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Diet and Eating Habits Hidden in the Subsistence Minimum

Dieta i nawyki żywieniowe ukryte w minimum egzystencji

Abstract

An exploratory power model analysis was conducted using data from Statistics Poland on 45 food products from 1999 to 2024. The data were deflated and divided into nine categories. Price sensitivity indices (quasi-elasticities) were then analysed for both individual categories and individual products. The results show that staple foods (including pasta, meat, and dairy) exhibit negative price sensitivity indices, which could indicate forced quasi-substitution with cheaper calorie sources, while products such as fats, confectionery, and fish exhibit positive price sensitivity indices. The definition of *survival economy* was proposed to describe the mechanism by which those most impoverished do not engage in substitution in the classical sense but eliminate products from the minimum basket.

Keywords: Welfare, Elasticities, Subsistence Minimum, Survival Economics.

JEL: D11, D12, E31, I32, Q18

Streszczenie

Przeprowadzono analizę eksploracyjną modelu potęgowego z wykorzystaniem danych Głównego Urzędu Statystycznego dotyczących 45 produktów spożywczych z lat 1999–2024. Dane zostały pozbawione trendu inflacyjnego i podzielone na dziewięć kategorii. Następnie przeanalizowano wskaźniki wrażliwości cenowej (quasi-elastyczności) zarówno dla poszczególnych kategorii, jak i dla poszczególnych produktów. Wyniki pokazują, że produkty podstawowe (w tym makarony, mięso i nabiał) wykazują ujemne wskaźniki wrażliwości cenowej, co mogłoby wskazywać na wymuszoną quasi-substytucję tańszymi źródłami kalorii, podczas gdy produkty takie jak tłuszcze, słodycze i ryby wykazują dodatnie wskaźniki wrażliwości cenowej. Zaproponowano definicję „ekonomia przetrwania” w celu opisanie mechanizmu, w którym osoby najuboższe nie dokonują substytucji w klasycznym rozumieniu, lecz eliminują produkty z koszyka minimalnego.

Słowa kluczowe: opieka społeczna, elastyczność, minimum egzystencji, ekonomia przetrwania.

JEL: D11, D12, E31, I32, Q18



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1. Introduction

In the field of poverty, groundbreaking conclusions may be drawn from Sen's work (1981, p. 1) – that insufficient food is not the primary cause of hunger and starvation. Entitlements, one of the concepts discussed by Sen, denotes a set of ways to gain access to resources. The second concept, much more important in the context of this work, is exchange entitlements, a set of goods that can be obtained in exchange for what one possesses. A person starves when their exchange entitlements do not include sufficient food. This fits perfectly with the analysis of the subsistence minimum (SM), demonstrating that a minimum level of income is not enough; what matters is the ability to exchange it for food and basic needs. Sen (1981) criticises the simple model of the SM as a *basket of goods*, replacing it with the aforementioned exchange entitlements. The SM is not a physical quantity of calories, but rather a set of goods available in exchange for resources (e.g., labour, land, benefits). If food prices rise faster than incomes, as in the 1943 Bengal Famine described by Sen, even those above the poverty line lose their entitlements and go hungry. For Poland, this means that the SM must be dynamic: linked not only to CPI inflation but also by real food prices and the availability of skilled labour. American philosopher Martha Nussbaum, in turn, proposed the capabilities approach (1999) in the context of women. Instead of asking “how many resources does a woman have?” and “is she satisfied?”, we should ask “what is a woman actually capable of doing and being?”. She gives the example of two women: one with sufficient resources who can choose to fast for religious reasons, and one who, hungry, must go without food (thus without choice). Capabilities provide a philosophical justification for constitutional rights. They demonstrate not only that women have the right to economic independence, but also why – because the ability to control one's environment is central to human dignity. Her approach has been widely accepted in economics, for example through the Human Development Index (HDI), which measures capabilities in health, education, and income. Nussbaum's list (bodily health, senses/thinking) is not only reflected in the HDI dimensions, but in the Multidimensional Poverty Index (MPI), which operationalised Nussbaum's list (Alkire, 2007). For example, health (corresponding to Nussbaum's *bodily health*) was measured through child mortality and nutrition, education (corresponding to Nussbaum's *senses/imagination/thought*) was measured through years of schooling and attendance, and standard of living (corresponding to Nussbaum's *control over the environment*) was measured through water, sanitation, electricity, fuel, and assets. Nussbaum herself began using this approach in an economic sense, criticising the GDP index for ignoring inequality and resource conversion (2011).

In the context of an econometric analysis of the price elasticity of the SM in Poland, Amartya Sen's groundbreaking conclusions emphasise that food shortages are not the primary cause of hunger, but rather limited access to resources and the ability to utilise them (the aforementioned *entitlements*). Sen criticises the simple model of the SM as a static *basket of goods*, detached from the real adjustment mechanisms that occur in conditions of poverty. In the Polish context, these theories imply the need to treat the SM as a dynamic construct, responding not only to

the general price level, i.e., inflation, but also to relative food prices and structural income constraints. The econometric model in this paper aligns with this approach, treating the SM not as a fixed consumption basket but as a normative function of the costs of biological survival, endogenously adjusted to changes in food prices. The estimated price elasticities, therefore, do not reflect consumer preferences or classical demand responses, but rather reveal the mechanisms of forced substitution and the elimination of goods under conditions of extreme budget constraints. In this sense, empirical analysis makes it possible to identify hidden forms of nutritional deprivation that are not visible in the nominal subsistence level, but are revealed in its sensitivity to changes in the prices of individual product groups. Ravallion (2020) demonstrates that the modern idea of “ending poverty” arose in the last decades of the 18th century, but it was not until the 20th century that it became a central policy goal. The Polish definition of the SM operationalises this idea – analogous to the Speenhamland System (England, 1795–1834), which guaranteed income indexed to food prices. Thus, poverty lines are normative constructs, not functions of revealed preferences – crucial for interpreting SM as an expert construct in elasticity models (Ravallion, 2020).

