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REGIONAL DISPARITIES IN PRICE DYNAMICS IN THE FAST-FOOD SECTOR IN CROATIA

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Abstract

Following the introduction of the euro on 1 January 2023 and a period of high inflation, Croatia has recorded notable price changes across sectors and regions. This paper analyzes regional differences in price growth in the Croatian fast-food sector, comparing tourist and non-tourist regions. The analysis relies on an original dataset of product prices collected at the micro level via the Google Reviews platform. Multiple regression models and a series of robustness checks, including robust regression, quantile regression, alternative data transformations, and a treatment-effects (IPWRA) estimator, were used to examine regional differences.

The results do not provide robust evidence that price growth differed systematically between tourist and non-tourist regions. In contrast, products with lower initial prices experienced stronger subsequent price growth, and price growth differed across initial price segments. No evidence was found that the relationship between tourist-region status and price growth varied across initial price segments.

Keywords: foodservice industry, tourist and non-tourist regions, price growth, pricing behavior, euro adoption

JEL classification: C21, E31, L83

1. Introduction

Croatia introduced the euro as its official currency on 1 January 2023, following EU approval in 2022. Ciraki, Vakanjac, and Lulić (2023) state that experiences in Slovenia and Estonia have shown an increased perception of inflation after the introduction of the euro, with the increase being particularly pronounced in Estonia despite the well-informed citizens there. The authors emphasize that inflationary developments following Croatia's euro adoption should be viewed in the context of broader market disruptions and external shocks. Recent external shocks, including the COVID-19 pandemic and supply chain disruptions, have further increased adjustment pressures across both goods and services markets (Čučković and Vučković 2023).

In December 2023, compared with December 2022, prices increased by 12.4% in Restaurants and hotels and by 6.7% in Food and non-alcoholic beverages (Državni zavod za statistiku Republike Hrvatske [DZS] 2024a).

According to the Croatian Bureau of Statistics (DZS 2024b), consumer prices in catering services increased markedly during the period surrounding Croatia's adoption of the euro. Particularly strong price growth was recorded in the fast-food and ready-made takeaway food subcategory, indicating that this market segment experienced more pronounced price dynamics than the broader restaurant sector.

A significant increase in food and beverage prices between 2022 and 2023 could have contributed to the price increase in the fast food segment. Also, the inflationary environment could have encouraged the substitution of more expensive food options with cheaper alternatives, increasing demand in the fast-food segment (Nevo and Wong 2015; Żurek and Rudy 2024). Previous research shows that changes in income and relative prices affect food consumption patterns in Croatian households, creating the possibility of substitution between different food categories (Mjeda, Vlahinić Lenz, and Cerović 2021). Despite the pronounced price growth in this segment, there is still a lack of empirical research analyzing price movements at the level of individual products and regions within the Croatian fast-food sector.

Existing empirical evidence on price developments after the introduction of the euro in Croatia has mainly focused on aggregate indicators and broader consumption categories. In contrast, little is known about price changes at the level of individual products and regions within the fast-food sector. Driven by significant price increases after 2022, this research analyzes regional differences in price increases within this sector. Previous research (Sorić 2024) did not find a statistically significant effect of the introduction of the euro on prices in the hospitality industry. However, narrower segments such as fast food may have experienced different price dynamics due to specific supply and demand characteristics. The existing evidence on price developments after the introduction of the euro in Croatia provides limited insight into price adjustments at the level of individual products and regions. Therefore, it is still not sufficiently investigated whether there are systematic differences in price growth between tourist and non-tourist areas and to what extent such differences are related to the initial price positioning of products.

Since tourism is important for the Croatian economy, it is important to investigate regional differences in price movements. Higher demand in tourist regions may contribute to faster price increases. Consequently, it is important to assess whether price growth differs systematically between tourist and non-tourist regions. At the same time, price adjustments may vary across products with different initial price levels, suggesting potential heterogeneity in pricing behavior within the fast-food sector.

The contribution of this paper is threefold. First, it provides the first micro-level empirical evidence on price dynamics within Croatia's fast-food sector during the post-euro period. Second, it examines differences in price growth between tourist and non-tourist regions, thereby addressing an important gap in the literature on regional price adjustments. Third, it relies on an original hand-collected dataset of menu prices, offering insights that are not available from official statistical sources.

Given the absence of official micro-level data on fast-food prices in Croatia, the analysis relies on manually collected menu-price data obtained from Google Reviews. The resulting dataset should therefore be interpreted as a source of research evidence rather than as a fully representative cross-section of the Croatian fast-food market. Accordingly, the empirical analysis focuses on regional differences in price dynamics rather than on identifying the causal effect of euro adoption itself.

