FOOD SELF-SUFFICIENCY IN LATVIA: LOCAL FOOD VERSUS IMPORTED FOOD

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The issue of food self-sufficiency is becoming topical in cases of military and economic cataclysms. In addition, increasing attention is being paid to environmental aspects, *e.g.*, reduction of greenhouse gases. These aspects call for research into countries' capacity to provide food for their citizens. Self-sufficiency research began in the early 20th century and continues to this day. However, scientists have no agreement on the methodology according to which the self-sufficiency index is calculated. In this study, the formula for calculating the self-sufficiency ratio was clarified. The goal of this study is to improve the methodology for calculating self-sufficiency ratio. To achieve the purpose of the study, several research tasks have been set: 1) to get acquainted with scientific research on this topic; 2) to theoretically analyse the obtained information; 3) to develop a more precise method for calculating self-sufficiency, which more accurately reflects the proportion of local food in consumption.
Available statistical data and a mathematical calculation method were used in this study. Relatively small countries tend to be exposed to external conditions, which is also linked to food self-sufficiency. Therefore, it was concluded that Latvia can supply its society with several types of food products fully. The updated SSR calculation formula provides more accurate information on self-sufficiency and calculates the consumption and export volume dependence on imported products.

Keywords: food, local food, self-sufficiency food, self-sufficiency ratio

INTRODUCTION

Food self-sufficiency is closely connected to the production and consumption of local food. At the beginning of the 20th century, Great Britain faced the blocking of maritime supply routes during the First and Second World Wars, so there was a need to address the issue of food self-sufficiency. Two world wars led to a rise in food self-sufficiency, with governments responding to the vulnerability of overseas supply lines to enemy attacks and increasing food production across the UK. Food supply is also affected by political, economic, and ecological crises. The economic crisis is also increasing to focus on home production; The most notable example was observed in the 1980s. In the early 1970s, when the global food crisis hit, which led to the publication in the UK of the White Paper on Food from Our Own Resources, which for the first time positively encouraged increased food self-sufficiency instead of simply continuing the program of increasing food production in line with the increase in demand (and thus maintaining the existing level of self-sufficiency) (Fallows & Wheelock, 1982). Political and economic crises led to a rise in food self-sufficiency in Iran after the 1979 revolution that put the country into political and economic isolation (Soltani et al., 2020). Not only is food self-sufficiency important, but also the quantity of greenhouse gases generated by the food production and consumption chain. The global food system is thought to account for between 25% and 30% of human-made greenhouse gas emissions. Consequently, soon, the food system will have to significantly reduce greenhouse gas emissions to meet the preferably 1.5 °C agreed in the Paris Agreement, in the best way 2 °C at the global warming limit. According to scientists, this also applies to interactions both between elements of the food system and such elements of the food system as harvest livestock farming, human nutrition, production, and supply chains (Theurl et al., 2020). It is, therefore, necessary to identify states' capacity to self-provide food for their populations and the volume of food imports needed to provide food for the population. The goal of this study is to improve the methodology for calculating self-sufficiency ratio (SSR). To achieve the purpose of the study, several research tasks have been set: 1) to get acquainted with scientific research on this topic; 2) to theoretically analyse the obtained information; 3) to develop a more precise method for calculating self-sufficiency, which more accurately reflects the proportion of local food in consumption.

THEORETICAL BACKGROUND

According to *Fallows and Wheelock,* there is no unequivocal answer to the question of food self-sufficiency, and this issue is understood very broadly in the food industry (Fallows & Wheelock, 1982).

Food self-sufficiency is evaluated in at least five different ways: 1) by the amount of food produced and consumed at the macroeconomic level (Fallows & Wheelock, 1982); 2) by the number of kilocalories required by man per day

(O'Hagan, 1976); 3) according to the ability of available agricultural resources to provide the population with food (Ciceri & Allanore, 2019; Grima & Singh, 2020; Jayne & Rukuni, 1993; Kim et al., 2015; Namany et al., 2019; Omari, 1986); 4) after self-sufficiency of households and farms with food (Burgin, 2018; Dworsky, 2005; Noromiarilanto et al., 2016; Soltani et al., 2020; Vávra et al., 2018) and 5) following political convictions as a protest against so-called Western expansion and the use of local resources (Roman-Alcalá, 2013). 5th the way food self-sufficiency is defined does not reveal how food self-sufficiency is calculated, as it incorporates the principles of political and social movement. This relatively new aspect has not been studied from an economic point of view and is not in line with the subject matter of this research. Consequently, this aspect is not taken into account in this paper.

