

ECONOMIC CONDITIONS AFFECTING FRUIT CONSUMPTION IN POLAND: EVIDENCE FROM A COUNTRY WITH TWO ECONOMIC SYSTEMS IN 1965–2014

Dawid Olewnicki¹✉, Marzena Iwańska¹, Zbigniew Laudański^{†1}

¹Warsaw University of Life Sciences, Poland

Abstract. The purpose of this study is to evaluate the long-term changes in total fruit consumption in Poland from 1965 to 2014, and to test the impact of developing trends and the effects of the economic situation on fruit consumption in that period. The analysis suggests that changes in fruit consumption in Poland over the last half century correlate with the characteristics of the economic cycle. Two phases of growth in consumption and two phases representing a downward trend may be identified. The artificial variable (the increase or decrease value) allowed to confirm the existence of cyclical factors. The two methods (HP and MLS) used to assess the changes provided a picture of the activity of these factors. It should be noted that the coefficient of the regression function calculated with the HP is very similar to the one calculate with the MLS, and is $R^2 = 0.645$. These methods may therefore be useful in predicting short-term changes in consumption levels.

Keywords: fruits, consumption, business cycles, economic conditions

INTRODUCTION

Apart from economic growth, consumption is one of the most important concepts in economics. Consumption is most often defined as activities aimed at satisfying all kinds of consumption needs. This includes not only goods and services which are used to meet the needs,

but also factors affecting the satisfaction of human needs (Śleszyńska-Świdarska, 2014).

Fruit is an important part of food in a proper human diet (WHO, 2003; Agudo and Pera, 1999). Despite numerous recommendations from dieticians and nutritionists, fruit consumption in Poland has been at a low level for many years, and demonstrated a downward trend in the past decade. This phenomenon is surprising, especially so when considering the economic theory (the *wealth effect*): as social welfare grows, so does the demand for normal goods (where most fruit species belong). Kwasek (2000) also emphasizes that the ability to meet nutritional needs is primarily determined by the households' financial situation. As the population becomes larger and more prosperous, the level and structure of food consumption changes (Klepacki, 2008). As emphasized by Zielińska and Zieliński (2002), fruit and vegetables have for many years had the second largest share in the Polish households' budget (with the largest share corresponding to meat and dairy products).

According to the theory of consumer behavior, basic determinants of the amount and structure of purchased goods are budgetary constraints and consumer preferences. The first of these aspects is determined by changes in price ratios and incomes. The second one, on the other hand, in the case of food, depends mainly on the population's age structure, household structure,

✉PhD Dawid Olewnicki, Section of Horticultural Economics, Warsaw University of Life Sciences, 159 Nowoursynowska St., 02-766 Warszawa, Poland, e-mail: dawid_olewnicki@sggw.pl, <https://orcid.org/0000-0002-3096-3882>

recommendations from doctors and nutritionists, food preparation technologies, changing lifestyles and the effectiveness and impact of advertising.

The purpose of this study was to evaluate the long-term changes in total fruit consumption in 1965–2014, and to verify the hypotheses about the existence of an upward development trend and the economic conditions behind the phenomenon considered over the study period.

MATERIALS AND METHODS

In this study, research was based on data from the Central Statistical Office (including detailed data from studies on the budgets of Polish households), the Institute of Agricultural and Food Economics, and from publications and papers on fruit consumption in Poland. The analysis period is from 1965 to 2014, spanning over two economic systems, i.e. the centrally planned economy (1945–1989) and the market economy (from 1990). Other macroeconomic factors, such as GDP, population income and prices, were not covered by the study because of incomparability of data between the sub-periods. The analysis is based purely on data retrieved from available literature.

The total (fresh and processed) fruit intake was analyzed on an annual basis, in kilograms per person per household. A time series was created for analysis on the basis of data from this period, which was then further subjected to detailed analysis. First, the basic statistical parameters, giving a summary description of the phenomenon analyzed, were calculated. This includes fixed-base indexes used to compare and analyze absolute figures recorded in the last year of the study period against the base year.

An average annual rate of analysed changes was the specified of which in the reviewed period ($t_0; t_n$). It was calculated as the difference between the average chain index from this period and the unification (Górczyński, 2004),

$$r_{t_0;t_n} = \sqrt[n]{\prod_{j=t_0}^{t_n} i_{jj-1}} - 1 = \sqrt[n]{\frac{y_{t_n}}{y_{t_0}}} - 1$$

The impact of domestic fruit supply in 1992–2014 on the annual fruit consumption volume in that period was also analyzed. The supply of fruit on the domestic market was expressed as total fruit harvest plus total

imports less total exports and re-exports. The study only covered the 1992–2014 period due to unavailability of reliable data on fruit exports, re-exports and imports in the Polish economy of the socialist era. A hypothesis was advanced that fruit consumption in 1992–2014 was interdependent with fruit supply on the domestic market. This was based on the assertion that a higher intake of fruit by the market would decrease prices, and as a consequence an increase in demand for these products would be experienced. To explain this phenomenon, the method of analysis of linear correlation was applied. To verify the hypothesis, Student's *t*-test (at $\alpha = 0.05$) was used.