2. Literature review

This section reviews the theoretical and empirical literature on regional price formation, tourism-related demand conditions and price adjustment mechanisms. Attention is devoted to studies examining tourism demand, consumer price perceptions, euro adoption and heterogeneous pricing dynamics, as these factors provide the theoretical foundation for the hypotheses developed in this study.

2.1. Tourism demand and regional price formation

Consumer price sensitivity plays an important role in firms' pricing decisions, particularly in tourism-intensive markets. Tourist regions are characterized by pronounced seasonal demand fluctuations, which can substantially affect price formation. Mangion, Durbarry, and Sinclair (2005) point out that price changes can significantly affect tourism demand and that tourists' price sensitivity varies across destinations. On the other hand, Berardi, Eife, and Gautier (2014) state that tourists, due to their lower knowledge of destination reference prices, may be less sensitive to price changes than local consumers. In addition, Boto-García and Baños Pino (2024) show that the price elasticity of consumption for bars and restaurants remained relatively stable during the pandemic, suggesting some resilience in demand for hospitality services among tourists. Taken together, these findings suggest that demand in tourist destinations may be less price sensitive than demand in non-tourist areas. In such circumstances, rising prices may negatively affect the competitiveness of products and services, particularly in price-sensitive market segments (Novinc and Škuflić 2025).

In addition to demand conditions, previous studies highlight the importance of location-specific characteristics in price formation. Prices are often influenced by seasonality and by the so-called location premium (Nadal, Font, and Rosselló 2004; Eleswarapu and Reinganum 1993; Alegre, Cladera, and Sard 2013). Mandić and Petrić (2021) find that proximity to tourist attractions increases accommodation prices, which points to greater market power of companies in more attractive locations.

An additional explanation for higher prices in tourist destinations can be found in the theory of hedonic pricing. Chin and Chau (2003) and Latinopoulos (2018) show that location and environmental characteristics can influence prices through the perception of quality and attractiveness. Furthermore, Balaguer and Pernías (2013) find that competition constrains prices less in tourist than in non-tourist regions. Therefore, it can be expected that regions with a higher intensity of tourism will record faster price growth than regions where tourism has a smaller economic role.

All things considered, the literature suggests that stronger seasonal demand, lower price sensitivity, and weaker competitive pressures may contribute to faster price growth in tourist regions than in non-tourist regions. The above theoretical arguments provide the basis for expecting that products in tourist regions will experience higher price increases than comparable products in non-tourist regions. Based on the above theoretical arguments and empirical evidence, the following hypothesis is proposed:

H1: Tourist regions are associated with higher fast-food price growth than non-tourist regions.

2.2. Euro adoption, consumer perceptions and price adjustments

Previous research suggests that the introduction of the euro in the hospitality industry has often been associated with price increases. For example, Golob, Jančič, and Lah (2009) noted an unusual increase in prices in Slovenian restaurants and bars even before the official changeover to the euro.

Similarly, Kerem et al. (2013) report that the hospitality sector in Estonia was considered particularly sensitive to price increases after the introduction of the euro, primarily due to rounding effects and inflationary expectations. The literature suggests several possible mechanisms for price adjustment after the introduction of the euro. One relates to the costs of changing prices (Mankiw 1985; Hobijn, Ravenna, and Tambalotti 2004), while Gaiotti and Lippi (2004) emphasize the role of market power and temporary nominal confusion of consumers in assessing new prices. Therefore, market power may be particularly important in tourism-intensive regions, where strong seasonal demand may reduce constraints on price increases.

Consumer perceptions and price expectations can also influence price adjustments during inflationary periods and currency transitions (Gray 1966; Garača et al. 2018). Consumers often evaluate prices relative to previously observed or expected price levels, making reference prices an important determinant of their reactions to price changes (Speck 2017; Jonas et al. 2002; Del Missier, Bonini, and Ranyard 2007). Accordingly, Boto-García and Baños Pino (2024) show that foreign tourists' reactions to price changes depend on the type of tourism service and the level of economic uncertainty. The authors emphasize the importance of perceived price fairness and reference prices, suggesting that consumers react more negatively to prices they perceive as unfair or higher than expected.

During currency changes, it may be more difficult for consumers to assess new prices, which may make it easier for businesses to make less noticeable price increases. Berardi, Eife, and Gautier (2014) show that tourist restaurants in France were more likely to increase prices during the introduction of the euro, suggesting the possible importance of tourist demand in shaping price adjustments.

The literature suggests that the introduction of the euro can stimulate price adjustments through price switching costs, nominal consumer confusion, and firm market power. In the context of this research, these mechanisms may be particularly relevant in tourist regions, where stronger demand can facilitate price increases.

2.3. Initial prices and heterogeneous price growth

Micro-level research shows that prices do not adjust equally across all products. Responses to economic shocks may vary depending on product characteristics and their initial prices.