In this work, self-sufficiency is considered in its first sense – according to the amount of food produced and consumed.

There are often discussions about food self-sufficiency, in which economic considerations and political imperatives collide. On the one hand, food self-sufficiency advocates believe that countries have the right to distance themselves from the international food market- protecting their citizens from the squash of the food market - relying on the local food market participants and their stability. On the other hand, the criteria for sufficiency claim that in countries that rely on their local food market, food costs are much higher than food prices in countries open to the global food market. Therefore, countries where political rather than economic considerations dictate food pricing policies are higher (Clapp, 2017). In addition, for these types of countries, food self-sufficiency becomes an obligation to ensure the population's human rights to food (Gonzalez, 2014). The formulation of food self-sufficiency is a compromise between closed borders and fully open trade. It allows for more significant consideration to be given to the circumstances in which policies to increase the country's food production for their internal consumption can bring economic and political benefits. Food self-sufficiency is a common term, but those who use it often do not define it precisely.

The simplest definition of food self-sufficiency is expressed as follows: a country that produces enough food to cover its' needs (Deb et al., 2009; FAO, 2016). It is a classic understanding of food self-sufficiency. Of course, such a definition speaks of the ideal case of a country self-providing its population with food and avoiding international food markets and closes its borders, allowing food self-sufficiency to reach 100%. However, this situation is only theoretical, and most countries rely at least partially on food imports, taking into account exotic food and exotic vegetables and fruits. Such practices are also practised by food-exporting countries that produce and export more than they consume. (Clapp, 2017).

Although the ideal definition of food self-sufficiency does not theoretically allow foreign food trade, it must be acknowledged that this can only happen in an ideal case. In reality, no country can exist without foreign trade because it is not always possible for a country to produce enough food to meet its self-sufficiency requirements. In terms of food, self-sufficient countries may specialize in producing certain foods for sale in other countries. Most importantly, self-sufficient countries produce food that is at least equal to or surplus. Food self-sufficiency can be considered the satisfaction of local demand, consuming as much food produced as necessary, accumulating the surplus (Jayne & Rukuni, 1993). In practice, national or local demand collateral is reflected in the self-sufficiency ratio (SSR). It should be noted that there are different calculation formulas for calculating the self-sufficiency ratio. Therefore, it is necessary to look at the most common ways of calculating self-sufficiency ratio and show the most important differences between them.

Researchers in the United Kingdom have developed the following formula for calculating the self-sufficiency ratio (Fallows & Wheelock, 1982):

$$SSR = \frac{Produced}{Consumed} \qquad (1)$$

However, the variant of this calculation formula does not answer how the volume of production produced and exported affects the self-sufficiency ratio. In our days, this formula for the calculation of the self-sufficiency factor is used in Switzerland (von Ow et al., 2020). According to Food and Agriculture Organization of the United Nations (FAO) (FAO, 2012) officials, the *SSR* formula looks like this:

$$SSR = \frac{Produced \times 100}{(Produced + Import - Export)} \qquad (2)$$

It should be noted that the formula proposed by the FAO, which is also referred to by Latvian scientists, does not provide a true reflection of self-sufficiency, as it also includes the volumes of imported products produced abroad.

The food self-sufficiency indicator is considered to be the difference between the amount of food produced and the amount of food consumed:

$$SSR = \frac{(Produced - Consumption)}{Consumption} \qquad (3)$$

There is another way to calculate the self-sufficiency ratio (Siddig & Mubarak, 2013):

$$SSR = \frac{Domestic\ supply}{Domestic\ demand} \qquad (4)$$

Calculation formula 4 does not specify domestic supply, as, according to FAO data, imported production can also be considered as part of the domestic supply (FAO, 2018).

The national food self-sufficiency index may be expressed as the ratio between the amount of food produced and demanded for consumption, and the food self-sufficiency index can be considered as a percentage (Soltani et al., 2020):

$$SSR = \frac{Produced}{Demand} \qquad (5)$$

In addition, the calculation type reflected in Formula 5 coincides with the type of calculation shown in Formula 1.

Attempts have been made to improve the calculation of the food supply ratio by taking into account fluctuations in the level of domestic food stocks. SSR is usually calculated for a particular commodity or group of goods, such as various vegetables, bread, meat and fish production.

The Food and Agriculture Organization recommends that the concept of SSR be applied with caution to get an information of the overall food situation in a country, as this calculation method can hide cases where a country produces much food while relying on other food imports. Most SSR calculations are applied to the main agricultural production groups: cereals, vegetables, fruits.

