Economia agro-alimentare /
Food Economy
An International Journal on Agricultural and Food Systems
Vol. 27, Iss. 3, Art. 16, pp. 511-537 - ISSNe 1972-4802
DOI: 10.3280/ecag2025oa20221

Economic crises and organic food consumption: A Danish perspective

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Abstract

The study aims to analyze the impact of the global economic crisis in 2008 and the COVID-19 crisis in 2020 on the consumption of organic food in Denmark, one of the largest markets for organic food in Europe. The Error Correction Model (ECM) has been implemented, with modifications applying the Markov Regime Switching (MRS) methodology to integrate breakpoint analysis. It has been confirmed a statistically significant dependency of organic food consumption on disposable income during both crisis and non-crisis periods. As the identified effect is positive during non-crisis periods and negative during crises, it has been confirmed that organic food consumption significantly increases when disposable income decreases during a crisis. The use of the Error Correction Model (ECM) with modifications incorporating the Markov Regime Switching (MRS) methodology allows the integration of breakpoint analysis and provides a more realistic description of the evolution of the variables under study. The study is designed to explore overall attitudes towards consumption and aims to measure the influence of disposable income on organic food consumption. It also seeks to analyze how this impact evolved over time and during the aforementioned crises.

Article info

Type:
Article
Submitted:
20/05/2025
Accepted:
06/11/2025
Available online:
01/12/2025

JEL codes:
D12, L66

Keywords:
Consumer behavior
Organic food
Organic food consumption
Disposable income
Economic crisis
Crisis period
Non-crisis period

Managing Editor:
Luca Cacciolatti

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Introduction

Organic food is an issue that has become a subject of academic interest from an economic perspective as a logical consequence of its growing importance at the turn of the 20th and 21st centuries. Traditionally, it has been defined as the output of alternative agricultural production characterized by sustainability and by the absence of synthetic chemicals and genetically modified structures (Campos *et al.*, 2024). However, various legislations place stricter demands on organic food. In the context of European Union law, there is much more scope beyond the original definition of organic food. Producers wishing to obtain the certified organic food producer label must respect natural biological systems and implement sustainable management systems that respect natural resources and observe animal welfare standards (Sujanska & Nadanyiova, 2023).

Although European Union legislation is uniform, the EU market displays marked regional disparities in terms of organic farming development. Recent evidence underscores both the maturity and resilience of Denmark's organic market and the broader European context. Denmark remains a global leader by retail market share; official statistics report DKK 16.0 bn in retail turnover for organic foods in 2024, and industry syntheses report a 11.8% retail market share (value) in 2023, with signs of recovery into 2024 (Statistics Denmark, 2025; Organic Denmark, 2024). According to Eurostat (2023), Austria and Estonia record the highest proportions of organic farmland (more than 20% of their utilized agricultural area), while countries such as Bulgaria, Malta and Ireland maintain comparatively lower shares, below 5%. These differences reflect variations in national agricultural structures, consumer demand, and policy support. One of the sources of these disparities is the reluctant attitude of producers, who argue for a higher price level for organic food and fear competitive disqualification in national markets (Jankalova & Vartiak, 2017; Maasz *et al.*, 2024). It is precisely the short-termism of economic thinking that is identified by Staton *et al.* (2024) as a clear barrier to the development of the organic food market.

An important objective of national policies is to mitigate the regional disparities identified within the European Union. The new Common Agricultural Policy for 2023-2027 (European Commission, 2022) and the European Green Deal's "Farm to Fork" strategy aim to reduce such disparities by supporting a target of 25% of EU farmland under organic management by 2030. Direct payments, eco-schemes, and rural development funds provide financial incentives for conversion to and maintenance of organic practices, reinforcing market development across member states.

At the EU level, the EU Agricultural Outlook 2024-2035 highlights a sector adapting to climate and demand shifts, and projects continued

structural changes in consumption, with policy baselines relevant to organics (European Commission, DG AGRI, 2024). Complementing this, a USDA/FAS market brief documents a 10.5% increase in EU organic sales in 2023, after the 2022 downturn, and anticipates modest growth in 2024-2025, noting strong per-capita spending in countries (von Witzke *et al.*, 2025). Regarding crisis dynamics and consumer behavior, systematic reviews of COVID-19 era consumption report shifts toward products perceived as healthier and more sustainable (Cramarenco, 2023).

The aim of this paper is to identify the relationship between disposable income and organic food consumption. The results will be used as an argument in favor of an active policy by the European Union and its individual Member States aimed at levelling out the significant regional disparities in the development of organic food markets. The generalization of the conclusions thus proposed will be possible by referring to the conclusions of the research carried out by First and Brozina (2009) on the impact of cultural dimensions on organic food consumption. There, it was identified that cultural dimensions have only a partial influence on organic food consumption, and even then only in the case of the dimensions of individuality and assertiveness.

The conclusions of the research will also be useful in the practice of pricing policy of entities implementing their business activities on the organic food market. The knowledge of the influence of disposable income on the consumption of organic food is the basis for the implementation of a functional pricing policy based on reference price limits strictly defining the organic nature of food as a source of consumers' subjectively perceived value of the product and, by analogy, a competitive advantage. This is because previous research has strictly preferred a consumer-oriented approach and has lacked a macroeconomic conception of the issue, which would address the dilemma of the mechanisms of consumer-perceived and consumer-implemented purchasing behavior in the area under study.

