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COMPLEMENTING THE SAPI METHODOLOGY

This paper extends the SAPI (Subsistence-Adjusted Price Index) methodology by formally testing its statistical relationship with the Consumer Price Index (CPI) over the period 1994–2024. Using data reconstructed from IPISS and Statistics Poland, the study applies structural break tests (Bai–Perron and Chow), Johansen cointegration analysis with break dummies, and a Vector Error Correction Model (VECM) to examine both long-run and short-run dynamics. The results identify multiple structural breaks (1996, 2000, 2006, and 2021), confirming the importance of methodological and macroeconomic shifts in shaping both indices. Cointegration analysis reveals a stable long-run relationship between SAPI and CPI, with faster adjustment toward equilibrium observed for SAPI. Short-run dynamics indicate one-sided Granger causality running from SAPI to CPI, suggesting that changes in subsistence costs precede and influence inflation, while the reverse effect is not statistically significant. Additionally, SAPI exhibits short-term autoregressive behavior, unlike CPI. These findings support the interpretation of SAPI as a complementary indicator to CPI, capturing price dynamics relevant to low-income households and offering additional insight into inflationary processes. The results provide a foundation for further development and validation of SAPI as a policy-relevant measure of cost-of-living pressures.

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Introduction

SAPI is a simple index that measures changes in the subsistence minimum in Poland and complements the CPI (Łuczka, 2025). It was created as a response to the lack of a single poverty indicator in Poland. The purpose of this paper is to enable continued development of this indicator, completing the necessary tests to distinguish it from the CPI. In response to the author's suggestions, I present the results of tests for structural break, cointegration, and causality with the CPI. For the years 1994-2024, SAPI was reconstructed using IPiSS data (1993-2024) and Łuczka's methodology (2025), as shown in Table 1.

Table 1. SAPI rounded to one decimal place.

1994	1995	1996	1997	1998	1999	2000	
43.4%	29.8%	17.7%	17.9%	19.7%	10.2%	11.4%	
2001	2002	2003	2004	2005	2006	2007	2008
7.5%	4.6%	1.0%	4.6%	3.8%	-3.2%	3.6%	7.0%
2009	2010	2011	2012	2013	2014	2015	2016
7.8%	6.2%	5.9%	4.1%	4.0%	0.4%	0.3%	1.7%
2017	2018	2019	2020	2021	2022	2023	2024
3.4%	3.0%	4.3%	-0.3%	0.4%	25.6%	16.2%	5.4%

Source: own work based on IPiSS (1995-2025) and Łuczka (2025).

For the same years, CPI data were obtained from Statistics Poland, as shown in Table 2.

Table 2. Inflation rounded to one decimal place.

1994	1995	1996	1997	1998	1999	2000	
32.2%	27.8%	19.9%	14.9%	11.8%	7.3%	10.1%	
2001	2002	2003	2004	2005	2006	2007	2008
5.5%	1.9%	0.8%	3.5%	2.1%	1.0%	2.5%	4.2%
2009	2010	2011	2012	2013	2014	2015	2016
3.5%	2.6%	4.3%	3.7%	0.9%	0.0%	-0.9%	-0.6%
2017	2018	2019	2020	2021	2022	2023	2024
2.0%	1.6%	2.3%	3.4%	5.1%	14.4%	11.4%	3.6%

Source: Statistics Poland (n.d.).

Methods

The analysis involved testing for structural breaks in the SAPI and CPI data using the Bai-Perron and Chow tests to identify and confirm significant structural breaks, including the 2006 changes to the subsistence minimum calculation methodology (Deniszczuk et al., 2007). The Johansen cointegration test with a dummy break test was then applied, which demonstrated the existence of a single cointegrating relationship between the SAPI and CPI. To examine short-run causality, a VECM model was used, in which the lagged coefficients $\Delta SAPI$ and ΔCPI were used to assess the direction and significance of interactions between variables, and the α coefficients indicated the speed of return to long-run equilibrium.

Results

For all tests, the model was assumed to be intercept-based, without trend. The Bai-Perron test (with a minimum window of 10%) detected three structural breaks in the SAPI and CPI (assessed using the BIC criterion) in 1996, 2000, and 2021. For both the CPI and SAPI, the Chow test confirms breaks in 1996 and 2000 (both $p < 0.0001$). For 2021, both are rejected ($p_{SAPI} \approx 0.205$ and $p_{CPI} \approx 0.468$). To ensure that a structural break also occurred in 2006 (Deniszczuk et al., 2007), a test was performed for the SAPI at that

time; the test showed $p \approx 0.041$, indicating that a structural break also exists. The Johansen 4-dummy test for each break confirms that at a 5% significance level, there is exactly one cointegrating relation:

$$SAPI - 0.401CPI - 14.751 \approx 0$$

The SAPI adjustment coefficient is approximately -1.765 , and the CPI approximately -0.869 , meaning that the SAPI returns to equilibrium more quickly, and the cointegration strength is $\lambda \approx 0.8357$. The test was conducted with 2 lags (selected using the BIC criterion). To confirm causality, a VECM model was analysed. In the short-run equation for CPI, a statistically significant coefficient on the lagged SAPI difference ($\Delta SAPI_{t-1}$: $\beta \approx 0.320$, $t \approx 3.040$, $p \approx 0.006$) indicates the existence of one-sided short-run Granger causality from the SAPI to the CPI. The lack of significance of the CPI self-lag (ΔCPI_{t-1} : $\beta \approx -0.025$, $t \approx -0.103$, $p \approx 0.919$) indicates a lack of short-term self-causality. In the short-run equation for SAPI, the significance of the SAPI self-lag ($\Delta SAPI_{t-1}$: $\beta \approx 0.487$, $t \approx 2.460$, $p \approx 0.022$) indicates an autoregressive, short-term self-causality. A statistically insignificant coefficient on the lagged CPI difference (ΔCPI_{t-1} : $\beta \approx -0.224$, $t \approx 0.455$, $p \approx 0.627$) indicates that there is no one-sided short-run Granger causality from the CPI to the SAPI.

Conclusions

The analysis indicates that the percentage change in the subsistence cost (SAPI) and inflation (CPI) are related in the long run – there is a single cointegrating relationship, with the SAPI returning to equilibrium more quickly than the CPI. In the short run, one-sided causality is observed: changes in the SAPI significantly affect inflation (CPI), while the reverse is not significant. Furthermore, the SAPI exhibits autoregressive behaviour in the short run, while the CPI does not exhibit self-correlation. Structural breakpoints in 1996, 2000, 2006, and 2021 had a significant impact on both variables, underscoring the importance of structural breaks for changes in subsistence costs and inflation. An increase in the subsistence cost triggers a short-term increase in inflation, while inflation itself does not immediately affect the subsistence level. The long-run relationship indicates that both indicators tend toward equilibrium, with the cost of living responding more quickly than overall prices. Fluctuations in breakthrough economic events have a clear impact on both indicators, underscoring their sensitivity to social policy and external factors. The above results should be treated as a basis for further research on SAPI.

AI use declaration

This work does not use artificial intelligence at any stage.

Conflict of interests

The author is the editor-in-chief of the journal but has undergone a full peer review process from two independent reviewers in the now defunct journal *Economics Communications*.

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