The assessment of long-term changes in fruit consumption in Poland, based on the observed time series and trends for the period considered, was the next stage of the analysis. It was assumed that fruit consumption may reflect the economic trends in Poland. In order to partially eliminate the potential economic fluctuations in such a long time series, a smoothing method based on several techniques (including moving average) was used. The test did not explain the behavior observed in the period concerned. However, data analysis with the use of 5-year arithmetic means enabled looking at the problem from a different angle (Fig. 2). In the classical analysis of developments covered by this study (fruit consumption), it can be assumed that the consumption level (Y_t) is a function of the following components present during the study period: the development trend (T_t), possible cyclical fluctuations (C_t) and random fluctuations (I_t). If, within a significant linear trend, some changes in the development are observed and autocorrelation of deviations from the regression line is detected, it means that the phenomenon examined is influenced not only by time but also by other factors which are practically indeterminable. These can be identified as economic fluctuations. In order to confirm this assumption, the regression analysis of time series data was performed with respect to the time variable and artificial variable, reflecting the level of economic fluctuations determined based on deviations from the regression line. The economic (artificial) variable was included to represent the increases and decreases, and so were the 'Bull or Bear market' influences in fruit consumption over the next 50 years. The value of the economic variable corresponds to the deviation from the regression line. The reason for introducing it was the test of the assumption that deviations from the regression line are

random. Random aberrations (i.e. irregular deviations of the phenomenon from the level expected based on other factors) were evaluated. For the measurement of random fluctuations, the autocorrelation and random aberrations coefficient was used; the Student's t-test (at $\alpha = 0.05$) was performed for that purpose.

If the assumption of autocorrelation of random deviations is confirmed, an artificial variable (p) will be introduced to reflect the decline or growth. It may take nine values ($-4, -3, -2, -1, 0, 1, 2, 3, 4$): -4 or 4 if the increase or decrease amounts to over 7 kg per capita each year; -3 or 3 if the increase or decrease is 5; etc. The variable is set so that its value is consistent with that of deviations from the regression line ($Y - Y_{reg}$).

This method allowed to demonstrate the significance of variation (referred to as cyclical variation) in the time series covered by the analysis. In this situation, to describe the development trend of fruit consumption within a given period, the least squares method was used in accordance with the regression model written as $Y_t = b_0 + b_1 \cdot t + b_2 \cdot p_t + e_t$.

The time series data was also subjected to the Hodrick–Prescott filter, a method commonly used to assess the economic changes in time series, including the identification of cycles and trends (McElroy, 2006; De Jong and Sakarya, 2016). The HP filter was used to minimize the sum of squares of time series deviations from its trend, using the lambda smoothing parameter (λ).

$$\min \left\{ \sum_{t=1}^T (y_t - g_t)^2 + \lambda \sum_{t=2}^{T-1} [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2 \right\}$$

where:

y_t – observed value; g_t – regression function value.

The lambda (λ) value was chosen intentionally, taking into account the particularities of the time interval. For annual data, lambda is 100 ($\lambda = 100$), which allows to examine cycles lasting up to 16 years. The trend's 'smoothness' can be described as dependent on lambda (λ). When lambda (λ) tends to infinity, the form of the regression function converges to a straight line. With a zero lambda ($\lambda = 0$), the potential consumption of fruit coincides with the real one (the trend coincides with the series of empirical data).

MACROECONOMIC FACTORS AND FRUIT CONSUMPTION

The development and growth of fruit production in Poland, especially in the era of centrally planned economy, increased the supply of fruit on the domestic market. As a consequence, a gradual increase in the consumption of fruits was observed. Yet, it should be noted that large fluctuations were recorded for many years (Olewnicki, 2011). As shown by the analysis, total fruit consumption in Poland between 1965 and 2014 increased from 21.6 kg to 43.1 kg per capita (i.e. by 100.0%), at an average annual growth rate of 1.4%. This increase, however, was not linear. In addition, consumption increase and decrease phases were clearly observed in this period. There was also a significant variation in consumption over the period considered. In this context, note that the coefficient of variation for the entire period was 21.3%. In the study period, consumption is well described by a polynomial of degree 6. The coefficient of determination in this case amounts to 75.2% (Fig. 1).

The regression function was selected, as suggested by regression results, based on a 5-year average (Fig. 2), as a polynomial of degree 6. This function provides a significant description of the phenomenon considered ($R^2 = 0.97$). The linear regression function was determined as well but failed to reliably describe this relation ($R^2 = 0.48$, $\alpha < 0.6$). Note that changes in 5-year average fruit consumption in the study period (as shown in the graph) are closely convergent with a classic economic cycle chart (Fig. 3). The growth and decline phases of economic cycles, limited by the upper and lower turning points, are clearly visible in this case (Kydland and Prescott, 1990; Gorton and Rouwenhorst, 2006).