1. Background

Pant *et al.* (2024) report, based on a content analysis of 783 papers published between 1991 and 2002 and contained in the Scopus database, that current themes in the field of organic food and its consumption are purchase motives, health consciousness, value schemas, theory of planned behavior, green marketing and environmental concerns. While individualistic motives such as improving individual health and quality of life dominated early research on this topic (Sampaio *et al.*, 2013), current trends suggest a significant shift towards altruistic motives related to sustainable principles

of organic food consumption (Buil & Mata, 2024; Martini *et al*., 2024). It is true that the same mechanism is also present with respect to the economic development of countries. In this case, individualistic motives are dominant in less developed economies, while there is also a substantial shift towards altruistic motives of organic food consumption as national economies develop (Anand *et al*., 2024). Ergonul and Ergonul (2015) stated that organic food is perceived by consumers as an expensive product whose quality parameters do not match the set price. These findings are corroborated by Dangi *et al.* (2020) who identify price as one of the key factors in purchase decision making in relation to organic food. However, these authors also point out that the importance of each factor varies depending on the development of the economy and the level of average income in that country. In the context of Lebanon's developing economy, Tleis *et al.* (2019) research identifying the key values of organic food consumption. Quality of life, enjoyment and peace of mind were identified by them. At the same time, purchase motives were found to vary in the context of consumption frequency. Frequent consumers of organic food were more concerned about the health of their family and the environment, but occasional consumers preferred their own pleasure and perceived organic food as a traditional product with nostalgic added value. Exploring the regional specificities of consumer perceptions of organic food is an important component of current scientific research in this area. Petrescu *et al.* (2017) found that in Romania, individual consumer affinity towards sustainable lifestyles is an important determinant of organic food consumption. Paradoxically, the status element of consumption was not identified. This means that the propensity to consume was not reinforced by the prospective acquisition of the status of so-called organic consumer. Similar conclusions are reached by Azzurra *et al.* (2019), according to whom environmentally conscious consumers tend to consume organic food to a greater extent, while the consumption of organic food alone does not evoke a more intense consumer contact with environmental issues and their active participation in their solution. Thus, in the context of the broader socio-economic context, it can be concluded that the consumption of organic food is a real manifestation of the existence of pro-environmentally oriented consumer values, while the consumption of organic food itself is not a prerequisite for the subsequent more intense presence of sustainability in consumer and civic behavior.

The above points in favor of examining organic food consumption not with a one-size-fits-all approach, but across different consumer groups. Such an approach has already been suggested by Baranauskas *et al.* (2015), who investigated organic food consumption in the case of athletes in Lithuania. However, their research only declares the positive impact of consumption on consumers' health, thus verifying one of the commonly used arguments in favor of purchasing this food category. Gustavsen and Hegnes (2020)

investigated the relationship between consumer personality type and propensity to consume organic food. Among other things, they found that consumers with high levels of conscientiousness as a personality trait are less willing to pay a higher price for organic food than for its non-organic alternatives. Chekima *et al.* (2017), however, draw attention to the fact that research oriented to ascertain consumer motives for buying organic food is biased by the recurrent phenomenon of respondent's insincerity towards themselves. Under the influence of this phenomenon, consumers answer as they think they should in order not to damage their self-image, but in a situation leading to a real purchase decision, completely different factors are relevant than those identified in motivation-oriented research. One of these factors is price (Sica & Franco, 2024). Bryla (2016) clearly describes the importance of price in the purchase decision of organic food in research conducted on Polish consumers. In their case, he states that the obstacle to the development of the organic food market is precisely its high price.

Kis *et al.* (2023) in the Hungarian context find that in the period confronted with the economic consequences of the COVID-19 pandemic (years 2020-2021), paradoxically, the consumption of organic food is increasing despite the decrease in the disposable income of the population. This finding can be justified by the attitudinal change of consumers related to the appeal of healthy lifestyles and health protection (Shenoy *et al.*, 2024). Such a post-COVID shift towards preference of healthier alimentation has been identified on the case study of honey consumption also by Murmura *et al.* (2024). However, Rutelione and Bhutto (2024) find that price does not have a significant impact on consumer's purchase decision in favor of organic food. On the other hand, however, they find the influence of the quality of organic food to be substantial. At the same time, however, they set boundaries on the applicability of these findings by considering the gender, education, age and income of the consumer. It is precisely in the case of consumers from higher income categories that the irrelevance of the price of organic food in the context of consumer purchasing decisions is valid. Barua *et al.* (2023), however, suggest that there is a relationship between income level and the extent of environmental awareness, and thus that the irrelevance of the financial aspect of buying organic food is related to the inherent positive affinity of consumers from higher income brackets towards socially responsible issues and sustainable consumption. Watanabe *et al.* (2023) find that consumers are generally willing to pay 5 to 10% more for organic food, with disposable income and organic label being significant predictors of their willingness to pay more. Guney and Giraldo (2019) do not generalize their research and focus on specific organic products. Using the example of organic eggs, they declare that Turkish consumers are willing to pay 0.76 monetary units more per egg if it is organic.

Disposable income, defined as the income available to individuals after taxes and other deductions, is a fundamental factor influencing consumer behavior. It determines the purchasing power of consumers. In the context of organic food, which is typically priced higher than conventional food, disposable income may play a vital role. From this perspective, consumers with higher disposable income possess the financial flexibility to opt for organic food despite its elevated cost. This viewpoint is corroborated by several studies (Mazur-Wlodarczyk *et al.*, 2024; Johansson *et al.*, 2014; Kuhar and Juvancic, 2005; Millock *et al.*, 2004). Conversely, it is frequently argued that disposable income is not a significant factor, as health consciousness and environmental awareness play more crucial roles in the organic food market (Azzurra *et al.*, 2018; Aschemann-Witzel and Zielke, 2015).