Szwacka-Mokrzycka (2021) analyses the trends in consumer behaviour and how they affected food consumption in Poland between 2003 and 2019. She demonstrates that food consumption among Polish households varies significantly by income level. Low-income households demonstrate high sensitivity of food demand to income changes, while affluent households exhibit low-income elasticity. An important complement is the study by Dudek and Myszkowska-Ryciak (2020), which uses the Food Insecurity Experience Scale (FIES) developed by the Food and Agriculture Organization (FAO) to measure food insecurity in Poland between 2014 and 2019. The authors confirm that the problem of food insecurity affected 23.9% of the population in 2014–2015, decreasing to 12.1% in 2018–2019, with the greatest improvement in households with three or more children (from 39% to 10%) thanks to the *Rodzina 500+* scheme (Dudek and Myszkowska-Ryciak, 2020). These results suggest that negative price elasticities in SM may be a proxy for hidden food insecurity, which is not visible in nominal subsistence levels. The work of Szwacka-Mokrzycka (2021) shows that many negative elasticities are expected. Thus, in line with economic theory, the substitution effect will then be examined, both between product categories and individual products – the titular *eating habits* and *diet* are intended to symbolise this effect.

The aim of this paper is to investigate whether there is a substitution effect or elimination from the basket of goods of those most impoverished in Poland, in cases in which price pressure has been imposed. A total of 45 different food products from 1999–2024 were selected for analysis, including baked goods, pasta, fish, meat, fats, confectionery products, and *miscellaneous*. They were selected to achieve a compromise between the quantity and diversity of products and the longest time series available on the Statistics Poland (GUS) website. The log-log model analysis will use the SM in Poland as the dependent variable. The SM will be defined based on an indicator developed by the Polish Institute of Labour and Social Studies (IPiSS) called the *Minimum Egzystencji*. This defines the line of extreme poverty, not

the limit of a comfortable life, thus representing the absolute minimum necessary for survival. It includes the costs of food, housing, clothing and footwear, health-care and hygiene, and education. Since the food basket constitutes approximately 40% of the entire SM (IPiSS, n.d.), this work concerns this food basket. SM per person (averaged for a man and woman) will be used as the income of those most impoverished, comparing it to the prices of selected food products at that time, to calculate elasticities.

The results obtained in this study can be interpreted within a framework referred to here as *survival economics*, because, as this paper will show, substitution effects are not logical in the sense that traditional or behavioural economics would assume. Thus, the aim of this paper is to show that the price elasticities of the SM reveal mechanisms of forced elimination of goods, not substitution. Clearly, the SM published by the IPiSS is a normative construct, based on expert estimates of the cost of biological survival, not on observable consumer preferences or actual household consumption data. In this context, the regression coefficients from the log-log model do not represent classical demand elasticities in the microeconomic sense, but rather the dynamics of how the minimum basket adjusts to price changes. Negative values for staple products (e.g., pasta, meat, dairy) indicate mechanisms of forced elimination or substitution with cheaper sources of calories under budgetary constraints, which are the *survival economics* referred to above. This interpretation is theoretically justified by the concepts of Amartya Sen (exchange entitlements) and Martha Nussbaum (capabilities approach), emphasising that food shortages result not from a physical lack of calories, but from a limited ability to exchange resources for an adequate basket of goods; this empirically corresponds to the studies by Dudek (2011) and Szwacka-Mokrzycka (2021), where negative elasticities are observed already in the third income quartile, which means that even people with average incomes have limited access to food. These studies may suggest that the most impoverished must reduce consumption of nutritious staples and substitute with cheaper calorie sources, reflecting *survival economics*, where households prioritise caloric adequacy over nutritional quality under budget constraints.

Section 2 describes the data and the research method (log-log model on Statistics Poland data, ADF and VIF tests, ElasticNet). Section 3 presents the results of simplified and detailed quasi-elasticity analysis. Section 4 contains a discussion of the results, practical implications, limitations, and directions for further research.

2. Methodology

The prices of the following goods between 1999 and 2024 were taken from Statistics Poland (GUS, 2025): 50g of wheat roll, one kilogramme of rye bread, one kilogramme of wheat-rye bread, one kilogramme of flour, 400g of egg pasta, 500g of barley groats, 500g of buckwheat groats, one kilogramme of rice, 250g of lard, 200g of butter, one litre of rapeseed oil, one kilogramme of fatback, 350g of muesli with fruit, one litre of apple juice, 300ml of multi-fruit juice, 100g of chocolate bars, 360g of jam, 150g of fruit yogurt, one kilogramme of carp, one kilogramme of hake,