In times of inflation and reduced purchasing power, consumers may switch to cheaper products within the same category. Weber and Wasner (2023) point out that this can increase demand for lower-priced products and reduce consumers' sensitivity to price changes. In such circumstances, companies may find it easier to increase prices, especially when consumers have little opportunity to switch to even cheaper alternatives. On the other hand, Guerrieri, Hartley, and Hurst (2013) show that units with lower initial prices experienced faster price growth than more expensive units. While the study focuses on the housing market, its results suggest that the initial price level may play an important role in subsequent price changes.

This view is broadly in line with the concept of pricing discretion. According to Ingenbleek, Frambach, and Verhallen (2013), companies set prices within a range bounded by costs on the one hand and the perceived value of the product to the customer on the other. At the same time, research shows that consumers perceive certain price changes within a zone of acceptability or indifference and react only when the price crosses certain thresholds (Ofir 2004; Han, Gupta, and Lehmann 2001). Consequently, it can be concluded that products whose prices are initially set at lower levels have more room for subsequent price increases before reaching limits that consumers consider unacceptable.

Taken together, these arguments suggest that initial price levels may represent an important source of heterogeneity in subsequent price dynamics. Consequently, products positioned in lower price segments may exhibit stronger subsequent price growth than products already located in higher price segments. Based on these arguments, the following hypothesis is proposed:

H2: Products with lower initial prices show stronger subsequent price growth.

Existing evidence on post-euro price developments in Croatia has primarily focused on aggregate consumer-price indices and broad expenditure categories (Sorić 2024). Consequently, little is known about price dynamics within specific hospitality subsegments and about potential regional differences in price adjustments. Furthermore, previous research rarely analyzes price adjustments at the level of individual products. This limitation is particularly relevant in the case of the fast-food sector, where official statistics provide only highly aggregated information and where substantial price increases have been observed in recent years.

Moreover, empirical evidence comparing price dynamics between tourist and non-tourist regions remains limited, especially in the context of post-euro price developments. As a result, it remains unclear whether stronger tourism demand is associated with higher price growth and whether such effects differ across products belonging to different price categories. In this regard, it can be expected that products with lower initial prices will experience stronger subsequent price increases than products that were already positioned in higher price segments.

To address these gaps, this study examines regional differences in price growth within Croatia's fast-food sector using an original hand-collected dataset of menu prices. Attention is devoted to differences between tourist and non-tourist regions, as well as to the association between products' initial price levels and subsequent price growth. Previous studies indicate that price dynamics may differ across units with different initial price levels (Guerrieri, Hartley, and Hurst 2013). Moreover, evidence from price-segment analyses suggests that heterogeneous adjustment patterns may remain hidden when only aggregate measures are considered (Waltl 2019). However, such heterogeneous price dynamics have not yet been examined in the Croatian fast-food sector. Building on these arguments, the following hypothesis is proposed:

H3: Price growth differs across product price segments.

The literature to date suggests that tourism-related demand conditions may influence firms' pricing behavior and contribute to differences in price dynamics across regions (Berardi, Eife, and Gautier 2014; Tkalec and Vizek 2016). At the same time, previous studies indicate that price adjustments may vary across products with different initial price levels (Guerrieri, Hartley, and Hurst 2013), while analyses based on price segments show that heterogeneous adjustment patterns may remain hidden when only aggregate measures are considered (Waltl 2019). Taken together, these findings suggest that the relationship between tourism intensity and price growth may not be uniform across all product price segments. However, this issue has not yet been examined in the Croatian fast-food sector. To address this gap, the following hypothesis is proposed:

H4: The association between tourist-region status and price growth differs across initial product price segments.