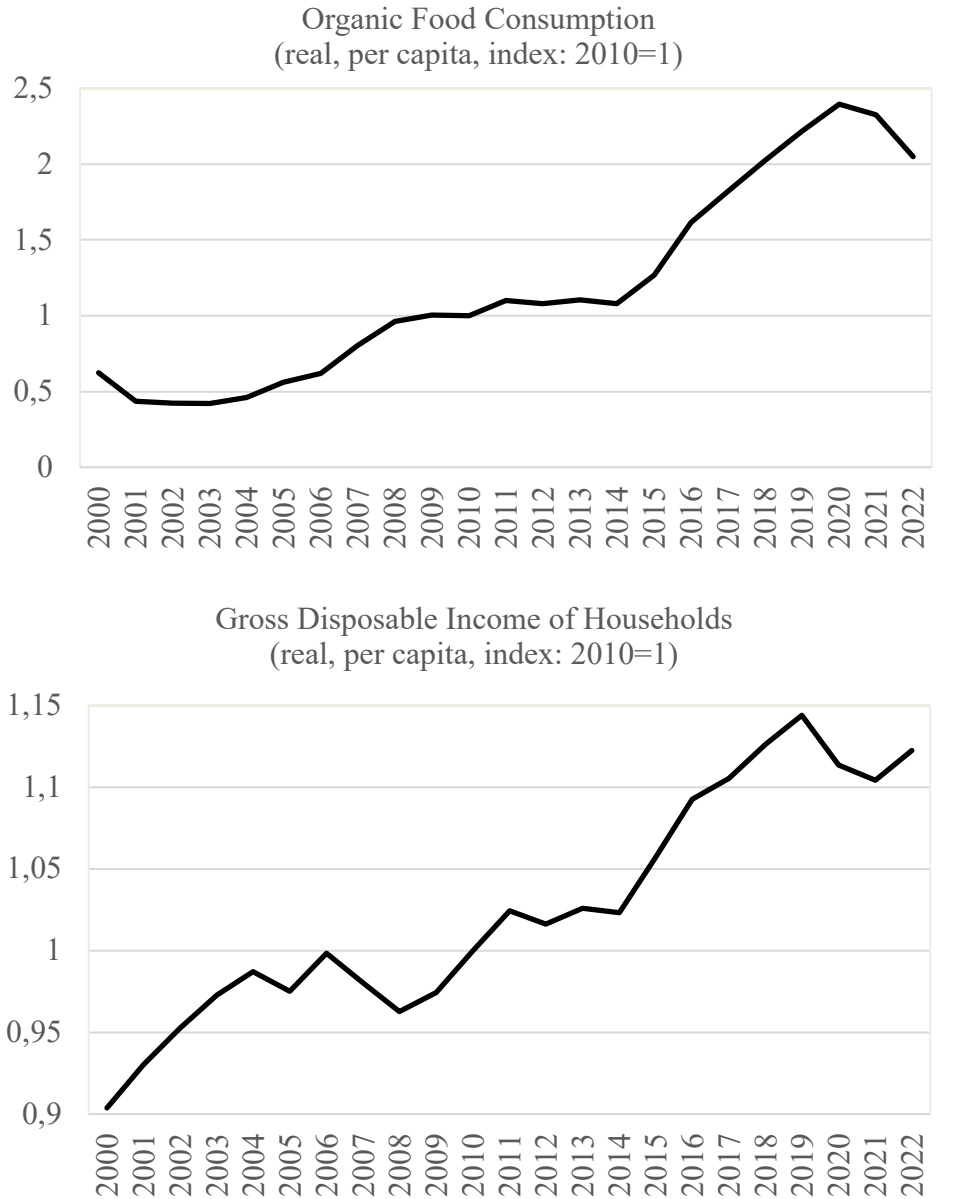
Therefore, the primary objective of this paper is to elucidate these contrasting attitudes by investigating the research question of how significant a factor disposable income is in the organic food markets. While the majority of empirical literature concentrates on microeconomic data, our research adopts a macroeconomic perspective, thereby contributing to the existing literature by applying a different viewpoint on this topic. The secondary research question explores how the relationship between organic food consumption and disposable income is influenced by severe economic crises.

2. Materials and methods

Data on total organic food consumption per capita in Denmark were sourced from the FiBL database, a research institute dealing with organic food at a European and global scale (https://statistics.fibl.org/). Real gross disposable income per capita was obtained from the Eurostat database (https://ec.europa.eu/). The time series of modelled variables for real organic food consumption per capita and real gross disposable income per capita were tested for stationarity using Perron's (1989) test designed for time series with a breakpoint, where the breakpoint was not fixed but detected by Perron's test. The development of the time series indicating a breakpoint during the onset of the global economic crisis in 2008 and in 2020 in connection with measures against the spread of COVID-19 is shown in the Figure 1.

The error correction model will be formulated in the logarithms of variables and in the absolute differences of the logarithmic values. Perron's test results of stationarity for the time series are therefore expressed for the logarithmic variables and their first differences. For the original variables, Perron's test used a trend and level constant, and for the differentiated data,

Figure 1 - Development of the time series indicating breakpoints in the years 2008 and 2020



Source: Authors' own calculations.

only a level constant was used in the test. The null hypothesis is always that the respective time series contains a unit root. The results are summarized in Table 1.

Table 1 - Results of the Perron stationarity test with a breakpoint in the time series

Perron stationarity test		**Logarithm of Real Consumption of Organic Food (per capita)**	**Logarithm of Real Disposable Income (per capita)**
Undifferenced Data	Test Statistic	–3.600	–3.954
	P-value	0.629	0.400
First Difference of the Variables	Test Statistic	–4.929	–5.195
	P-value	0.011	<0.01

Source: Authors' own calculations.

The results in the table show that in all cases the undifferentiated data are non-stationary and also that their transformation using 1st differences has already ensured their stationarity. For this reason, an error correction model was chosen to model the dependence between the consumption of organic food and disposable income, both with the aim of eliminating the problem of spurious regression in non-stationary time series and for the purpose of describing both the long-term equilibrium relationship between the mentioned quantities and the short-term dynamics.

The formulated error correction model is not, however, econometrically estimated using the standard two-phase Engle, Granger (1987) method. The chosen methodology of the error correction model is modified and the assumption of time-invariant coefficients is replaced by parameters changing over time, using Hamilton's (1989) methodology of Markov Regime Switching (MRS) models. Abandoning the assumption of time-invariant coefficients allows for a much more realistic description of the development of modelled variables within the examined time interval 2000-2022, during which both the global economic crisis in 2008 and the crisis in 2020 caused by measures to prevent the spread of COVID-19 occurred. However, since the standard error correction model with constant parameters is the initial modelling framework that is subsequently modified, this standard model will first be briefly summarized and then the specific way of its modification will be shown.

Standard error correction model

The econometric estimate of the long-term equilibrium relationship between the consumption of organic food and disposable income is realized in the original Engle-Granger (1987) methodology on (undifferentiated) non-stationary time series using the Ordinary Least Squares (OLS) method in the classical linear regression model:

$$\ln(C_t) = \alpha_0 + \alpha_1 \cdot \ln(Y_t) + u_t, \tag{1}$$

where C_t denotes real organic food consumption per capita,
Y_t represents real disposable income per capita,
u_t is random error with white noise properties.