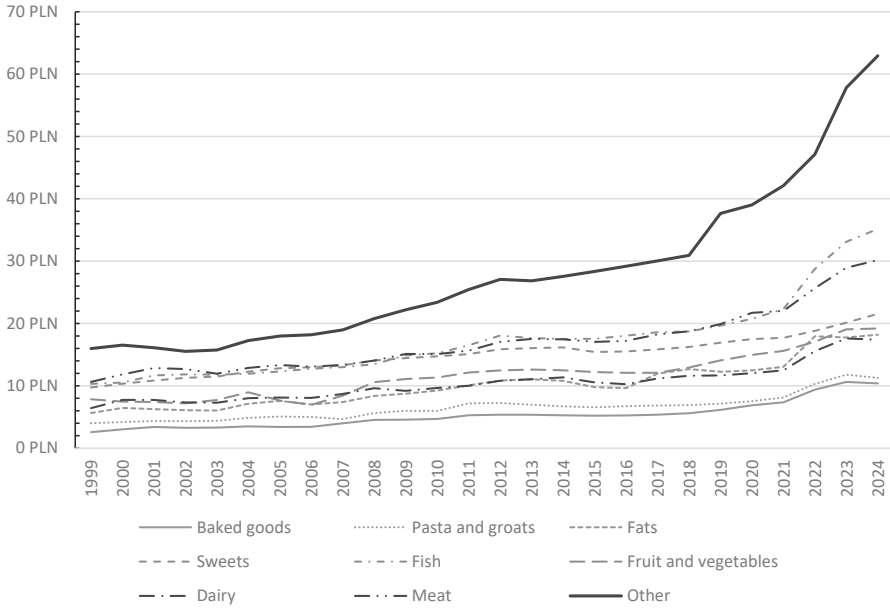
one kilogramme of mackerel, 500g of carrot and pea mixture, 500g of strawberries, one litre of full-fat milk, eggs, 200g of 18% cream, one kilogramme of ripened cheese, one kilogramme of cottage cheese, one kilogramme of pork shoulder, one kilogramme of bone-in beef, one kilogramme of pork ham, one kilogramme of dry sausage, one kilogramme of smoked sausage, one kilogramme of smoked bacon, one kilogramme of raw bacon, one kilogramme of chicken tenderloin, one kilogramme of headcheese, one kilogramme of kishka (Polish black pudding), 300g of tinned meat, one kilogramme of chicken, one kilogramme of sugar, 400g of honey, 250g of coffee, 100g of tea, 100g of cocoa.

The price file contained more labels than actual products. Therefore, they were normalised to represent prices converted to a consistent unit size and measure:

- Wheat rolls price – for 2024, the data was rescaled from 60g to 50g to maintain unit comparability.
- Flour price – in 2023, two different measurement methods and a price conflict occurred, so the data was averaged, while a new methodology was applied from 2024 onwards.
- Muesli with fruit price – data for 1999–2000 was rescaled from 400g to 350g.
- Egg pasta price – data for 1999 was rescaled from 250g to 400g.
- Multi-fruit juice price – data for 1999–2014 was rescaled from 175ml to 300ml.
- Rye bread price – for the years 2000–2015, the unit was adjusted from 0.5 kg to one kg.
- Wheat-rye bread price – for the years 1999–2000, the data was rescaled from 0.6 kg to one kg, and for the years 2001–2024, from 0.5 kg to one kg.
- Fruit yogurt price – for the years 1999–2003, the data was rescaled from 250 ml to 150 g, assuming an approximation of 1 ml = 1 g.
- Cream price – for the years 1999–2014, the data was rescaled, assuming an approximation of 1 ml = 1.05 g.
- Coffee price – a data conflict occurred in 2023, so the data was averaged.

The analysis is conducted to obtain food elasticities relative to SM. A simplified analysis will be based on division of food into nine baskets with scaled prices (figure 1):

- Baked goods – wheat rolls, rye bread, wheat-rye bread, and flour,
- Pasta and groats – egg pasta, barley groats, buckwheat groats, and rice,
- Fats – lard, butter, fatback, and oil,
- Confectionery products – muesli, apple juice, multi-fruit juice, milk chocolate, jam, and yogurt,
- Fish – carp, hake, and mackerel,
- Fruit and vegetables – a mixture of carrots and peas, and strawberries,
- Dairy – whole milk, eggs, cream, cottage cheese, and ripened cheese,
- Meat – pork shoulder, bone-in beef, ham, dry sausage, smoked sausage, raw bacon, smoked bacon, poultry tenderloin, headcheese, and kishka, tinned meat and chicken,
- Miscellaneous – sugar, honey, coffee, cocoa, and tea.

Figure 1.*Basket prices and their dynamics, after scaling.*

Source: own work based on Statistics Poland from 1999 to 2024.

In the baskets, all prices were scaled to represent exactly one kilogramme or one litre of the product. Additionally, it was assumed that 18 eggs would be placed in the basket, which roughly corresponds to a kilogramme of their mass. Due to the lack of data regarding the methods used by the IPiSS to assemble the food basket, an average was adopted – the basket value was divided by the number of products.

Consumer Price Index (CPI) deflation may lead to an underestimation of the changes in food prices relative to the rest of the basket, however both the IPiSS SM and prices were deflated using the CPI, which ensures comparability of the series over time, deprives the data of a clear trend, and mostly addresses the non-stationarity of the price time series and the SM. The non-stationarity of most of the series was confirmed using the Augmented Dickey-Fuller test.

Detailed analysis will be based on individual products in a model isolated in its categories and at original, unscaled prices. In both simplified and detailed analyses, the following model was estimated (equation 1)

$$\ln SM_t = \alpha + \sum_{i=1}^k \beta_i \ln P_{i,t} + \varepsilon_t \quad 1)$$

where:

- SM_t is the deflated SM at given year t
- $P_{i,t}$ is the given price of commodity/basket i , at given year t
- k is the total amount of analysed prices

Then, the ElasticNet model will be based on individual products in a non-isolated model (with unscaled prices), to determine which products represent different multilinear prices increases. This is motivated not by model complexity, but by the high dimensionality of the price basket relative to the short time span, which renders classical regression techniques unreliable.

2.1. Methodological positioning and limitations

This study deliberately departs from standard microeconomic demand estimation. The dependent variable is not household consumption or expenditures, but the SM, which is a normative cost-of-living function constructed by IPiSS experts, not a revealed preference function. Therefore, the estimated elasticities should not be interpreted as classical Marshallian or Hicksian price elasticities of demand. The estimated parameters, later called *price sensitivity indices*, therefore reflect structural shifts in the minimum basket – e.g., the abandonment of more expensive products for cheaper alternatives – which heuristically illustrates the hidden qualitative deprivation of the diet of the impoverished, rather than optimising consumer behaviour. Consequently, the microeconomic interpretation serves as an exploratory metaphor, enabling the identification of *price pressure points* (e.g., via ElasticNet), without violating the assumptions of economic theory.