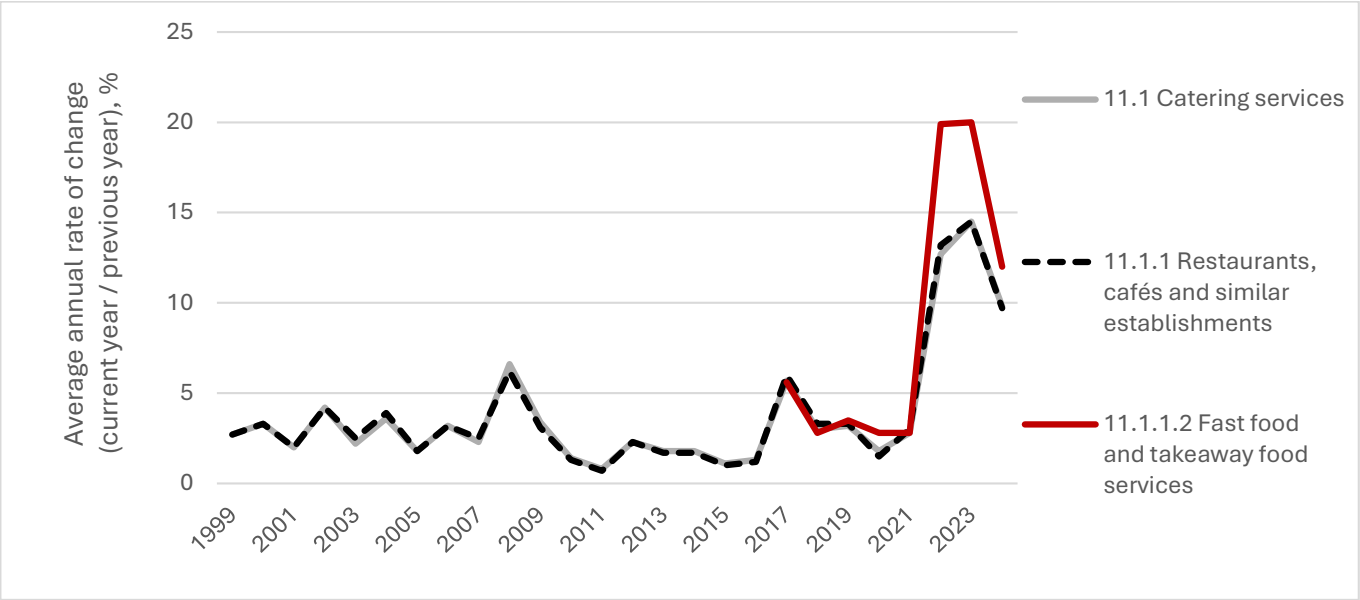
3. Research methodology

This section describes the data source, sample selection procedure, variable construction and econometric framework used to examine regional differences in fast-food price growth in Croatia. Attention is devoted to data validation procedures, the operationalization of key variables and the empirical specifications used to test the proposed research hypotheses.

3.1. Background and motivation

Before presenting the dataset, it is useful to illustrate the broader price developments that motivated the empirical analysis. Figure 1 shows consumer price indices for catering services according to the ECOICOP classification published by the Croatian Bureau of Statistics.

Figure 1. Consumer price indices in Croatia, by ECOICOP classification



The three series fluctuate mostly between 0% and 7% through 2021, then rise sharply. Fast-food and takeaway services reach about 20%, while the broader catering and restaurant series peak near 14%, before all series ease in the final observation.

Source: Author's illustration based on data from the Croatian Bureau of Statistics (DZS 2024b).

Figure 1 shows that prices in the fast-food and ready-made takeaway food subcategory increased more strongly than prices in broader catering-service categories during the euro-changeover period. These aggregate developments motivate the subsequent micro-level analysis of regional price dynamics presented in this paper.

Since there are no official data on historical product prices in the Croatian fast-food sector at the regional level, an original dataset was created based on menu photos available on Google Reviews. This enabled a comparison of price changes between tourist and non-tourist regions. Since there is no publicly available database in Croatia that allows for monitoring historical fast food prices at the regional and product level, using data from online platforms such as Google Reviews and Yelp is a common approach in hospitality and tourism research. For example, Mathayomchan and Taecharungroj (2020), Shin et al. (2022), Yang et al. (2017), and Luca (2011) used data collected from online platforms to analyze the restaurant market and hospitality services. These studies demonstrate that online platform data constitute a credible and increasingly established source of information in hospitality and tourism research.

The analysis included seven product categories selected according to the criterion of comparability and availability across fast-food establishments: classic burger, chicken, French fries, sandwich, veggie burger, beer (0.5 l) and non-alcoholic (NA) carbonated drink. Coca-Cola (0.25 l) was used as the reference NA carbonated drink because it was the most consistently available product across establishments and observation periods. In cases where the restaurant did not have a veggie burger, another vegetarian option was selected. For each individual product category within the same facility, an effort was made to use the same or the most similar comparable product in both observed years to reduce the impact of changes in product composition or quality on estimated price changes. To reduce the influence of seasonality (Mandić and Petrić 2021), prices from the tourist season (from April to October) were used for all coastal establishments in both observed years, thereby ensuring a comparable basis for price comparisons across fast-food outlets.

The observation period was defined by the pre- and post-euro comparison: 2022, before Croatia's

adoption of the euro, and 2023, after its introduction. Given the strictly defined time frame and the reliance on user-uploaded menu photographs, data collection was particularly demanding during the tourist season. Data availability was additionally constrained by the residual effects of the COVID-19 pandemic in 2022, which reduced tourist activity and limited the availability of up-to-date menu photographs on Google Reviews. Only establishments for which menu photographs were available in both observed years and for which the same or closely comparable products could be identified over time were included in the final sample. Establishments were excluded if menu photographs were incomplete, time-indeterminate, or insufficiently legible.