Because the time series $\ln(C_t)$ and $\ln(Y_t)$ are non-stationary, there is a problem of spurious regression in this econometric estimation of parameters. However, it is possible to use the OLS estimates of the parameters $\hat{\alpha}$ and $\hat{\beta}$ for the purpose of estimating the deviation from long-term equilibrium $\hat{u}_t$:

$$\hat{u}_t = \ln(C_t) - \hat{\alpha}_0 - \hat{\alpha}_1 \cdot \ln(Y_t). \tag{2}$$

The error correction model is formulated in the following form:

$$\Delta c_t = \beta_1 \cdot \Delta y_t + \beta_2 \cdot \hat{u}_{t-1} + \varepsilon_t, \tag{3}$$

where $\Delta c_t \equiv \ln(C_t) - \ln(C_{t-1})$ i is the difference in consumption of organic food,
$\Delta y_t \equiv \ln(Y_t) - \ln(Y_{t-1})$ represents the difference in real disposable income,
$\hat{u}_{t-1}$ denotes the deviation from the long-term equilibrium relationship in the revious period,
ε_t is the error term with white noise properties.

Given that the variables are in logarithms, their absolute difference approximates the relative difference of the original non-logarithmic variables: $\ln(X_t) - \ln(X_{t-1}) \cong \frac{X_t - X_{t-1}}{X_{t-1}}$. Therefore, the parameters β_1, β_2 can be interpreted as coefficients of relative elasticity. The coefficient β_1 ndicates by how many percent the consumption of organic food will change if the disposable income increases by 1%. Similarly, the parameter β_2 xpresses by how many percent the consumption of organic food will change if this consumption in the previous period was 1% above its long-term equilibrium value.

Modification of the standard ECM model

The econometric estimation of the long-term equilibrium relationship between the consumption of organic food and disposable income in this study, as in the original Engle-Granger (1987) methodology, is carried out on (undifferentiated) non-stationary time series. However, it is not done using the OLS method, but using Hamilton's MRS methodology of Markov regime-switching models:

$$\ln(C_t) = \alpha_0(S_t) + \alpha_1(S_t) \cdot \ln(Y_t) + u_t, \tag{4}$$

where the time-varying coefficients $\alpha_0(S_t)$ and $\alpha_1(S_t)$ re functions of the unobservable state variable S_t:

$$\alpha_0(S_t) = \begin{cases} \alpha_{0,1}, & \text{for } S_t = 1, \\ \alpha_{0,2}, & \text{for } S_t = 2, \end{cases}$$

$$\alpha_1(S_t) = \begin{cases} \alpha_{1,1}, & \text{for } S_t = 1, \\ \alpha_{1,2}, & \text{for } S_t = 2, \end{cases}$$

The variable S_t s a discrete random quantity that can only take on two possible values $S_t = 1$ and $S_t = 2$, characterizing the state of the economy. Its evolution is determined by a Markov chain with transition probabilities given by:

$$P = \begin{bmatrix} p_{11} & 1 - p_{11} \\ 1 - p_{22} & p_{22} \end{bmatrix},$$

where $p_{ij} = P(S_t = j | S_{t-1} = i)$ is the conditional probability that the system will be in state j at time t, given that it was in state i at time $t - 1$.

The regression equation of long-term equilibrium (4) s only an auxiliary regression used exclusively for estimating the deviation from equilibrium, and not for estimating the parameters $\alpha_0(S_t)$, $\alpha_1(S_t)$, with the estimates of deviations from equilibrium being the obtained residuals.

The application of the error correction model requires that the used variables $\ln(C_t)$, $\ln(Y_t)$ e cointegrated of the first order, i.e., the deviation from long-term equilibrium must be stationary. Stationarity was again tested using the standard Augmented Dickey-Fuller (ADF) test and the results are summarized in the following table, where symbols *, ** and *** denotes that the null hypothesis was rejected at 10%, 5% and 1% level of significance, respectively.

Table 2 - Results of the stationarity ADF test for the estimate of deviation from long-term equilibrium

ADF Test for Stationarity	Deviation from Long-Term Equilibrium ($\hat{u}_t$)
Test Statistic	–4.103
P-value	0.005***

Source: Authors' own calculations.

The null hypothesis H_0:$\hat{u}_t$ has a unit root is rejected even at the 1% significance level. Therefore, the deviation from long-term equilibrium $\hat{u}_t$ is stationary and the error correction model can be applied.

The mentioned standard ECM model was further modified by abandoning the assumption of time-constant parameters not only in the long-term equilibrium equation (1), but also in equation (3). Specifically, for this purpose, the Markov regime-switching model will be used again in the following form:

$$\Delta c_t = \beta_1 \left(S_t \right) \cdot \Delta y_t + \beta_2 \cdot \hat{u}_{t-1} + \varepsilon_t, \tag{5}$$

where the time-varying coefficient is again a function of the unobservable state variable S_t:

$$\beta_1 \left(S_t \right) = \begin{cases} \beta_{1,1}, & \text{for } S_t = 1, \\ \beta_{1,2}, & \text{for } S_t = 2., \end{cases}$$

3. Results

Estimation of parameters and discussion

The econometric estimation of the parameters of the error correction model with time-varying parameters was performed using Hamilton's (1989) methodology. Since autocorrelation was detected using Q-statistics within the correlogram analysis, estimates of standard errors for estimated parameters were obtained using the HAC (Heteroscedasticity and Autocorrelation Consistent) methodology (White, 1980). The results are summarized in Table 3. In addition to the parameter estimates, the table also includes the P-value of the z-statistic for testing statistical significance for each estimate. Symbols *, ** and *** denotes that the null hypothesis was rejected at 10%, 5% and 1% level of significance, respectively.

Table 3 - Results of the econometric estimation of the ECM model using MRS methodology

Parameter Estimates (P-value of the z-Statistic)		
$\hat{\beta}_{1,1}$	$\hat{\beta}_{1,2}$	$\hat{\beta}_{2}$
4.398	–6.550	–0.339
(0.001)***	(0.000)***	(0.001)***

Source: Authors' own calculations.