In the context of these products, the collinearity of prices should be clearly noted. The strongest correlation ($r \approx 0.995$) is achieved between kishka and head-cheese prices; both are pork or offal meats, often coming from the same species or the same part of the supply chain. Other meats correlate with a value of $r > 0.8$. Similarly, the second strongest correlation is between rye and wheat-rye bread ($r \approx 0.982$). A total of 502 pairs have a correlation of $|r| \geq 0.5$, which means that approximately 51% of product pairs demonstrate at least weak collinearity, and 137 pairs have $|r| \geq 0.8$, which means that approximately 14% of product pairs demonstrate strong price collinearity. Multilinearity of prices is an inherent and economically significant feature of food markets, as many products share common supply chains, raw materials, and cost factors. Rather than treating multicollinearity as a statistical defect that must be eliminated, this study treats it as an inherent feature of the price system faced by the most impoverished households. The multivariate model therefore aims to capture aggregate price movements and pressures at the system level, while isolated univariate models serve a purely heuristic role, illustrating hypothetical *ceteris paribus* responses that are largely absent at the subsistence level.

The Variance Inflation Factor (VIF) will be calculated for each product. High coefficients will undoubtedly appear, and this is intentional. Budget pressures for the poorest housing stocks are inevitable, and price collinearity is precisely what exerts this pressure. The study aims to identify what those most impoverished are forced to forgo under the pressure of price collinearity, among other factors. Therefore, this is only a methodological limitation and was left in the work on purpose, and the VIF is calculated only to confirm this effect.

Formal stationarity tests (ADF) were conducted, even though the SM is not a stochastic process generating farm behaviour. It is a normative function of the

cost of biological survival, constructed by IPiSS experts in response to observed market prices. The dependence of the SM on prices is therefore structural, not dynamic, which justifies estimation at levels – the data is non-differentiated. Furthermore, this exploratory approach supports the aforementioned deliberate multicollinearity.

However, to complement the exploratory analysis and meet the requirements of econometric analysis, the ElasticNet model was used, which allows for non-stationarity of data, eliminates the problem of insufficient degrees of freedom, and is robust with regard to price multicollinearity. Unlike LASSO, it does not remove variables from the regression, but estimates them. It is a better choice than RIDGE in terms of the compromise with LASSO. The regularisation parameters were selected using the LOOCV method. The coefficients are interpreted as long-term price sensitivity indices, assuming a common price trend after inflation correction.

3. Results

The data from the SM from 1994 to 1998 are rejected due to their significant outliers and the fact that the data on food product prices from Statistics Poland only concern the period from 1999. Both the IPiSS SM and food prices were deflated using the same price deflator (CPI), which ensures comparability of the series over time. Average annual inflation was calculated using data from Statistics Poland, employing the CPI with a base year of 1998 = 100 and a chain-linked methodology based on monthly indices where the previous month equals 100. For each year, the CPI was averaged, using a weighted average based on the number of days in each month. The price dynamics index is then calculated as the ratio of the current year’s average to the previous year’s average. Table 1 presents the values of the SM before deflation, and table 2 presents the values after deflation (taking 1999 as the base year).

Table 1.
Subsistence minimum in PLN from IPiSS data before deflation rounded off to two decimal places.

1999	2000	2001	2002	2003	2004	2005	2006	2007
280.52	312.40	335.72	351.11	354.76	371.17	385.09	372.70	386.30
2008	2009	2010	2011	2012	2013	2014	2015	2016
413.20	445.33	472.72	500.68	521.11	541.91	544.09	545.76	555.02
2017	2018	2019	2020	2021	2022	2023	2024	
574.01	591.14	616.55	614.74	617.36	775.42	901.04	949.89	

Source: IPiSS datasets from 1999 to 2024.

Table 2.

Subsistence minimum in PLN from IPISS data after deflation rounded off to two decimal places.

1999	2000	2001	2002	2003	2004	2005	2006	2007
280.52	283.84	289.18	296.82	297.53	300.54	305.41	292.31	295.91
2008	2009	2010	2011	2012	2013	2014	2015	2016
303.32	314.86	325.42	330.69	331.77	341.02	341.82	346.02	354.18
2017	2018	2019	2020	2021	2022	2023	2024	
363.30	370.79	357.68	341.55	374.82	391.09	397.18	363.30	

Source: own work based on IPISS datasets and Statistics Poland from 1999 to 2024.

The remaining fluctuations that are visible in the SM and products in real prices are natural, and still carry the necessary information, further used by the log-log model. Table 3 presents the results of stationarity tests that justify price deflation – the vast majority of series are non-stationary, which would make it impossible to conduct regression in the current system. The test was performed by selecting one lag using the AIC criterion, with a specification with trend.

Table 3.

ADF stationarity test results for price time series.