These different rates of food self-sufficiency provide a variety of information on national trade and food security, but they are not the same. In terms of food, a self-sufficient country can theoretically be an active importer and exporter of food simultaneously (Clapp, 2017). S. Dzene uses the same formula in his doctoral thesis as used by the Rural Support Service of the Republic of Latvia when calculating the volume of production produced in the territory of the Republic of Latvia:

$$S = Q_s + Q_i - Q_e + K \qquad (6)$$

where: Q_s – the amount of food produced;
Q_i – the amount of food imported;
Q_e – the amount of food exported;
K – stock changes;
S – supply for local consumption (Dzene, 2014);

In addition, this calculation method can also be found in the Statistical Manual of Food and Agriculture Organization of the United Nations (FAO, 2018). It should also be noted that stocks of manufactured products are considered to be restricted information (Dzene, 2014). Taking into account that the task of the present study is to find out what amount of locally produced food is transferred for consumption by the population of the Republic of Latvia, the formula needs to be transformed. Exported products are not consumed in the Republic of Latvia while the imported production may not be considered as produced within the Republic of Latvia and consequently, its consumption may not be considered as consumption of domestic products. Therefore, the most appropriate formula for this study should be expressed as follows:

$$S_v = Q_s - Q_e + K \qquad (7)$$

where: Q_s – the amount of food produced;
Q_e – the amount of food exported;
K – stock changes;
S_v – supply of locally produced products for local consumption.

As a result of studies of scientific literature, a formula for calculating the self-sufficiency index has been developed.

METHODS

The self-sufficiency coefficient of local food, which characterizes the country's independence in terms of food security, without imported products and maintaining the volumes of existing export, can be calculated according to the formula:

$$Q_{pn} = \frac{S_v}{(Q_p \times Q_{pop}) \times 10^{-6}} \times 100 \qquad (8)$$

where: Q_{pn} – food self-sufficiency (%);
S_v – supply of locally produced products for local consumption per year (thousands of tons, thousands of litres, million pcs.) (Official Statistics of Latvia, 2021c, 2021a, 2021d);
Q_p – the amount of consumed production (kg, l, pcs.) per person per year (Official Statistics of Latvia, 2020);
Q_{pop} – population of the Republic of Latvia at the beginning of the calendar year (Official Statistics of Latvia, 2021b).

Information on average food consumption at the Latvian household level is compiled by the Central Statistical Bureau of Latvia. The annual data collection has been carried out continuously from 2002 to 2014 according to the COICOP methodology and from 2015 to 2016 and in 2019 according to the ECOICOP methodology.

The new formula reflects the country's food self-sufficiency while maintaining export volumes and the country's dependence or independence on imported food. The newly developed formula differs from the widely used formulae. It separates the volume of consumption from exports and distinguishes the volume of imports from the volume of food produced in the country and offered for consumption.

The gradation of the results obtained shall be expressed according to the following principles: If the calculated SSR is more than 100%, then the country is self-sufficient in the food sector, if the SSR is in the range of 0% to 100%, then the state is not considered self-sufficient in terms of food. On the other hand, if the calculated SSR is less than 0, that is, negative, then consumption and part of the exports depend on the volume of imported production.
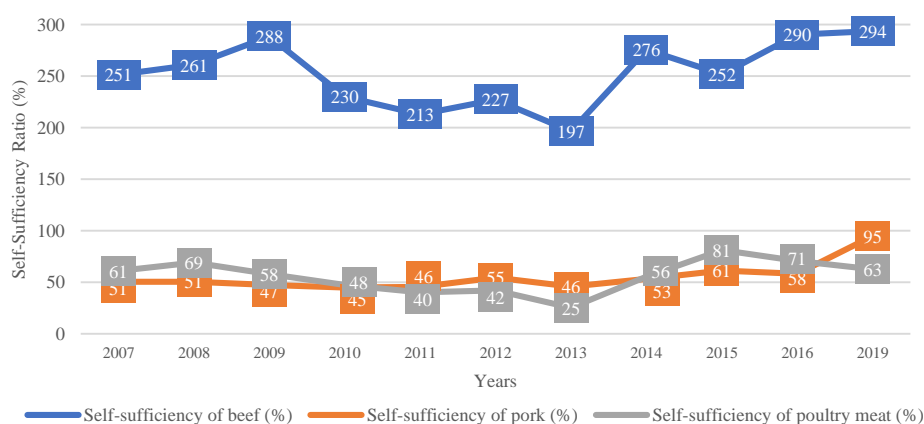
RESULTS