The statistical significance of all parameters was demonstrated by the z-statistic even at the 1% significance level. If the economy is in the first non-crisis state $S_t = 1$, the regressor Δy_t has a positive and statistically significant impact on the consumption of organic food. A year-on-year increase in disposable income per capita by 1% in this case leads to a year-on-year increase in total consumption of organic food per capita by 4.398%.

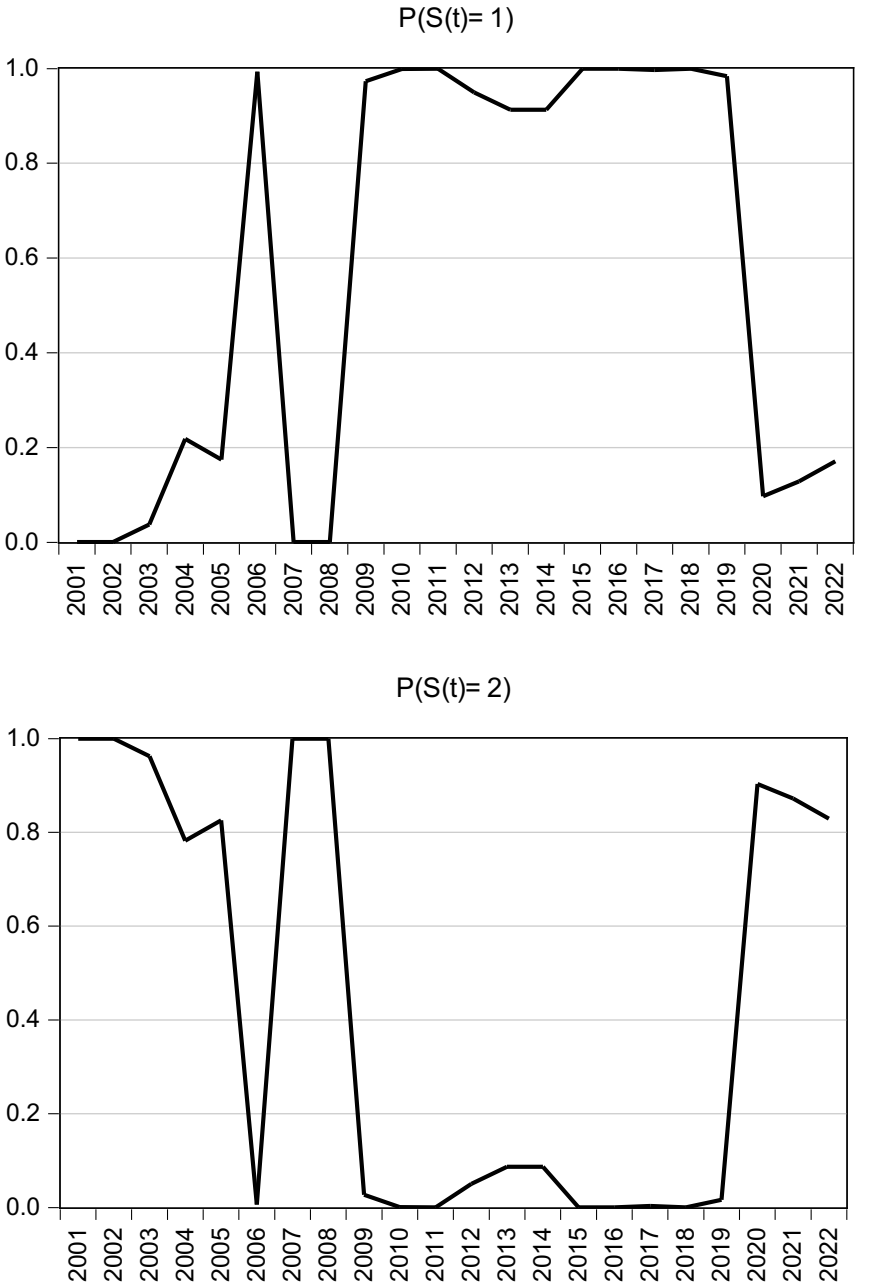
However, if the economy finds itself in its second crisis state $S_t = 2$, this statistical dependence of organic food consumption on disposable income reverses. A one percent decrease in disposable income per capita during a crisis period triggers a statistically significant and very high increase in organic food consumption per capita, amounting to 6.550%.

In terms of the coefficient β_2, the a priori condition $\beta_2 \in (-1,0)$ is met. The fulfillment of this condition ensures that the consumption of organic food partially returns to its long-term equilibrium if it was deviated from equilibrium in the previous period. The statistical significance of this adjustment mechanism, which keeps the variables close to equilibrium, has been demonstrated even at the 1% level of statistical significance. Therefore, if the total consumption of organic food deviates above its equilibrium value by 1%, then in the following period, the total consumption of organic food will decrease by 0.339% year-on-year.

Regime probabilities estimation

The concept of a smoothed estimate is applied to the individual states $S_t = 1$ and $S_t = 2$. This technique uses all the information from the entire dataset to provide a more accurate estimate. The results of this process are visually depicted in the Figure 2.

Figure 2 - Smoothed Estimates of Regime Probabilities $P(S_t = 1)$ and $P(S_t = 2)$



Source: Authors' own calculations.

Figure 2 provides a clear and concise graphical interpretation of the data, facilitating a more straightforward understanding and analysis of the probabilities of the individual states. It offers valuable insights into the behaviour of the individual states under consideration, significantly contributing to our understanding of the dataset as a whole. Specifically, the provided graph unequivocally demonstrates that in the years 2007-2008, the market for organic food in Denmark was almost certainly (with 100% certainty) in a crisis state $S_t = 2$. This undoubtedly occurred in connection with the global financial crisis that broke out in 2007 and culminated in the following year 2008, escalating into a global economic crisis. The graph also shows that the market for organic food in Denmark was in this crisis regime $S_t = 2$ with a very high probability (over 80%) also in the years 2020-2022. This certainly occurred in connection with measures to prevent the spread of COVID-19 infection. The estimated MRS model was thus able to very reliably detect the effect of these two significant global events on the market for organic food in Denmark.