The changes in fruit consumption, as observed above, are linked to economic conditions which prevailed in the last half-century. Economic changes had a significant impact on the development of consumer behavior. Throughout the post-war period until mid-1989, Poland maintained a cheap food policy, based on production and consumption subsidies, in order to keep a relatively low level of food prices which often failed to reflect the production costs. The intended effect of this policy was to achieve a higher level of nutrition for the population than would result from the economic development level (Gulbicka, 2000). Furthermore, agricultural progress contributed to a gradual increase in the productivity of different agricultural sectors. The period from the early

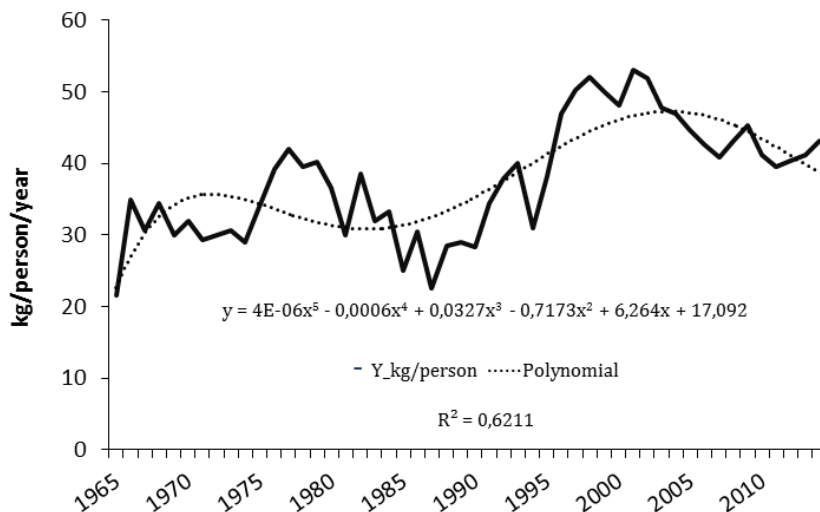


Fig. 1. Changes in total fruit consumption in 1965–2014 (kg/person/year)
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

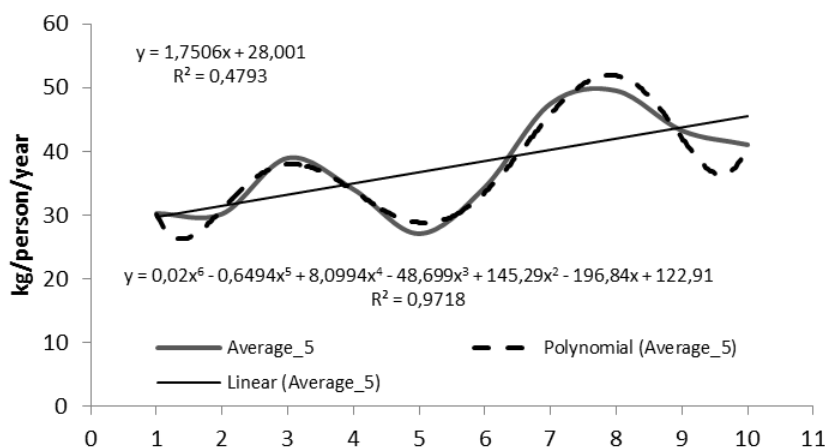


Fig. 2. 5-year average total fruit consumption in 1965–2014 and the trend line.
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

1960s to the late 1980s is referred to in the literature as the rationalization of consumption under the conditions of the cheap food policy. This might have had an impact on the level and structure of total food consumption in Poland as a whole and in different population groups.

The basic idea of the cheap food policy was the equalization of consumption. It resulted, however, in

the prices of food being well below the market equilibrium. The consequence was the consolidation of excess demand for food, further strengthened through the *steep approach* effect described in the literature. Excessive prices of the whole range of commodities, spanning from necessities (food) to luxury goods, were the result of excessive pressure of less affluent households

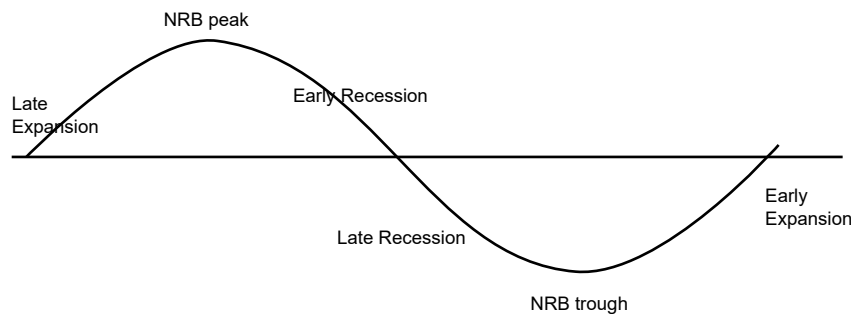


Fig. 3. Economic cycle in its classical form with its phases and turning points
Source: own elaboration based on Gorton and Rouwenhorst, 2006.

on the demand for necessities. Seemingly, the *steep approach* and cheap food policy resulted in food consumption beyond one's means (Gałązka and Grzelak 2013). According to Woś (after: Gałązka and Grzelak, 2013), food consumption levels in this period were above those that were supposed to result from the Polish economic development. These factors had an impact on the consumption of fruits, considered to be 'everyday goods' at that time. Since the mid-1960s, a gradual increase in consumption was observed (from 21.6 kg in 1965 to around 31.0 kg in early 1970s. Note that the early 1970s witnessed a stagnation in fruit consumption. However, 1975 saw renewed growth in consumption, reaching a level of 40.0 kg per capita per year. Taking into consideration the period 1965–1977, changes in consumption took the form of an increasing polynomial of degree 3, written as $y = 0.0729x^3 - 430.97x^2 + 849236x - 6 \times 10^8$. The alignment of empirical data with the trend was explained in 78.02% (Fig. 4).