Rice	Roll	Flour	Muesli	Egg pasta	Barley groats	Buckwheat groats	Apple juice	Multifruit juice
–2.842(1)	–3.135(1)	–2.796(1)	–1.752(1)	–0.342(1)	–2.632(1)	–3.515(1)**	–3.004(1)	–1.744(1)
Milk	Chocolate	Lard	Butter	Oil	Fatback	Egg	Honey	Rye bread
–2.235(1)	–1.121(1)	–2.738(1)	–3.352(1)*	–2.998(1)	–1.721(1)	–2.272(1)	–1.239(1)	–0.793(1)
Wheat-rye bread	Pork shoulder	Beef	Ham	Dry sausage	Smoked sausage	Smoked bacon	Raw bacon	Chicken tenderloin
–0.810(1)	–1.557(1)	–2.985(1)	1.318(1)	0.284(1)	0.496(1)	0.620(1)	–1.290(1)	–0.146(1)
Headcheese	Kishka	Tinned meat	Chicken	Carp	Hake	Mackerel	Yoghurt	Cream
–0.279(1)	0.158(1)	0.404(1)	–1.503(1)	–0.674(1)	–1.490(1)	–0.786(1)	–1.412(1)	–1.933(1)
Carrot and peas	Strawberries	Sugar	Jam	Coffee	Tea	Cacao	Cottage cheese	Cheese
–2.102(1)	–3.512(1)**	–2.900(1)	–2.341(1)	–0.922(1)	–0.002(1)	–2.825(1)	–2.539(1)	–2.202(1)

Source: own work based on Statistics Poland from 1999 to 2024.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; number of lags provided in parentheses

3.1 Simplified analysis

The results of the log-log regression estimation on grouped prices are presented in table 4. Staple goods such as pasta and groats, meat, dairy products, and fruit and vegetables experience negative price sensitivity indices, most likely due to forced

substitution toward cheaper calories under severe budget constraints. For those on the verge of poverty, an increase in the price of these products means they are replaced by cheaper calories. Goods such as fats, confectionery products, and fish have high price sensitivity indices ranging from 0.2 to 0.7. A heuristic approach would suggest considering whether they are more rigidly defined in the IPiSS subsistence basket than the others. Nevertheless, fats and confectionery products are cheap and very high-energy products, while fish contain many vitamins, so the IPiSS may simply not reduce them below a certain biological level. In turn, baked goods and other products such as cocoa, sugar, tea, coffee, and honey have price sensitivity indices of -0.275 and -0.153 , respectively. Baked goods are very easily substituted, but they do not constitute a major part of the diet, as do goods such as coffee, tea, and sweeteners. The intercept has no sensible economic interpretation, because all prices at once will never be equal to one. It only acts as a normalisation parameter.

Table 4.

Log-log regression results with individual categories.

Coefficients								
Baked goods	Pasta	Fats	Confectionery products	Fish	Fruit and vegetables	Dairy	Meats	Miscellaneous
-0.275 (0.198)	-0.114 (0.195)	0.056 (0.164)	0.584^{***} (0.152)	0.662^* (0.250)	0.148 (0.126)	0.148 (0.246)	0.275 (0.314)	-0.153 (0.152)
R^2			F			Std. error		
0.992			230.3 ^{***}			0.034		

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

Although Szwacka-Mokrzycka's income elasticities (2021) are measured differently, they provide a useful reference for comparison. Szwacka-Mokrzycka's work shows that between 2003 and 2019, baked goods achieved a price sensitivity index of 0.015 to 0.059, as opposed to 0.104 in the SM model, which may show that poorer people consume them more often. Cakes and bakery products achieved a price sensitivity index of 0.430 to 0.556, confectionery products from 0.302 to 0.670, and juices from 0.533 to 0.972. This suggests that in the classical sense, confectionery products for the average person are closer to luxury than for the poor (the price sensitivity index in the SM model is 0.272).

For the average Pole, fruit has an elasticity ranging from 0.416 to 0.546, while vegetables range from 0.070 to 0.157 (Szwacka-Mokrzycka, 2021). For those most impoverished, vegetables and fruit have a slightly negative price sensitivity. This value is close to zero, but still negative, highlighting the effect of substitutability with other, cheaper calories. Dairy and meat products achieved very different values, ranging from 0.053 to 0.670, which contrasts with price sensitivity indices of -0.227 and -0.286 , respectively. Meat and dairy products have high price volatility, and for those most impoverished, they are not essential products for survival, and as the price sensitivity index indicates, they are substitutable.

Every other value is consistent with Szwacka-Mokrzycka's results (2021), excluding pasta and groats, which were dispersed across other baskets than in this study.

3.2 Detailed analysis

In this part of the paper, each of the nine baskets was isolated, and then the price sensitivity indices of the products constituting the basket were calculated using the same method (log-log). These price sensitivity indices allow assessment of the quasi-substitution effect with respect to the products themselves. This is a quasi-substitution effect because it is not a substitution effect in the microeconomic sense, but rather it should be interpreted as decisions made by IPiSS experts "for" the poor. Price collinearity, which is a problem in most analyses, is an advantage here. This analysis examines which products will increase and which will decrease in quantity when the prices of the entire basket increase. Viewing the whole not as a classical economy, rather as a *survival economy*, this would be the effect of structural adaptation of consumption under an income constraint.

Table 5.

Log-log regression results in the baked goods category.

Variable	Coefficient	VIF
Roll	-0.616 (0.152) ***	6.3
Rye bread	0.407 (0.111) ***	21.6
Wheat-rye bread	0.160 (0.160)	29.9
Flour	0.126 (0.090)	3.8
R^2	F	Std. error
0.924	64.1***	0.031

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

In the isolated baked goods model (table 5), rolls achieved a price sensitivity index of -0.616, rye bread 0.407, wheat-rye bread 0.160, and flour 0.126. This would mean that as the prices of baked goods rise, those most impoverished are abandoning suboptimal bread rolls, especially in favour of cheaper and denser calorie bread, or even flour (to bake their own bread). The VIF for rolls, rye bread, wheat-rye bread, and flour is 6.3, 21.6, 29.9, and 3.8, respectively. Therefore, only flour can be considered as having an acceptable level of price collinearity. Price pressure is visible.

Table 6.

Log-log regression results in the pasta and groats category.