The graph also provides a clear visual representation of the impact of global events on the organic food market in Denmark. It highlights the resilience of this market in the face of significant global crises, demonstrating its ability to adapt and recover from the crisis state $S_t = 2$ at an accelerating rate. This is particularly evident in the years following the global financial crisis in 2007-2008, where despite the challenges, the market was able to return back immediately in 2009. This resilience is a testament to the robustness of the organic food market in Denmark and its ability to withstand severe external shocks. The MRS model's accurate detection of these effects underscores its utility as a tool for analysing and understanding market dynamics. This analysis contributes to our broader understanding of the factors influencing the organic food market, providing valuable insights for policymakers, stakeholders, and researchers alike.

Figure 2 also substantiates that with a very high probability (over 95%), the relationship between the consumption of organic food and disposable income was governed by the crisis regime $S_t = 2$ also in the years 2001-2003. However, in the subsequent years 2004-2006, the estimated probability $P(S_t = 2)$ gradually decreased, practically to zero by 2006. In Denmark, there was no crisis in the organic food market in the years 2001-2003. But the organic food market was in its early stages of development during this period and its development was very rapid and dynamic. Therefore, the transition from state $S_t = 2$ to state $S_t = 1$ in the period 2000-2006 can thus be explained by this fact. Rapid development of organic market in 2004-2006 was supported by government measures. The Danish government actively worked to make Denmark a leader in the field of organic farming, which included increasing the area of agricultural land under organic farming and supporting sustainable practices (Kaad-Hansen, 2022).

4. Discussion of the results and implications

The transition from state $S_t = 2$ to state $S_t = 1$ in the period 2000-2006 can also be viewed in a broader perspective, particularly in relation to the global food crisis that broke out in 2000. This global food crisis was characterized by a sharp increase in the prices of basic foods, which had very negative impacts mainly on developing economies, where hundreds of millions of people faced chronic hunger (Ivanic and Martin, 2008; Soekirman, 2001; Timmer and Cabot, 2010). The negative impacts were certainly not so significant on the advanced Danish economy, however, this significant global event naturally led to a global support for genetically modified foods having the potential to mitigate the negative consequences of such global food crises in developing economies. This is fully in accordance with the theory of Barua *et al.* (2023) who have identified that there is a relationship between income level and the extent of environmental awareness, and thus that the irrelevance of the financial aspect of buying organic food is related to the inherent positive affinity of consumers from higher income brackets towards socially responsible issues and sustainable consumption. On the other hand, it also confirms the importance of price as a substantial factor of buying behavior in favor of the organic food products as it has been stated by Dangi *et al.* (2020) and Sica and Franco (2024).

The production of genetically modified foods has expanded significantly already in the 1990s. After 2000, this significant increase continued and led to economic benefits and an increase in the production of agricultural crops (Brookes and Barfoot, 2013; Qaim and Kouser, 2013). However, the expansion of genetically modified foods inevitably brings concerns about their safety and health harmlessness, which can explain the significant development of the organic food market in Denmark observed in the years 2000-2006. In our estimated model, this was manifested by a gradual transition from state $S_t = 2$ to state $S_t = 21$, which is demonstrated in Figure 2 by an increase in the probability $P(S_t = 1)$, or a decrease in the probability $P(S_t = 2)$, during years 2000-2006.

These findings have several important implications in relation to the research questions: (1) significance of positive effect of disposable income during non-crisis periods, (2) economic resilience of organic food consumption during crisis periods.

The study confirms that disposable income exerts a significant influence on the consumption of organic food from a macroeconomic perspective. This finding is significant in light of research conducted by Chekima *et al.* (2017), who found that there is significant variation in consumer survey results and resulting consumer behavior in organic food consumption. It is by conducting research on the consumption of organic food at the macro level that it is

possible to provide relevant information on consumption patterns and their dependence on changes in disposable income in the category of consumers who, in real terms and not only declaratively for the purpose of improving their social perception, consider organic food product valuable and prefer it in their purchasing decisions.

During non-crisis periods, a surge in disposable income corresponds to an escalation in organic food consumption. This suggests that as individuals possess more disposable income, they are more likely to purchase organic food. This outcome, derived at a macroeconomic level, answers our first research question and complements the conclusions of other studies that reported similar results using microeconomic data (Johansson *et al*., 2014; Kuhar and Juvancic, 2005; Millock *et al*., 2004).

Extending the outcomes of the research led by Kis *et al.* (2023) in scope of the pandemic COVID-19 impact on organic food consumption, the results also suggest that the consumption of organic food is resilient to economic downturns. Even during economic crises, when disposable income decreases, the consumption of organic food increases. This reveals an intriguing phenomenon implying that such a high level of resilience in the organic food market that can provide a degree of stability for businesses in this sector during turbulent economic times. This resilience could be attributed to a variety of factors, such as increased health consciousness or a desire for higher quality food during uncertain times. Thus, it can be also stated that we have confirmed the research outcomes of Rutelione and Bhutto (2024) who have identified that price does not have a significant impact on consumer's purchase decision in favor of organic food.

This finding is closely related to our second research question. The relationship between disposable income and organic food consumption is reversed during a crisis. A decrease in disposable income leads to an increase in organic food consumption. This counterintuitive result suggests that during times of economic hardship, consumers may prioritize spending on organic food due to health consciousness and environmental awareness despite having less disposable income as is often argued in empirical studies (Azzurra *et al*., 2018; Aschemann-Witzel and Zielke, 2015; Bazhan *et al*., 2024).

Pandemic-era research consistently documents how COVID-19 reconfigured agri-food demand and strained supply chains: in the United States, local food systems in several countries showed adaptive capacity through rapid channel shifts and community-based logistics (Thilmany *et al*., 2021). Italy's agri-food value chains faced pronounced shocks along production, HORECA, and export links, while retail partially offsetting losses, serving as evidence of simultaneous resilience and vulnerability (Borsetta *et al*., 2023; Coluccia *et al*., 2021). Sectorally, fisheries across Europe experienced measurable downturns in catch and prices under

COVID-19 restrictions (Seixas *et al.*, 2024). At the firm/plant level, preparedness and risk-management gaps in the food industry were widespread, highlighting the need for robust contingency planning and safety protocols (Nakat & Bou-Mitri, 2021). Together, these findings align with our regime-switching evidence for Denmark: crisis conditions can trigger shifts in purchasing and channel usage while exposing bottlenecks in upstream logistics.