After filtering, complete data was collected for a total of 33 restaurants in tourist regions and 25 in non-tourist regions. The following cities were included in the sample of tourist regions: Split, Pula, Poreč, Medulin, Crikvenica, Šibenik, Makarska, Rogoznica, Okrug Donji, Brač, Drvenik, Gradac, Dubrovnik, and Zadar. All others were taken as non-tourist destinations, except for the City of Zagreb. Zagreb, in addition to being off the coast, is also the capital and a significant tourist center, so it was excluded from the analysis because its data could impair comparability between groups.

The unit of analysis is the individual product rather than the restaurant. Each establishment contributes observations for up to seven comparable menu items depending on product availability in both years, resulting in 406 product-level observations nested within 58 restaurants (33 tourist and 25 non-tourist establishments). Because multiple observations originate from the same establishment, standard errors are clustered at the restaurant level to account for within-restaurant correlation. The slight imbalance between tourist and non-tourist establishments is a consequence of differential data availability on Google Reviews after applying identical inclusion criteria to both groups, rather than a deliberate sampling decision.

The sample is a convenience sample determined by data availability rather than by statistical sampling. Inclusion required clearly dated menu photographs for both 2022 and 2023 and the availability of the same or highly comparable products across years. Many establishments were excluded because historical menu photographs were unavailable, incomplete, illegible, or because product comparability could not be ensured. Although these criteria reduced the final sample size, they increased the reliability and comparability of the price observations. Consequently, the findings should be interpreted as evidence of associations within the observed sample rather than as estimates representative of the entire Croatian fast-food sector.

Although the sample is not completely balanced across regions, the same strict inclusion criteria were applied to both groups of restaurants during the database construction. No artificial balancing of the number of restaurants between tourist and non-tourist regions was intentionally implemented, as such an approach could further distort the natural availability of data and introduce additional selection bias.

Despite the limitations, the resulting dataset provides novel product-level evidence on price dynamics within a specific and previously underresearched segment of the Croatian foodservice market. The findings should therefore be interpreted as evidence of regional differences in price dynamics derived from a convenience sample constrained by the availability of historical menu photographs on Google Reviews rather than as estimates representative of the entire Croatian fast-food sector.

3.2. Definition and operationalization of variables

Most studies examining price developments following euro adoption rely on aggregate consumer-price indicators such as the Harmonized Index of Consumer Prices (HICP) (Sorić 2024). However, such measures are available only for broad expenditure categories and do not allow the analysis of product-level price dynamics across regions. The dataset used in this study enables the examination of individual fast-food products in tourist and non-tourist regions, providing a level of disaggregation that is particularly important given the theoretical

arguments developed in Section 2 regarding heterogeneous price adjustments across locations, products, and initial price levels.

The dependent variable, PriceGrowth, is defined as the percentage change in product prices between the observed periods:

$$\text{PriceGrowth}_{ir} = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100$$

where PriceGrowth_{ir} denotes the percentage price growth of product i in restaurant r between 2022 and 2023.

Relative percentage changes were used instead of absolute price differences because they allow direct comparisons across products and establishments with different initial price levels. The analysis used relative price changes, with 2022 prices converted into euros using the official conversion rate (1 EUR = 7.53450 HRK). This operationalization facilitates the comparison of identical or closely comparable products across tourist and non-tourist regions while accounting for differences in their initial price levels.

Given the theoretical expectation that tourism-related demand conditions may influence pricing behavior, TouristRegion is treated as the principal explanatory variable. It is a dummy variable coded as 1 for establishments located in tourist regions and 0 for establishments located in non-tourist regions.

In line with the arguments developed in Section 2.3, several model specifications additionally account for the role of initial price levels. First, InitialPrice measures the product price observed in 2022 and is included to examine whether products with different starting prices exhibit different subsequent growth rates. Second, products are classified into PriceQuantiles, defined as tertiles of the initial price distribution. This approach allows the analysis of heterogeneity in price growth across products with different initial price levels and provides an empirical assessment of the patterns discussed in the literature on heterogeneous price adjustments.

To account for product heterogeneity in the structure of the fast-food offer, ProductGroup is included as a control variable. It distinguishes between the seven product categories analyzed in the study: food products (burger, chicken, fries, sandwich and vegetarian option) and beverages (beer and NA carbonated drink). Previous research suggests that tourism-related price effects may differ across categories of goods and services (Tkalec and Vizek 2016), making such controls important for isolating regional differences in price growth.

Table 1 summarizes the dependent, independent and control variables used in the empirical analysis together with their definitions, data sources and expected relationship with price growth.