Variable	Coefficient	VIF
Egg pasta	0.202 (0.068)	1.9
Barley groats	0.589 (0.069) **	7.5

Variable	Coefficient	VIF
Buckwheat groats	0.016 (0.060) ***	7.1
Rice	−0.207 (0.051) ***	2.1
R^2	F	Std. error
0.940	81.9***	0.028

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

In the pasta and groats model (table 6), egg pasta achieved a price sensitivity index of 0.202, barley groats 0.589, buckwheat groats 0.016, and rice −0.207. Therefore, as the prices of these products increase, IPISS experts replace expensive and calorie-inefficient rice with slightly cheaper barley groats and pasta. The VIF for pasta, barley groats, buckwheat groats, and rice is 1.9, 7.5, 7.1, and 2.1, respectively. The high collinearity of both groats prices is a logical assumption.

Table 7.

Log-log regression results in the fats category.

Variable	Coefficient	VIF
Lard	0.079 (0.157)	7.9
Butter	0.274 (0.065) ***	2.2
Oil	−0.118 (0.089)	1.5
Fatback	0.251 (0.123) †	9.6
R^2	F	Std. error
0.871	35.5***	0.040

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

In the fat model (table 7), butter paradoxically achieved the highest price sensitivity index (0.274), followed by fatback (0.251). Lard comes in second (0.079), and finally, oil achieves negative price sensitivity index (−0.118). Therefore, the most expensive butter in this group is left in the basket, likely due to its health benefits, at the expense of unhealthy oil. Fatback appears to be an even cheaper alternative. The VIF for lard, butter, oil, and fatback are 7.9, 2.2, 1.5, and 9.6, respectively. Again, high price collinearity results from the fact that lard can be rendered from fatback, probably causing lard's price sensitivity index to be around zero.

Table 8.

Log-log regression results in the confectionery category.

Variable	Coefficient	VIF
Muesli	−1.292 (0.227) ***	3.6
Apple juice	−0.096 (0.148)	3.2

Variable	Coefficient	VIF
Multifruit juice	−0.078 (0.067)	1.8
Chocolate	−0.139 (0.209)	1.9
Jam	0.508 (0.258)	1.6
Yoghurt	−0.054 (0.199)	1.7
R^2	F	Std. error
0.871	21.3***	0.043

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

Confectionery products can indeed be considered a luxury (table 8). When it comes to increasing the overall price of confectionery products, muesli is the first to be abandoned (−1.292), followed by chocolate (−0.139). Other products, such as juices (price sensitivity index of −0.096 for apple juice, −0.078 for multi-fruit juice) and yogurt (−0.054), also achieve negative but low price sensitivity indices. Only jam (0.508) can serve as a necessity here – it offers a good compromise between the calories from sugar and the vitamins derived from fruits. The VIFs for muesli with fruit, apple juice, multi-fruit juice, chocolate, jam, and yogurt are 3.6, 3.2, 1.8, 1.9, 1.6, and 1.7, respectively. Therefore, none of the products in the confectionery products basket is sufficiently collinear to be rejected using classical econometrics.

Table 9.

Log-log regression results in the fish category.

Variable	Coefficient	VIF
Carp	0,030 (0.058)	1.8
Hake	0,400 (0.058) ***	1.6
Mackerel	0,443 (0.090) ***	1.6
R^2	F	Std. error
0.894	62.0***	0.036

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in parentheses

In the case of fish (table 9), this is the only group with only positive price sensitivity indices. Mackerel and hake dominate, with elasticities of 0.443 and 0.400, respectively, followed by carp with price sensitivity of 0.030. Carp is likely an occasional product and is not part of the subsistence basket, as consumption of carp is most often restricted to Christmas in Polish culture. Fish is relatively cheaper than other meats, which is likely why hake and mackerel achieve such results. The VIFs for carp, hake, and mackerel are 1.8, 1.6, and 1.6, respectively, which is an interesting result confirming the nonlinearity of their prices. These types of fish have different nutritional profiles, as mackerel is an oily marine fish rich in Omega-3, hake is a lean, easily digestible marine species with protein, and carp is

a freshwater fish with a slightly higher fat content, which likely accounts for the nonlinearity of their prices.

Table 10.

Log-log regression results in the fruit and vegetables category.

Variable	Coefficient	VIF
Carrots and peas mix	-0.041 (0.038)	1.5
Strawberries	0.393 (0.155) **	1.5
R^2	F	Std. error
0.348	6.1**	0.087

Source: own work.

Notes: *** p<0.001, ** p<0.01, * p<0.05, † p<0.10; standard errors provided in parentheses

The fruit and vegetables basket (table 10) contains only two products – pea and carrot mix with a price sensitivity index of -0.041 and strawberries with a price sensitivity index of 0.393. It is difficult to analyse the effect of structural adaptation due to the small number of prices analysed. The carrot and pea mix and strawberries achieve the same VIF (1.5). A far-reaching, yet logically consistent, conclusion may be that pea and carrot mix is of lower quality than strawberries.

Table 11.

Log-log regression results in the dairy category.

Variable	Coefficient	VIF
Milk	-0.280 (0.235)	3.2
Eggs	0.366 (0.135) **	6.1
Cream	0.001 (0.345)	5.6
Cottage cheese	0.623 (0.257) **	3.3
Cheese	-0.062 (0.153)	1.7
R^2	F	Std. error
0.872	27.1***	0.041

Source: own work.

Notes: *** p<0.001, ** p<0.01, * p<0.05, † p<0.10; standard errors provided in parentheses

In the case of dairy products (table 11), the most impoverished consumers first give up milk (-0.280), followed by cheese (-0.062). As dairy prices rise, they are forced to switch to cottage cheese (0.623) and eggs (0.366). Only cream exhibits an almost zero price sensitivity index (0.001), thus probably it is not included in the IPISS subsistence basket. This theory is supported by the fact that cream is not crucial to survival. In this group, eggs have the highest VIF of 6.1, followed by cream with 5.6, cottage cheese with 3.3, milk with 3.2, and finally ripened cheese with a VIF of 1.7.

Table 12.

Log-log regression results in the meats category.