Research findings also have significant additional implications in these areas: 1) strategic planning and crisis management; 2) marketing and consumer engagement; 3) supply chain management and 4) policy engagement.

Understanding this trend can aid businesses in the organic food sector in strategic planning and crisis management. Businesses can take comfort in the knowledge that demand for organic food is likely to remain stable, or even increase, during economic downturns. This can inform business strategies, investment decisions, and risk management plans.

The findings can also guide marketing strategies and consumer engagement efforts. If consumers are more likely to purchase organic food during economic crises, businesses can tailor their marketing campaigns to highlight the benefits of organic food, particularly during times of economic uncertainty. Moreover, the findings indicate a lower degree of demand sensitivity to the consumer's economic situation. However, this is not the case absolutely, but only for consumers who are intrinsically convinced of the value of organic food. For consumers who are not so attitudinally profiled, price remains a significant factor in their purchasing decisions. It is therefore appropriate to step up activities to systematically cultivate consumer awareness of the value of organic food across the motives and factors that have been defined as relevant in each consumer category. From a supply chain perspective, businesses in the organic food sector can use these results to ensure they are prepared to meet increased demand during economic crises. This could involve securing robust supply chains, increasing production capacity, or investing in storage and distribution infrastructure. These findings could also have implications for policy engagement. Businesses in the organic food sector could use this evidence to advocate for policies that even more support the organic food sector.

5. Summary of the main findings

The aim of the study was to analyze the impact of the global economic crisis in 2008 and the COVID-19 crisis in 2020 on the consumption of organic food in Denmark. Methodologically, an Error Correction Model (ECM) was implemented, with modifications applying the Markov

Regime Switching (MRS) methodology to integrate breakpoint analysis. Econometric estimation of the modified error correction model showed the following main quantitative results: (1) The adjustment mechanism toward the long-run equilibrium is statistically significant at the 1% level, with a speed-of-adjustment coefficient $\lambda = -0.339$. This implies that roughly 34% of any disequilibrium is corrected each year and the deviation's half-life is approximately 1.7 years. (2) Cointegration of the long-run relation is supported by an ADF test on the equilibrium error (ADF = −4.103, p = 0.005). (3) The dependence of organic food consumption on disposable income is significant at the 1% level in both regimes, but with opposite signs: positive in non-crisis periods and negative in crisis periods. In the non-crisis regime, the income effect is positive as expected; by contrast, in the crisis regime the effect reverses sign and strengthens in magnitude – such that declines in disposable income are associated with increases in organic food consumption. (4) In the non-crisis regime, a +1% annual increase in real disposable income per capita is associated with a +4.398% annual increase in total per-capita organic consumption (p = 0.001). (5) In the crisis regime, a –1% year-on-year change in real disposable income per capita is associated with a +6.550% increase in total per-capita organic consumption (p < 0.001). These findings are summarized in the following Table 4.

Table 4 - Key ECM-MRS Estimates: Income Effects and Adjustment Dynamics (Denmark, 2000-2022)

Quantity	**Shock definition**	**Estimated effect on organic consumption (y/y)**	**Significance**	**Interpretation**
Income elasticity (non-crisis regime)	+1% in real disposable income (y/y)	+4.398%	1% level (p = 0.001)	Positive and significant outside crises
Income elasticity (crisis regime)	–1% in real disposable income (y/y)	+6.550%	1% level (p < 0.001)	Sign reversal in crises: lower income → higher organic consumption
Speed of adjustment (λ)	Deviation from long-run equilibrium in t–1 = +1%	–0.339 pp	1% level (p = 0.001)	Consumption partially reverts to equilibrium each period

Source: Authors' own calculations.

6. Conclusions

Contribution to existing knowledge

The paper contributes to the literature on organic food consumption in several important ways. First, by employing a macroeconomic approach, it extends prior research that has largely been based on micro-level survey data. Whereas consumer surveys often suffer from attitudinal bias – where stated preferences do not always translate into actual behavior – our findings provide aggregate evidence that income dynamics shape organic food consumption in measurable and regime-dependent ways. This helps reconcile inconsistencies in earlier consumer-level studies (e.g., Chekima *et al*., 2017; Johansson *et al*., 2014), which reported considerable variation in the strength and direction of income effects.

Second, integrating the ECM-MRS methodology enabled analyzing breakpoint dynamics, delivering a more realistic depiction of regime changes while remaining interpretable.

Third, regime-probability evidence indicates near-certain crisis states in 2007-2008 (~100%), high crisis probabilities in 2020-2022 (>80%), and an earlier crisis episode in 2001-2003 (>95%), with transitions back to non-crisis around 2006 and after 2009. Overall, Denmark's organic market exhibits high resilience during macroeconomic stress, consistent with stable or countercyclical demand in this sector.

Fourth, we showed that Danish organic consumption is tightly linked to disposable income, with a positive elasticity outside crises and a sign-reversing, countercyclical elasticity in crises, both statistically strong. The discovery of a sign-switching income elasticity across regimes adds a novel dimension to the debate on affordability and resilience in sustainable food markets. While prior work has emphasized the price sensitivity of organic products (Dangi *et al*., 2020; Azzurra *et al*., 2018), our results show that during crises, demand for organic food may increase despite income contraction. This counterintuitive outcome underscores the role of heightened risk perceptions, health consciousness, and environmental salience in shaping consumer priorities. By capturing this effect at the macro level, our study provides evidence that organic demand is not only income-responsive but also context-sensitive, with different drivers prevailing in stable versus turbulent economic environments.

Fifth, the analysis demonstrates the resilience of the Danish organic market during two major crises (2008 and 2020), highlighting its stability relative to other food categories. This aligns with recent findings from Kis *et al.* (2023) on pandemic-era consumption, but adds historical depth and a methodological contribution by explicitly modeling regime transitions.

In doing so, the paper enriches the understanding of organic markets as potential stabilizers in food systems during periods of uncertainty, a perspective less emphasized in the existing literature.