When it comes to economic policy elements described above, in the late 1970s inflation was observed and was not adequately reflected in the statistics. For instance, the official price increase rate of 8.1% in 1978 did not fully correspond to the way it was perceived by the public, considering the 100% increase in the price of meat and sausages, or a 60% to 80% increase in vegetable and fruit prices. As shown by the analysis of the economic situation, the 1980s were characterized by a far-reaching relaxation, market imbalance, high inflation, and inability to efficiently meet basic social needs (Kieżun, 2011). This was correspondingly reflected by a sharp drop in fruit consumption.

In 1978-1990, consumption declined at an average rate of 2.71%, as illustrated by a polynomial of degree 2, written as $y = 0.1132x^2 - 450.42x + 447940$, explaining 66.98% of variability of the regression (Fig. 5). The transformation initiated in 1989 significantly affected the levels of food intake. The deep restructuring of the national economy disabled a part of the production infrastructure, resulting in a reduction in employment, a decline in the population's real income, and hence a decline in demand for fruit, vegetables and flowers. The same was true for products with high income elasticity of demand. The rapid erosion of the population's real income caused a dramatic reduction (by about one third) in demand for food. This was followed by a decrease in producer prices incomes (Wawrzyniak, 1998). An indicator margin squeeze for agriculture has worsened, which contributed to a significant decline in domestic food production. The demand for food was largely met through imports. In subsequent years, there was a rebound (*a dead cat bounce*) in the population's income level.

The gradual improvement in the population's income and the recovery of price relationships (experienced since the mid-1990s) were accompanied by diversification trends in the intake of food of vegetable origin. In particular, fruit consumption increased at that time. The economy became more open to foreign trade, and the population's income conditions improved, contributing to an increase in the consumption of fruit which were no longer a product consumed mainly during holidays in Poland (Gałązka and Grzelak, 2013). Also, as Olewnicki remarks (2011), since the late 1990s, there have been numerous significant changes in food

consumption patterns, resulting from: a consistent improvement in the standard of living of the Polish population; the opening of new commodity markets; and general access to products which were considered luxury goods in the centrally planned economy. The transformation resulted in changing the consumption structure of certain food products and the structure of financial resources allocated to various foodstuffs and normal goods. As pointed out by Ciechomski et al. (2000), despite a clear upward trend in fruit consumption (2.3 kg per capita per year) in the 1990s, fruit intake still fell short of the theoretical saturation level and represented 25% to 50% of consumption figures recorded in the European Union. In the market economy, there have been significant changes in the structure of fruit consumption. According to the analysis results, the consumption of the most common domestic apple species followed a clear downward trend, while the share of tropical fruit consumption began to gradually increase. In 1992, apple consumption reached the level of 18.7 kg, while in 2008 it decreased to 15 kg. A decrease in apple consumption was also observed in the US, Germany and other developed countries. In the United States, in a 100-year period of increasing social prosperity, the demand for apples decreased from 30.1 kg in 1910–1911 to 8.2 kg per capita in 2005–2006 (Brzozowski, 2009). This means that apples became inferior goods in the US, and it will also be the case in Poland in the near or more distant future. However, according to Adamczyk (2002), apples were still perceived as ‘normal goods’ at the beginning of the last decade.

Between 1991 and 2001, the average annual fruit consumption increased by 4.40%; the trend was linear ($y = 1.9755x - 3899.2$) and explained in 72.58% (Fig. 6). Despite a clear increase in fruit consumption in Poland, it was still very low in the 1990s compared to EU countries. According to Filipiak (2006), fruit consumption in Poland in the 1990s was more than 3 times lower than in Greece and Slovenia (countries with the highest fruit consumption levels).

In 2002–2014, fruit consumption entered a phase of decline at an average annual rate of 1.52%. The trend, expressed as a polynomial of degree 2 ($y = 0.1307x^2 - 525.46x + 528292$) explains the volatility of regression at 81.32% (Fig. 7). Changes in consumption in these years seem surprising because, according to many sources, the growing affluence of the Polish society in the past decade, as well as Poland’s accession to the European Union, had a very clear impact. According to Ancyparowicz (2009), in 2000–2007, the synthetic measure of the wealth of the Polish society increased by two and a half times (in nominal GDP per capita). However, if measured with purchasing power parity, it grew only by about 50%. Note also that according to a report by the Ministerstwo... (2014), even the 2008 economic crisis did not lead to an overall decline in consumption (the most stable factor in economic growth) in Poland. Thus, there was no ‘wealth effect’ on the consumption of fruits (considered as normal goods), i.e. the growing welfare did not drive an increase in demand for fruits (as normal goods). This might mean that fruits became ‘essential goods’ in the past decade.

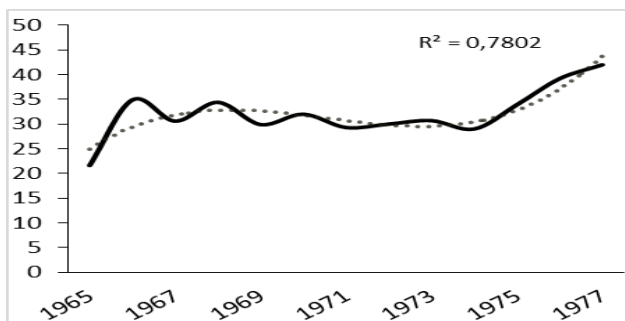


Fig. 4. Total fruit consumption in 1965–1977 (kg/person/year)
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