Variable	Coefficient	VIF
Pork shoulder	−0.102 (0.087)	8.9
Beef	−0.035 (0.095)	45.7
Ham	0.029 (0.447)	83.8
Dry sausage	−1.330 (0.345) **	19.1
Smoked sausage	−0.621 (0.291) †	64.5
Smoked bacon	0.249 (0.370)	55.3
Raw bacon	0.306 (0.250)	194.0
Chicken tenderloin	0.727 (0.412)	87.7
Headcheese	−0.252 (0.246)	208.0
Kishka	0.812 (0.244) **	294.0
Tinned meat	0.236 (0.151)	30.0
Chicken	−0.086 (0.074)	3.3
R²	F	Std. error
0.986	74.5***	0.017

Source: own work.

Notes: *** p<0.001, ** p<0.01, * p<0.05, † p<0.10; standard errors provided in parentheses

The largest group is the meat basket (table 12). As cold cuts become more expensive, the most impoverished consumers forgo dry and smoked sausages (price sensitivity index −1.330 and −0.621, respectively). They also forgo headcheese (−0.252), pork shoulder (−0.102), and, most interestingly, chicken (−0.086). Beef has the lowest price sensitivity index, closest to zero (−0.035), but this a very expensive meat not essential to survival, so it is most likely not included in the basket at all. The most impoverished consumers replace meats with very cheap kishka (0.812), and whole chicken with chicken tenderloin (0.727). Both products are much cheaper than the alternatives and are still high in fat and protein. Other meats are replaced with raw and smoked bacon (0.306 and 0.249, respectively). Unfortunately, tinned meat (reaching a price sensitivity index of 0.236) can be a good and inexpensive substitute, though not necessarily healthy. Finally, like beef, pork ham (0.029), is most likely not included in the real basket. This is the group with the highest VIFs - chicken has a VIF of 3.3, and pork shoulder has a VIF of 8.9. Dry sausage has a VIF of 19.1, tinned meat has a VIF of 30.0, raw bacon has a VIF of 55.3, smoked sausage has a VIF of 64.5, ham has a VIF of 83.8, smoked bacon has a VIF of 194.0, headcheese has a VIF of 208.0, and kishka has a VIF of 294.0. This is to be expected, as most of these products come from two animals, and their prices are strongly collinear.

Table 13.*Log-log regression results in the miscellaneous category.*

Variable	Coefficient	VIF
Sugar	0.022 (0.036)	1.4
Honey	0.305 (0.124) *	6.1
Coffee	-0.007 (0.052)	3.1
Tea	0.089 (0.043) †	5.5
Cocoa	0.163 (0.065) *	5.6
R^2	F	Std. error
0.922	47.5***	0.032

Source: own work.

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$; standard errors provided in the parentheses

Finally, price sensitivity for the basket of remaining products (table 13) – sugar (0.022), tea (0.089), and coffee (-0.007) is rigid. They are most likely not included in the IPiSS SM basket or are a ritual that those most impoverished cannot forego. Only cocoa (0.163) and honey (0.305) have interpretable values. Honey contains many nutrients and vitamins and may be a better substitute for sugar. The value of cocoa is difficult to understand – if SM were analysed for the entire family, a far-reaching theory could be advanced, in which cocoa would function as a *stimulant* for children, like chocolate or other confectionery products. This should be verified in a separate study. Sugar has a VIF of 1.4, honey has a VIF of 6.1, coffee has a VIF of 3.1, tea has a VIF of 5.5, and cocoa has a VIF of 5.6. The pricing pressure resulting from collinearity is small, but visible here.

The results should be interpreted heuristically and with great caution. As mentioned earlier, the SM is a normative measure, not the preferences of those most impoverished. Most likely, the significance of individual products can be interpreted as empirical evidence of their impact on the SM and, at the same time, their existence in the basket of goods established by the IPiSS. At a 5% significance level, the basket of goods includes products such as rolls, rye bread, barley and rye groats, rice, butter, bacon, muesli, hake, mackerel, strawberries, eggs, cottage cheese, dry sausage, smoked sausage, kishka, chicken tenderloin, honey, and cocoa.

3.3 ElasticNet analysis

In ElasticNet, the estimated coefficients are not classical demand elasticities, but indices describing the sensitivity of the subsistence basket's cost to changes in the prices of selected goods. Using the ElasticNet method leads to the identification of prices that represent the main price dynamics in the basket, rather than the goods with the highest weight share. The absence of other, products not discussed does not mean that they are unnecessary for survival, but that the prices behave similarly to other prices in the basket. Their value is completely irrelevant to the analysis, unlike the fact whether the algorithm left the variable or removed it from the model.

Interestingly, some nutritionally less important products appear as strong predictors, reflecting price dynamics rather than dietary importance. The algorithm chose to retain muesli, butter, headcheese, kishka, carp, hake, cream, sugar, jam, cottage cheese, and ripened cheese. These results should not be interpreted as the most important for survival, but rather as those with prices that best explain changes in the basket cost. This analysis aims to explore price pressure points, i.e., to identify where price increases most quickly impact the subsistence level.

Of the 45 food products analysed, the model indicated eleven with non-zero coefficients. This means that less than one quarter of the products, or rather their price dynamics, provide independent predictive information about changes in the total basket cost. Previous simple quasi-substitution analyses showed how price changes for certain products may influence basket choices. ElasticNet complements this exploration by identifying products whose prices contribute independent information about the overall basket cost. Products *zeroed* by the algorithm have prices strongly correlated with others and do not contribute additional information, so they can be treated as price-redundant in the context of subsistence analysis. This approach enables the identification of price pressure points in exploratory work.

4. Final conclusions

4.1 Conclusions

Several methodological features of this study may seem unconventional compared to classical econometric standards, including price multicollinearity. However, these features are a direct consequence of the research objective and the nature of the analysed construct.