Table 1. Description of variables

Variable	Description	Type	Source	Expected sign
PriceGrowth	Relative percentage price change between 2022 and 2023	Dependent	Own calculation based on Google Reviews	NA
TouristRegion	Dummy variable: 1 = tourist region; 0 = non-tourist region	Independent	Own classification	+
InitialPrice	Product price in 2022 (EUR)	Control	Google Reviews	-
PriceQuantile	Price tertiles based on the initial price distribution	Control	Own calculation	- for higher quantiles
ProductGroup	Product-group controls	Control	Google Reviews	+/-
TouristRegion × PriceQuantile	Interaction term between tourist region and price group	Interaction	Own calculation	Ambiguous

Source: Author's own processing

3.3. Econometric framework

Multiple regression specifications estimated using ordinary least squares (OLS) were employed to examine the association between tourist regions and product-level price growth, while accounting for differences in initial price levels, price tertiles and product categories.

The models are designed to test the hypotheses developed in the previous sections in a stepwise manner. The baseline specification examines whether price growth differs between tourist and non-tourist regions (H1), the second specification introduces the initial product price to examine the relationship between initial price levels and subsequent price growth (H2), the third specification examines differences in price growth across initial price tertiles (H3), and the final specification includes interaction terms between tourist regions and price tertiles to assess whether regional differences in price growth vary across product price categories (H4).

All specifications are estimated on the same sample to ensure comparability across models. Given the observational nature of the data, the estimated coefficients should be interpreted as conditional associations rather than causal effects.

All specifications include $\mathrm{ProductGroup}$ controls to account for heterogeneity across products, while standard errors are clustered at the establishment level to account for potential within-establishment correlation of observations.

The basic model is estimated as follows:

$$\mathrm{PriceGrowth}_{ir} = \alpha + \beta\ \mathrm{TouristRegion}_r + \gamma\ \mathrm{ProductGroup}_i + \varepsilon_{ir}$$

where $\mathrm{PriceGrowth}_{ir}$ denotes the percentage growth of the price of product i in establishment r, $\mathrm{TouristRegion}_r$ represents a binary variable that takes the value 1 if the establishment is in a tourist region, while $\mathrm{ProductGroup}_i$ denotes the product-group controls. Coefficient β measures the average difference in price growth between tourist and non-tourist regions, conditional on product-group controls. Coefficients γ capture systematic differences between product categories that are constant over time.

The second specification extends the baseline model by including the initial price of product i in establishment r, measured in 2022. This specification examines whether products with different starting price levels exhibit different subsequent price growth, as suggested by the theoretical discussion in Section 2.3.

The model can be extended as follows:

$$\mathrm{PriceGrowth}_{ir} = \alpha + \beta\ \mathrm{TouristRegion}_r + \delta\ InitialPrice_{ir,2022} + \gamma\ \mathrm{ProductGroup}_i + \varepsilon_{ir}$$

The coefficient δ measures the relationship between initial price and subsequent price growth. A negative coefficient suggests that products with higher initial prices experienced slower price growth than products with lower initial prices.

A third specification introduces tertiles of initial prices to examine whether price growth differs among products with different initial prices (Waltl 2019; Guerrieri, Hartley, and Hurst 2013). The products are divided into three groups according to the starting price in 2022, with the tertile with the lowest prices serving as the reference category. The coefficient measures the difference in price growth between higher price tertiles and the reference tertile.

This specification makes it possible to assess whether price growth differs systematically across initial price tertiles.

$$\mathrm{PriceGrowth}_{ir} = \alpha + \beta\ \mathrm{TouristRegion}_r + \sum_{q=2}^{3} \vartheta_q\ \mathrm{PriceQuantile}_{iq} + \gamma\ \mathrm{ProductGroup}_i + \varepsilon_{ir}$$

In the final specification, interaction terms between $\mathrm{TourisRegion}_r$ and $\mathrm{PriceQuantile}_{iq}$ are introduced to examine whether the association

between tourist regions and price growth varies across product price categories. The estimated model can be written as:

$$\text{PriceGrowth}_{ir} = \alpha + \beta\ \text{TouristRegion}_r + \sum_{q=2}^{3} \vartheta_q\ \text{PriceQuantile}_{iq} + \sum_{q=2}^{3} \lambda_q\ \left(TouristRegion_r\ x\ \text{PriceQuantile}_{iq}\right) + \gamma\ \text{ProductGroup}_i + \varepsilon_{ir}$$

The coefficients λ_q measure the additional association between tourist-region status and price growth for products in higher price tertiles relative to the reference lowest price tertile. This specification allows an assessment of whether regional differences in price growth depend on the initial price position of a product.

These four model specifications are used to gradually test the hypotheses developed in the theoretical part of the paper.

4. Results

This section presents the results of the empirical analysis. After descriptive analysis and testing of regional differences in price growth, the results of regression models and robustness checks follow.