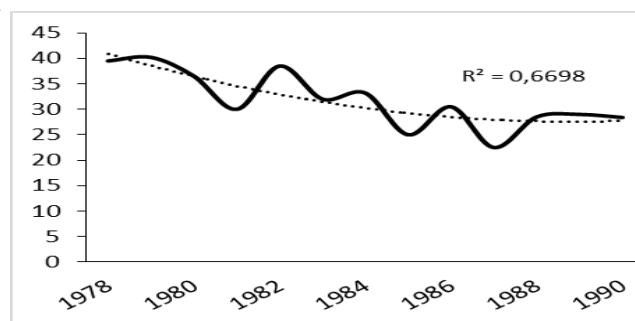


Fig. 5. Total fruit consumption in 1978–1990 (kg/person/year)
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

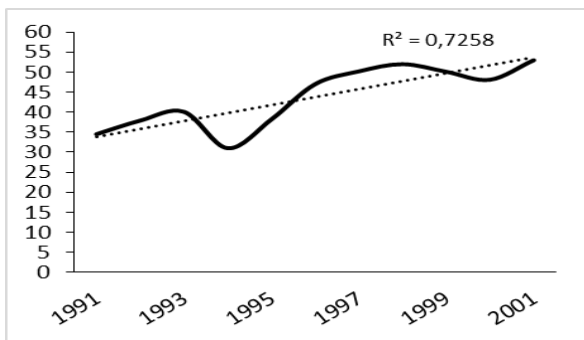


Fig. 6. Total fruit consumption in 1991–2001 (kg/person/year)
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

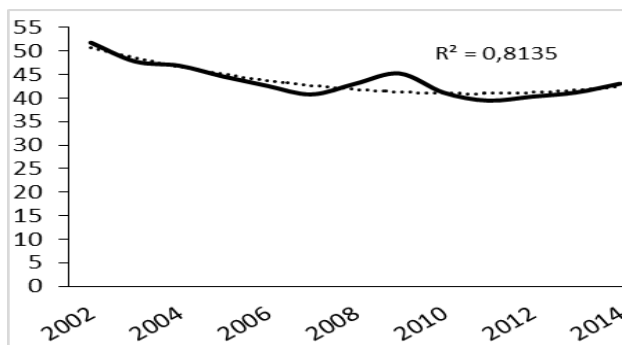


Fig. 7. Total fruit consumption in 2002–2014 (kg/person/year)
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

As shown by the analysis of correlation between fruit consumption and supply to the domestic market (100 thousand tons annually) in 1992–2014, there was a significant positive correlation between fruit consumption and supply to the domestic market ($R^2 = 0.3143$; $t_{emp} = 3.103$; $\alpha = 0.05$). The resulting equation takes the

following form: $y = 22,688 + 0,6613 \cdot \text{podaż}$. This
 $S_{y_0} = 6,9873$ $S_{y_1} = 0,2132$

means that 100 thousand tons of fruits delivered to the market will entail an increase in the consumption at an average rate of 0.66 kg per capita (Fig. 8).

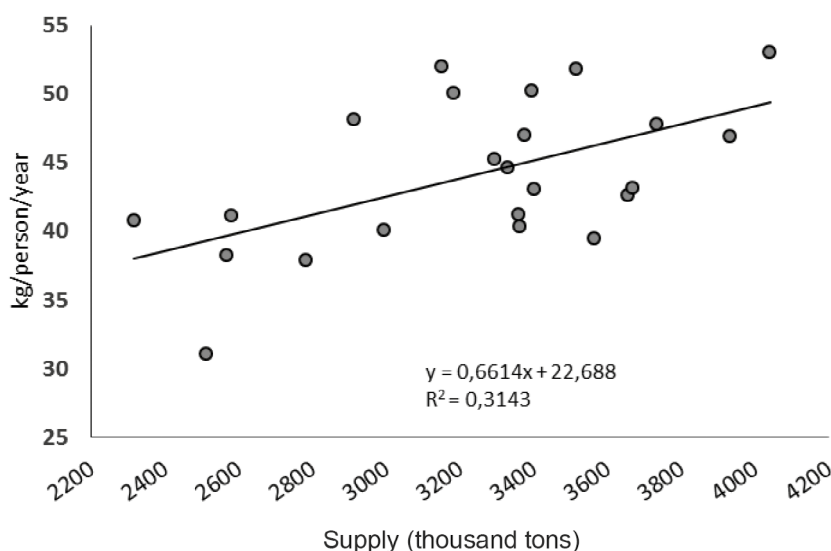


Fig. 8. Total fruit supply (thousand tons) compared to fruit consumption (kg/person/year) in 1992–2014
Source: own study based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

COMPARISON OF TIME SERIES SMOOTHING METHODS IN THE ASSESSMENT OF LONG-TERM FRUIT CONSUMPTION PATTERNS

The next stage of the analysis was the assessment of long-term trend changes in fruit consumption in Poland in the period considered, based on time series data. An attempt was made to verify the hypothesis of a significant linear trend (upward development trend) expressed with the following equation: $y = 0.353 \cdot t + 28.627$ ($R^2 = 0.412$). There was significant autocorrelation of the random component (deviations from the regression line) $r = 0.711$ ($t_{emp} = 6.935$; $\alpha < 0.001$). This means that the phenomenon under consideration evolves in time but is also impacted by other factors that can be described as economic fluctuations. At the same time, a significant regression coefficient indicates that the average annual increase in consumption in the study period was 0.35 kg per capita.