In both parts of the analysis, the dependence of SM on prices should be interpreted not as a function of the demand of an individual, but as a way in which external experts adjust the minimum subsistence basket to changes in prices and the structure of goods, which is supposed to reflect the most basic needs of those most impoverished, such as the demand for high-calorie meals and vitamins and other minerals. Thus, a simplified analysis by basket shows deviations from traditional price sensitivity indices or elasticities. They indicate that in the SM, basic food goods may act as a substitution cost buffer, while fats, confectionery products and fish are relatively rigid biologically and cost-wise. The percentage of people living under the SM line has never exceeded 25% (IPiSS, n.d.), and Dudek's research (2011) confirms that elasticities for food products can be negative already in the third income quartile of people, so the negative price sensitivity indices in this study are not an anomaly.

A simplified analysis makes it possible to deduce which areas of food products are most substitutable, while a detailed analysis makes it possible to deduce where the quasi-substitution effect occurs among products of the same category. The negative price sensitivity indices of butter and oil, together with the positive price sensitivity index of lard and fatback, indicate a quasi-substitution effect in the fat

group, and thus an increase in the price of butter or oil encourages consumers to reach for cheaper fatback in the minimum subsistence basket more often. The price sensitivity indices of meat products and cold cuts show a clear division between easily substituted and fixed goods in the subsistence basket. Dry and smoked sausages and headcheese exhibit large negative price sensitivity indices, indicating a quasi-substitution effect towards cheaper products. Poultry tenderloin, kishka, and smoked and raw bacon have high positive price sensitivity indices, reflecting their fixed and indispensable role in the basket – likely due to their cheapness, nutritional value, and caloric content.

The study, however, draws not only heuristic but primarily empirical conclusions. The basket of SM goods is influenced by the prices of rye bread (as opposed to wheat-rye bread), all types of groats and rice, but not pasta. Fatback and butter also have an impact, as do oil or lard. Muesli is the only confectionery product that is significant in the models, similar to strawberries in the context of plant-based products. Eggs and dairy products are also the only ones significant in the dairy category, and are declared to be healthier than other products. The same applies to honey and cocoa, and, in the context of meats, to kishka or sausage. All these products have a relatively low price compared to their calorie content. The empirical conclusions will therefore concern the types of products included in the basket, while the *survival economics* mechanism is a more complex concept, which this paper was intended to only outline.

4.2 Discussion

This study proposes term *survival economics* to describe observed mechanism of quasi-substitutions. Although this effect should legitimately be examined using real budget data from those most impoverished, this work was primarily intended to address this concept. Those most impoverished eliminate instead of substituting, so negative price sensitivity indices cannot be interpreted as preferences, but rather as pushing products out of the basket. This work shows that calories are the most protected overall. Fats, confectionery products, low-quality meats like offal, and bread are sources of cheap, very calorie-dense energy, followed by the rest, the goods that are first to be *thrown away* – higher quality meat, dairy products, fish, flour and groats, and even vegetables and fruits. Such behaviour cannot be fully explained by classical rational-choice frameworks, as classicists assume, nor is it a behavioural response, as behaviourists would assume – survival economics is something insufficiently researched and overlooked, yet it is an important area in the life of society as a whole.

The above analysis might trigger reflection on the following questions:

1. Is quasi-substitution economically rational, or perhaps structurally forced? – it is difficult to determine whether the consumption decisions of those most impoverished are still choices or merely defensive reactions to prices.
2. Is the negative price sensitivity index of basic goods a signal of hidden deprivation? – in the case of those most impoverished, this may indicate a real decline in dietary quality, which is not visible in nominal measures of the minimum.

3. Should social policy address price sensitivity indices, not just price levels? Or, to put it another way, should public support be directed where price sensitivity indices are most negative?

Finally, the question remains whether *luxury* in the SM is losing its classical meaning. In my opinion, products with a price sensitivity index greater than one are not luxuries in the sense of utility. The paradox is that for those most impoverished, price sensitivity indices (referred to as elasticities) less than -1 may indicate a luxury product. Survival economics would assume that when prices rise, luxuries should be foregone as quickly as possible. This challenges the classical definition of luxury goods or at least forces a redefinition.

Question 1 remains to be answered in future, more complex studies, similarly to question 2. However, to answer question 3, i.e., where to direct aid to those most impoverished, it is sufficient to address the issue of subsidies. For example, for products that are pushed out of the basket, personalised vouchers could be created for people below a certain income. These vouchers could be redeemed at any store. The store would then reclaim from the government. Their main goal would be to ensure a minimum basic diet even with a significant decline in purchasing power. This would act as a frozen fixed value, expressed in product units rather than in currency. Of course, this system should not be confused with the rationing of goods in the Polish People's Republic. The vouchers would serve as a guaranteed minimum, with consumers covering the remainder from their own funds. They would be distributed to a definable group of those most impoverished, not to all citizens, and the personalised nature of the vouchers would prevent trade, where they would receive, for example, stimulants in return. However, introducing this system will be much more difficult – it would be easier to give cash directly from transfers, which will not be used properly.

This work is more socio-exploratory in nature than econometric. The results may be useful for institutions monitoring the evolution of SM costs by identifying product groups that act as early indicators of price pressure. To draw full conclusions about price pressures, future research must focus on the results of budget surveys of those most impoverished to better estimate the scale and level of the effect of *survival economics*. Johansen or Gregory-Hansen tests to prove cointegration between baskets, and the Toda-Yamamoto test for non-stationary data are the next steps in this area if this is to evolve into a fully-fledged econometric analysis. However, I believe the most important step would be to fully recreate the food basket developed by the IPiSS to model a regression equation based on it, or at least conduct a sensitivity analysis through manual experiments with the weights of food items in the basket.

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