4.1. Descriptive statistics

As an initial step, the analysis compares price growth between tourist and non-tourist regions using descriptive statistics and group-comparison tests. Similar approaches have been employed in previous restaurant-industry research based on online-platform data (e.g., Lu 2022). To account for potential departures from normality, both parametric (two-sample t-test) and non-parametric (Mann-Whitney rank-sum test) comparisons are reported in Table 2.

Average price growth was higher in tourist regions (22.39%) than in non-tourist regions (18.74%), corresponding to a difference of approximately 3.65 percentage points. Both the parametric two-sample t-test (p = 0.034) and the non-parametric Mann–Whitney rank-sum test (p = 0.011) indicate statistically significant differences between the two groups. These descriptive results suggest raw regional differences in price growth, but they should be interpreted only as preliminary patterns because they do not account for product characteristics, initial prices, or price categories.

While the descriptive results suggest significant regional differences in price growth, they do not account for variation in initial prices, product characteristics or price categories. These factors are examined in the multivariate analysis presented below.

4.2. Econometric Results

Table 3 presents the results of the four regression specifications introduced in Section 3.3. The models progressively incorporate initial prices, price tertiles and interaction effects to examine the determinants of product-level price growth and to test hypotheses H1–H4.

Table 2. Descriptive Regional Differences in fast-food prices

Variable	Test	Non-tourist regions (n = 175)	Tourist regions (n = 231)	Mean difference	Test statistic	p-value
Price growth (%)	Two-sample t-test	18.74 ± 17.18	22.39 ± 17.15	−3.65	t = −2.12	0.034
Price growth (%)	Mann–Whitney rank-sum test	Rank sum = 32,640	Rank sum = 49,981	—	z = −2.54	0.011

Source: Author's own calculation

Notes: Values are reported as mean ± standard deviation.

Table 3. Determinants of fast-food Price Growth

Variables	(1) Baseline	(2) Initial price	(3) Price tertile	(4) Interaction
Tourist region	3.651 (2.987)	4.925 (3.048)	5.666* (3.066)	7.958 (5.297)
Initial price (2022)		-1.224* (0.632)		
Price tertile 2			-8.293** (3.120)	-7.279* (4.111)
Price tertile 3			-11.71*** (4.378)	-8.899* (5.305)
Tourist Region × Price tertile 2				-2.308 (5.061)
Tourist Region × Price tertile 3				-4.892 (5.989)
Constant	21.05*** (2.794)	26.79*** (4.345)	29.97*** (4.501)	28.90*** (5.023)
Observations	406	406	406	406
R^2	0.024	0.039	0.062	0.065

Notes: Clustered standard errors at the restaurant level are reported in parentheses. All specifications include product-group dummy variables. Product group 1 and the lowest price tertile serve as reference categories. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author's own calculation

Column (1) shows the basic model including the tourist region variable and controls for product groups. The estimated coefficient for tourist region is 3.651, indicating that prices in tourist regions grew about 3.7 percentage points faster on average than in non-tourist regions. However, this result is not statistically significant (p = 0.22). Therefore, the baseline specification does not provide statistical support for H1.

In column (2), the initial price of the product from 2022 is included in the model. The results show that products with higher initial prices had slower price increases, while products with lower initial prices recorded larger price increases. This finding is consistent with hypothesis H2. Including the initial price increases the estimated effect of tourist regions to 4.925 percentage points, but remains statistically insignificant.

In column (3), the initial price is replaced by price tertiles, allowing for a comparison of products across different price groups. The results show that products in the middle and highest price tertiles experienced slower price growth than products in the lowest tertile. Specifically, price growth in the middle tertile was, on average, about 8.3 percentage points lower, while products in the highest tertile recorded price growth approximately 11.7 percentage points lower than those in the lowest tertile. Both effects are statistically significant. At the same time, the estimated effect of tourist-region status increases to 5.666 percentage points and becomes marginally statistically significant (p < 0.10). After accounting for differences in initial product price categories, the estimated coefficient for tourist-region status becomes marginally statistically significant. However, because this result is not robust across model specifications, it should be interpreted with caution. These results provide support for hypothesis H3 and confirm that products with lower initial prices experienced stronger subsequent price growth than more expensive products.