The regression analysis with two variables (time t and level p), written as $y = 28,325 + 0,386 \cdot t + 2,220 \cdot p$, ($R^2 = 0.9756$), demonstrates that the average annual increase in fruit consumption was 0.37 kg per capita (which is very close to 0.35), while the possible annual average decrease or increase is 2.22 kg per unit of the artificial variable.

Note that the autocorrelation coefficient is insignificant ($r = -0.085$, $t_{emp} = -0.5859$; $\alpha > 0.05$) which indicates the absence of autocorrelation of deviation from the

regression line. This is understandable because that variable reflects the changes in economic cycles; this means that deviations from the regression line are random. It must be therefore concluded that the use of this variable (the increase or decrease value) confirms the existence of cyclical factors which evolve over time and affect the consumption value. There is (Fig. 9) a variable level of increase or decrease of 9 values accomplished in the time shown, with no time variable included. Note that the coefficient of determination ($R^2 = 0.7394$) is very close to the value of $R^2 = 0.752$ calculated with the predetermined polynomial regression function for this variable.

When comparing the trends obtained using these methods (MNK and MHP), regression can be noticed. Moreover, there is a significant similarity in behavior over the course of the phenomenon being studied i.e., over the last 50 years. The results obtained with the regression polynomial of degree 6 and the Hodrick-Prescott filtering method (HP) are shown in Fig. 10. In both cases, climatic changes in consumption can be observed, demonstrating a consistent upward trend. As it may be easily seen, there is a significant similarity between regression functions ($r = 0.9752$; $t_{emp} = 30.508$) obtained with the two methods, in particular in the 1978–1998 period. While these results are not identical, the relationship can be described as follows: $MHP = 3,640 + 0,903 \cdot MNK$.

Note however that the coefficient of determination calculated with the *HP* method is very similar to that

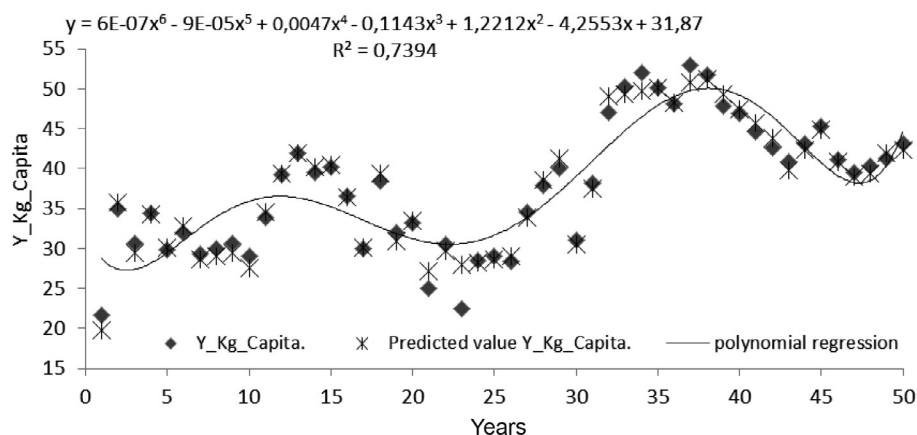


Fig. 9. Possible economic cycle of fruit consumption in 1965–2014
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

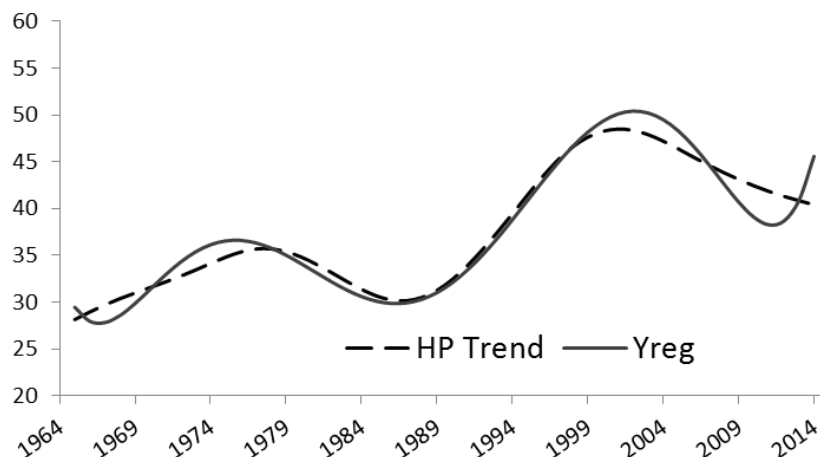


Fig. 10. Comparison between the polynomial regression function of degree 6 and the Hodrick-Prescot (*HP*) filtering method
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

obtained with the *MNK* method, and equals $R^2 = 0.645$. In contrast, particularly large differences between the two models exist in the 2012–2014 period for which the polynomial form indicates a growth trend. Conversely, in the *HP* method, a downward trend was observed after 2002 (Fig. 10).

