25. UNCTAD. (2017b). The Role of Science, Technology and Innovation in Ensuring Food Security by 2030 (UNCTAD/DTL/STICT/2017/5). New York and Geneva, DC: United Nations. (pp. 47). Retrieved from http://unctad.org/en/PublicationsLibrary/dtlstict2017d5_en.pdf.
26. UNCTADstat (2018). International trade in goods and services, Economic trends. 1995-2015. Retrieved (Jan. 4, 2018) from http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx.
27. U.S. Department of Agriculture (2008). *Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices* (Economic Research Service/USDA: WRS 0801). (pp. 30). Washington, DC: R. Trostle. Retrieved from https://www.ers.usda.gov/webdocs/publications/40463/12274_wrs0801_1_.pdf?v=41057.

28. WACZIARG, R., WELCH, K. (2008). Trade Liberalisation and Growth: New Evidence. *World Bank Economic Review*, 22(2), p. 187-231. doi:10.1093/wber/lhn007.

29. WTO. (2015). *International Trade Statistics. Special Focus: World Trade and The WTO: 1995-2014*. (pp. 166). Genewa: World Trade Organization. Retrieved (July 14, 2017) from https://www.wto.org/english/res_e/statis_e/its2015_e/its2015_e.pdf

30. WTO. (2017). *World Trade Statistical Review 2017*. (pp. 177). Genewa: World Trade Organization. Retrieved (January 24, 2017) from https://www.wto.org/english/res_e/statis_e/wts2017_e/wts2017_e.pdf.

31. WTO Statistics Database. (2017). *The Time Series on international trade: merchandise trade by commodity 1995-2015*. Retrieved (Dec. 3, 2017) from http://stat.wto.org/Home/WSDBHome.aspx?Language=E.

32. ZEGAR, J. (2013). *Kwestia bezpieczeństwa żywnościowego a ekonomia*. Paper for the IX Congress of Polish Economists in Warsaw (28-29 November). Retrieved (December 9, 2017) from http://www.pte.pl/kongres/referaty/.