This publication reflects only a few types of food that are typical of the Latvian food industry and are also important in food consumption: bread, meat, vegetables and fruits, including berries.
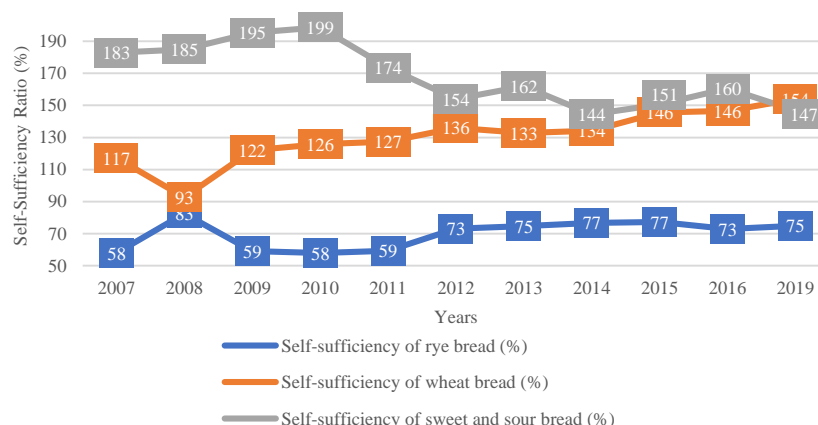
Source: author's calculations according to the data of the Official Statistics Portal of Latvia
Figure 1: Indicators of self-sufficiency index of types of bread consumed in Latvia

Figure 1 shows the self-sufficiency of the types of bread consumed in Latvia. The obtained information shows that the production of both sweet and sour bread and wheat bread creates complete self-sufficiency with bread production. A different situation is observed in the case of the volume of rye bread produced and consumed - it is necessary to import about 25% of the volume of rye bread consumed in Latvia in 2019, maintaining the volume of rye bread export.

Source: author's calculations according to the data of the Official Statistics Portal of Latvia
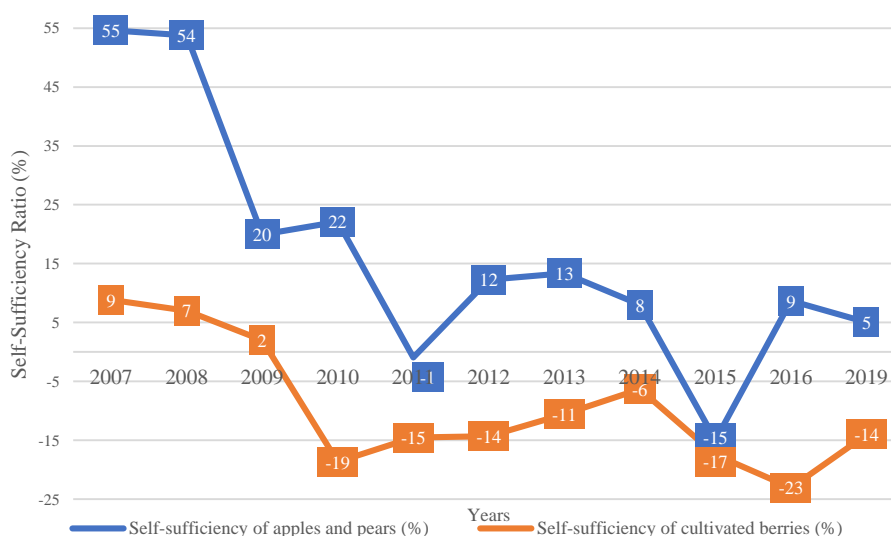Figure 2: Indicators of self-sufficiency index of types of meat consumed in Latvia