Taking into account the deviations from the regression line calculated with the *MLS* method and the *HP* filter, similarities ($r = 0.9187$; $t_{emp} = 16.117$) can also be clearly observed in the development of the level of total fruit consumption in the study period covered by the analysis (Fig. 11). Both methods revealed the economic

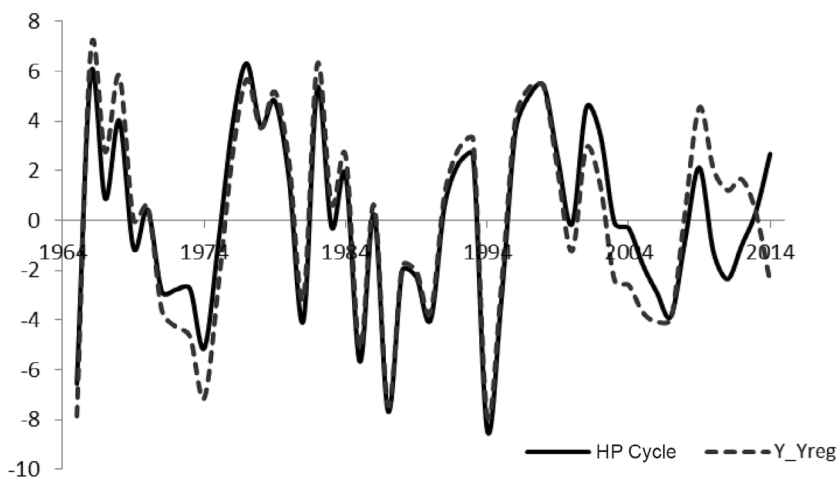


Fig. 11. Random deviations of polynomial regression of degree 6 and of the Hodrick-Prescot (*HP*) filter
Source: own elaboration based on data from the CSO (1966–1996), IAFE (1996–2015) and Brzozowski (2008)

cycle affecting this phenomenon. As already mentioned, significant differences can be seen only in the last years of the study period (i.e. 2012–2014). These methods may therefore be useful in forecasting changes in consumption in the near future. However, this requires further comparative analysis to be performed in the coming years in order to determine the suitability of both methods and their compliance with empirical data, so that fruit consumption in Poland may be evaluated.

SUMMARY AND CONCLUSIONS

As is clear from this research, the total fruit consumption in Poland in 1965–2014 increased from 21.6 kg to 43.1 kg per capita (by nearly 100.0%), at an average annual growth rate of 1.4%. This increase, however, was not linear; phases of growth and decline in consumption were also observed in this period. A polynomial of degree 6 depicts well the consumption trend in the period considered. The coefficient of determination was 75.2%. It is important to emphasize that, as shown by the analysis, changes in fruit consumption in Poland over the last half century are characteristically affected by economic cycles. There were two phases of growth in consumption that period, and two phases of downward trends. It should be noted that the second downward phase took place in the past decade and coincided with a growth of social welfare. This challenges the economic theory which claims that the growth of the population's income should result in an increase in consumption. Note also that according to the analysis of linear correlation between fruit consumption and the fruit supply to the domestic market in 1992–2014, there was a significant positive correlation which allows to conclude that fruit supply contributes more than 30% to the level of consumption.

The artificial variable (i.e. the increase or decrease value) allowed to confirm the existence of cyclical factors (e.g. supply) which operate independently from consumption and affect its level. Indeed, the declines and increases in economic cycles were so large that it was difficult to consider them a random effect. A picture of the activity of these factors was also provided, which worked according to two methods for assessing changes i.e. *HP* method and *MLS*. Note that the coefficient of determination of the regression function obtained with the *HP* method is very similar to that obtained with the *MLS*, and equals $R^2 = 0.645$. These methods may

therefore be useful in predicting changes in consumption in the near future. However, this requires further analysis to be performed in the coming years in order to determine the suitability of both methods and their compliance with empirical data, so that fruit consumption in Poland after 2014 may be evaluated.

REFERENCES

- Agudo, A., Pera, G. (1999). Vegetable and fruit consumption associated with anthropometric, dietary and lifestyle factors in Spain. EPIC Group of Spain. European Prospective Investigation into Cancer. *Public Health Nutr.*, 2(3), 263–271.
- Adamczyk, G. (2002). Analiza dochodowych uwarunkowań konsumpcji w gospodarstwach domowych w latach dziewięćdziesiątych [Analysis of profitable conditions of household consumption in the nineties]. *Rocz. Akad. Roln. Pozn.*, 343, 3–16.
- Ancyparowicz, G. (2009). Bezpośrednie inwestycje zagraniczne w Polsce po akcesji do Unii Europejskiej [Direct foreign investment in Poland after accession to the European Union]. *Zesz. Nauk. SGGW Ekon. Org. Gosp. Żywn.*, 77, 89–103.
- Brzozowski, P. (2008). Zmiany w ekonomice produkcji jabłek w Polsce w latach 1950–2005 [Changes in the economics of apple production in Poland in the years 1950–2005]. PhD thesis, Institute of Pomology and Floriculture, Skierniewice.
- Brzozowski, P. (2009). Zagospodarowanie jabłek w Polsce w ostatnim 40-leciu [Development of apples in Poland in the last 40-year period]. *Zesz. Nauk. Inst. Sadown. Kwiac.*, 17, 41–52.
- CSO [GUS] (1966–1996). *Roczniki statystyczne z lat 1966–1996* [Statistical Yearbooks from 1966–1996]. Warsaw: Główny Urząd Statystyczny.
- Ciechomski, W., Marzec-Wołyńska, T., Niewiadomski, J. (2000). Rynek owoców i warzyw. Strategiczne opcje dla polskiego sektora agrobiznesu w świetle analiz ekonomicznych [Fruit and vegetable market. Strategic options for the Polish agribusiness sector in the light of economic analysis]. Warszawa: Wyd. Wieś Jutra.
- De Jong R.M., Sakarya N. (2016). The Econometrics of the Hodrick-Prescott filter. *Rev. Econ. Stat.*, 98(2), 310–317.
- Filipiak, T. (2006). Produkcja oraz spożycie owoców i warzyw w Polsce [Production and consumption of fruit and vegetables in Poland]. *Rocz. Nauk. SERiA*, 8(3), 33–38.
- Gałązka, M., Grzelak, A. (2013). Tendencje konsumpcji żywności w Polsce na tle uwarunkowań globalnych [Trends