Sixth, the results contribute to the policy debate on food equity and sustainability. Previous studies have called attention to the importance of certification credibility, consumer trust, and labeling coherence (Aschemann-Witzel & Zielke, 2015; Rutelione & Bhutto, 2024). Our findings substantiate these arguments by showing that demand for organic products persists, and even strengthens, when risks are perceived to be high. This underscores the importance of maintaining strong institutional frameworks – certification, enforcement, and communication systems – that support consumer confidence in organic markets.

Finally, this research situates Denmark's experience within broader discussions of market maturity and the extent to which findings derived from high-penetration markets can be generalized to other countries. Denmark represents a high-penetration case, and our results highlight both the opportunities and limitations of extrapolating from such a context. Thus, the study provides a baseline framework for future comparative work across countries with different levels of organic market development, certification regimes, and consumer income distributions.

Therefore, our contributions advance the field by demonstrating that organic food consumption is not only shaped by disposable income but is also contingent on broader macroeconomic conditions, institutional contexts, and shifts in consumer perceptions during crises. This opens new avenues for research on the resilience, equity, and sustainability of food systems.

Implications

Individually, these findings can be applied in strategic planning, marketing, supply chain management and policy formulation in the organic food sector. Let's first discuss implications for firms (managerial strategy). The regime-dependent income elasticity warrants dual-regime strategies. During non-crisis periods – when income effects are positive – firms should emphasize portfolio premiumization (higher value-added, products strongly defined by trust-based qualities), assortment breadth (greater variety across categories and price tiers), and experience-based differentiation (in-store education, traceability apps, and external validation of quality). In crisis periods – when the sign reverses and risk salience increases – firms should prioritize protection of core organic lines, credible signaling of safety and authenticity (well-recognized certification, residue testing transparency, narratives emphasizing product origin and supply chain journey), and affordability-oriented pricing schemes (smaller pack sizes, temporary price guarantees,

retailer-branded organic products). In both regimes, managers should integrate scenario planning those accounts for potential regime shifts into demand forecasting, and they should align promotion schedules, inventory targets, and working capital policies with the estimated transition probabilities.

Implications for policymakers (regulation and equity). The countercyclical nature of organic demand observed during economic crises indicates a need for policy interventions that safeguard equitable access to organic products at times when perceived health and environmental risks become more pronounced. Priorities include: (i) strict certification standards and effective enforcement mechanisms to maintain consumer confidence; (ii) interventions to enhance the quality of consumer information (establishment of public communication standards, mechanisms for rapid response to misinformation, and greater consistency between nutritional and sustainability labelling; and (iii) targeted affordability instruments that are time-limited and countercyclical (temporary reductions in value-added tax on certified organic products, vouchers for vulnerable households, or subsidies directed toward staple organic categories with significant health externalities). Policymakers should also consider privacy-preserving data-sharing frameworks to enable timely monitoring of regime shifts and to coordinate with industry on contingency supply measures.

Implications for supply-chain actors (operations and contracts). Countercyclical demand during downturns raises the risk of stock-outs precisely when producers and suppliers face reduced financial flexibility, making it more difficult to expand inventories and meet the heightened demand. Distributors and retailers can mitigate this through crisis-contingent contracts (e.g., flexible minimum-order quantities, option contracts with upper bounds on prices), inventory policies with service-level triggers linked to regime probabilities, supplier diversification across geographies and certification bodies in order to reduce dependency on any single region or certifying institution, and sourcing strategies aligned with established certification standards designed to minimize verification delays and reduce bottlenecks in compliance processes. Investments in traceability infrastructure (batch-level traceability, rapid certification verification) and expanded quality-assurance capacity improve both compliance and consumer confidence under heightened risk salience.

Limitations and directions for future research

While the ECM-MRS approach yields interpretable regime dynamics, several limitations constrain the strength of the inferences and motivate further work.

Aggregation and compositional masking. The macro series cannot disentangle category-specific or demographic heterogeneity (e.g., differences between fresh vs. processed organic food, or between households in differnt lifecycle stages). Future research might integrate product-level scanner data and household panel microdata to recover segment-specific elasticities and substitution patterns.

Price measurement and promotion dynamics. Future research might incorporate transaction-level price data, measures of price dispersion, and indicators of promotion intensity. Doing so would make it possible to distinguish income effects from price-driven mechanisms and to estimate both own- and cross-price elasticities for organic and conventional products.

Model specification and identification. Regime classification is probabilistic and may be sensitive to lag length, or transition rules. Robustness checks employing alternative regime specifications (e.g., threshold VAR/ECM or time-varying parameter models), as well as allowing for state-dependent error variances, would provide a useful test of the stability of our results.

External validity and market maturity. Denmark is among the countries with a very high market share of organic products. Consequently, our findings may not be directly transferable to contexts characterized by lower levels of organic market penetration or by generally lower consumer incomes. Comparative work across countries with different certification regimes, retail structures, and income distributions could help to identify contextual factors of regime-dependent elasticities. Methodologically, the ECM-MRS specification is not Denmark-specific. It can be applied to other geographical markets to study regime-dependent adjustments in organic consumption during economic crises, assuming adequate data coverage and comparability.

Temporal granularity and dynamics. Higher-frequency data (monthly/weekly) could reveal short-run adjustment, inventory hoarding, or panic-buying effects that annual data may smooth out. Future models might incorporate time-varying transition probabilities linked to macro indicators (unemployment, uncertainty indices) to improve early-warning properties.

Communication environment and trust. We do not observe the information ecosystem (media coverage, misinformation events) that plausibly shifts preferences in crises. Coupling demand data with media/online attention measures could quantify the mediating role of information and trust.

Future research agenda. We recommend: (i) estimating joint price-income-promotion models within an ECM-MRS or TVP framework; (ii) combining macro and micro (multi-level) data to reconcile aggregate resilience with household heterogeneity; (iii) exploiting policy experiments (labeling changes, VAT tweaks) for causal identification; (iv) conducting cross-country comparative analyses to assess institutional moderators; and (v) integrating uncertainty and risk-perception indices to test mechanisms underlying the

crisis-regime sign switch. Collectively, these extensions would sharpen causal claims, enhance forecast accuracy, and improve the translational value of regime-aware strategies for managers and policymakers.

Acknowledgements

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This paper was supported within The Internal Grant Agency of AMBIS University KMCR-2025-01 and KEVS-2025-01.

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