Figure 2 shows the results of calculations that show that of all the most common types of meat used in Latvia, only beef self-sufficiency is considered adequate and a production surplus is formed, while only in 2019 pork self-sufficiency is considered almost adequate. SSR of pork and poultry meat is considered self-insufficient The volume of poultry meat produced and consumed shows that without imported poultry meat it is not possible to ensure the consumption of this type of meat in the Republic of Latvia.
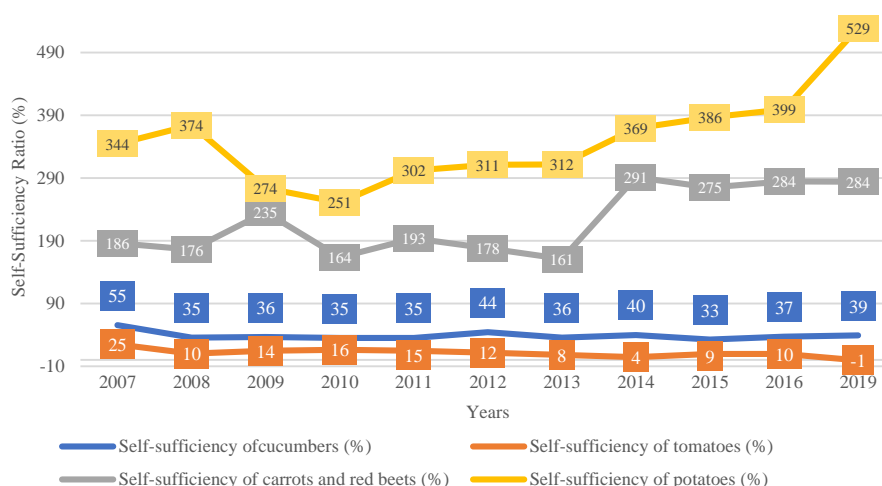
Source: author's calculations according to the data of the Official Statistics Portal of Latvia
Figure 3: Indicators of self-sufficiency index of types of vegetables consumed in Latvia

Figure 3 summarizes the calculation results, which reflect the self-sufficiency of vegetable production. The self-sufficiency of Latvian vegetables - potatoes, carrots and red beets - is assessed as sufficient, however, it should be noted that the Central Statistical Bureau of Latvia does not distinguish a group of non-food potatoes *i.e.,* potatoes from which starch is obtained. Also, combining two different types of vegetables in one statistical record - carrots and red beets - does not give a true picture of self-sufficiency calculations. Thus, it can be considered that the self-sufficiency of tomatoes and cucumbers is deemed to be insufficient, also taking into account the negative SSR of tomatoes in 2019, which indicates that 1% of the imported production is exported to other countries. In turn, the self-sufficiency index of tomatoes and cucumbers shows that this type of vegetables is consumed much more in Latvia than is produced. It is important to emphasize the negative value of the tomato self-sufficiency index in 2019. The obtained result shows that not only consumption depends on the volume of imported products, but also the volume of exports depends on the volume of imports.

Source: author's calculations according to the data of the Official Statistics Portal of Latvia
Figure 4: Indicators of self-sufficiency index of types of fruit and berries consumed in Latvia

Figure 4 shows the results of the self-sufficiency index calculations, which reflect the self-sufficiency of fruit and berry production. The obtained information shows that the self-sufficiency of both fruits and berries can be assessed as insufficient. Apple and pear SSR is considered self-insufficient; moreover, in 2011 and 2015, part of the exported production depended on the volume of imports. The results show that the SSR of cultivated berries until 2009 is considered to be self-insufficient, and consumption depends on the production of imports. Since 2010, it can be observed that consumption and part of the volume of exported production depends on the volume of imported products.

An important factor is the practice of Statistics Latvia to combine several product groups into one. For example, apples, pears and garden quinces are grouped together with stone fruits. A similar situation is observed in the group of cultivated berries, where gooseberries, currants, blackcurrants, chokeberries, raspberries, blueberries and strawberries are grouped. Such an unjustified aggregation of various berries and vegetables does not give a true picture of either production or consumption; thus it is not possible to calculate the self-sufficiency index accurately. The results obtained in this case can be considered preliminary.

CONCLUSIONS

Information obtained in the scientific literature shows that there is no common understanding of the calculation of self-sufficiency. In the methodology of international organizations, imported products are often considered to be an element of self-sufficiency, and the exact understanding of concepts is confused.

The statistically unsound aggregation of different categories of products, vegetables and fruits, including berries, in one group does not give a true picture of the production and consumption of these products, vegetables and fruits, so it is not possible to obtain accurate information and make accurate calculations.

The updated calculation SSR formula provides more accurate information on self-sufficiency and calculates the consumption and export volume dependence on imported products.

The obtained calculation results show that there are product groups whose self-sufficiency rato exceeds 100%, that is, the consumption of these products in the Republic of Latvia is fully ensured - potatoes, carrots, beets, wheat and sweet and sour bread, beef.

Partial self-sufficiency is observed in the case of pork, rye bread and cucumbers.

Consumption of apples, pears, cultivated berries and tomatoes can be mentioned as import-dependent consumption and export.

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