- in food consumption in Poland against global conditions]. *Rocz. Ekon. Kuj.-Pom. Szk. Wyż. Bydg.*, 6, 223–241.
- Gorton, G., Rouwenhorst, K. G. (2006). Facts and Fantasies about Commodity Futures. *Fin. Anal. J.*, 62(2), 47–68.
- Górczyński, J. (2004). Podstawy ekonometrii [Basics of econometrics]. Sochaczew: Wyd. Wyższej Szkoły Zarządzania i Marketingu.
- Gulbicka, B. (2000). Wyżywienie polskiego społeczeństwa w ostatniej dekadzie XX wieku. *Studia i monografie [Polish society nourishment in the last decade of the twentieth century].* Studia i monografie. Wydawnictwo Instytut Rolnictwa i Gospodarki Żywnościowej, Warszawa.
- IAFE [Instytut Rolnictwa i Gospodarki Żywnościowej] Analizy Rynkowe – Rynek owoców i warzyw z lat 1996–2015 [Market Analysis – Fruit and vegetable market between 1996–2015]. Wydawnictwo Instytutu Ekonomiki Rolnictwa i Gospodarki Żywnościowej, Warszawa.
- Idzik, M. (2009). Zarządzanie ryzykiem cenowym, a możliwości stabilizowania dochodów producentów rolnych – aspekty poznawcze i aplikacyjne [Price risk management and the possibility of stabilising the income of agricultural producers-cognitive and application aspects]. W: Program Wieloletni 2005–2009. Ekonomiczne i Społeczne Uwarunkowania Rozwoju Polskiej Gospodarki Żywnościowej po Wstąpieniu Polski do Unii Europejskiej, nr 148. Warszawa: Wyd. IERiGŻ.
- Kieżun, W. (2011). Reforma powiatowa z 1975 roku. Dekada Gierka – wnioski dla obecnego okresu modernizacji Polski [The reform of the counties in 1975. Gierka's decade-proposals for the modernisation of the Polish current period] (p. 27–35). Warszawa: Wydawnictwo Uczelnia Vistula.
- Klepacki, B. (2008). Przesłanki zmiany roli rolnictwa w gospodarce narodowej [Grounds for changing the role of agriculture in the national economy]. Warszawa: SGGW.
- Kwasek, M. (2000). Współzależność między spożyciem żywności a poziomem dochodów w świetle współczynników dochodowej elastyczności spożycia (popytu) [The correlation between the consumption of food and income levels in the light of the coefficients of income consumption elasticity (demand)]. *Mat. Konf. „Konsument żywności i jego zachowania rynkowe”* (pp. 155–159). Warszawa.
- Kydland, F. E., Prescott, E. C. (1990). Business Cycles: Real Facts and a Monetary Myth. *Quart. Rev. Fed. Reserv. Bank Minneapol.*, 14(2), 3–18.
- McElroy, T. (2006). Exact Formulas for the Hodrick-Prescott Filter. Research report series: Statistics 2006-9, Statistical Research Division U.S. Census Bureau, Washington.
- Ministerstwo Spraw Zagranicznych 2014: PL-UE. Polskie 10 lat w Unii [Polish 10 years in the EU]. Raport. Ministerstwo Spraw Zagranicznych.
- Olewnicki, D. (2011). Przemiany w gospodarce ogrodniczej w Polsce w latach 1965–2008 oraz perspektywy jej rozwoju [Changes in the economy of horticulture in Poland between 1965–2008 and the prospects of its development]. Praca doktorska. Warszawa: SGGW.
- Śleszyńska-Świdorska, A. (2014). Konsumpcja a wzrost gospodarczy w Polsce. W cieniu globalnego kryzysu gospodarczego [Consumption and economic growth in Poland. In the shadow of the global economic crisis]. *Nierów. Społ. Wzrost Gosp.*, 38, 352–364.
- Wawrzyniak, J. (1998). Zagadnienia ekonomiczne ogrodnictwa w reformującej się gospodarce [Economic issues of horticulture in the economy reforming]. Poznań: Wyd. AR.
- WHO(2003). FruitAndVegetablePromotionInitiative-AMeeting Report, 25-27/08/03. Retrieved July 6th 2016 from: http://www.who.int/dietphysicalactivity/publications/f&v_promotion_initiative_report.pdf
- Zawojńska, A., Pisa, M. (2007). Polityka fiskalna jako stabilizator koniunktury gospodarczej w teorii realnego cyklu koniunkturalnego oraz praktyce krajów OECD w latach 1970–2005 [Fiscal policy as a stabilizer in economic theory, real business cycle and practice of OECD countries in the years 1970–2005]. *Zesz. Nauk. Ekon. Org. Gosp. Żywn.*, 63, 5–22.