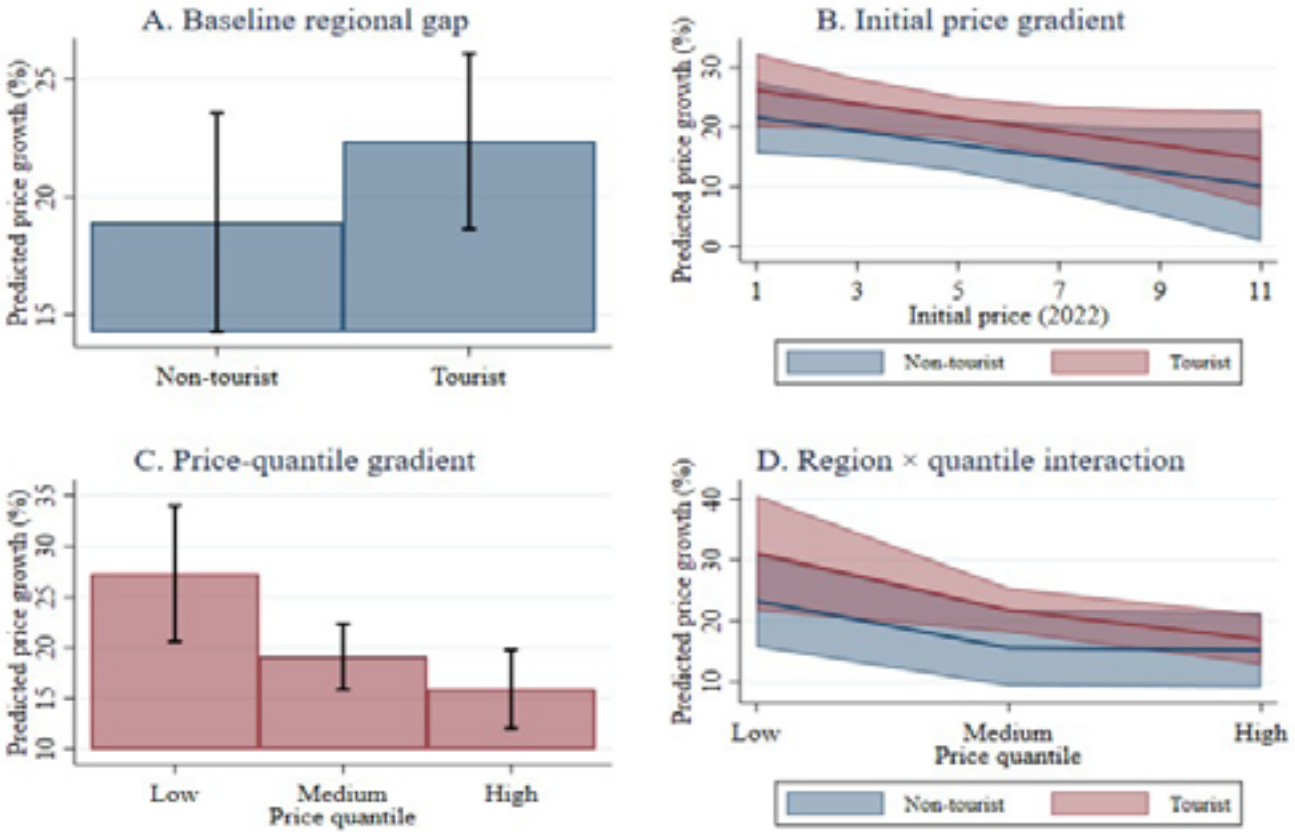
Column (4) includes interactions between tourist regions and price tertiles to test whether the association between tourist regions and price growth differs across product price groups. The results show that regional differences are greatest for products in the lowest price tertile, but the

interaction coefficients are not statistically significant. Therefore, there is insufficient evidence that the effect of tourist regions differs across price groups, and hypothesis H4 is not confirmed.

A relatively low coefficient of determination (R^2) is expected in analyses of cross-sectional microeconomic data due to the pronounced heterogeneity of the observation units and the presence of numerous unobserved factors (Gujarati and Porter 2009; Goldberger 1991). Such values are therefore not uncommon in studies based on micro-level data. It should also be borne in mind that price changes are also influenced by other factors that were not available for inclusion in the analysis, as discussed in more detail in the section on research limitations.

Overall, Figure 2 illustrates the main patterns estimated in Table 3. Predicted price growth is higher in tourist than in non-tourist regions, while lower initial prices are associated with stronger subsequent price growth. The interaction plot visually suggests that the difference between tourist and non-tourist regions is largest among lower-priced products. However, consistent with the regression results reported in column (4) of Table 3, the interaction effects are not statistically significant. Therefore, the graphical results complement and reinforce the regression findings, rather than providing separate evidence of heterogeneous effects across price categories.

Figure 2. Price Growth by Tourist Region and Initial Price Level



Panel A shows higher predicted growth in tourist than non-tourist regions, with overlapping uncertainty intervals. Panel B shows predicted growth declining as the 2022 initial price rises. Panel C shows the highest predicted growth in the lowest price tertile and progressively lower growth in the middle and high tertiles. Panel D shows tourist and non-tourist estimates converging across tertiles, with overlapping confidence bands.

Source: Authors

4.3. Robustness checks

Several robustness checks were conducted to assess the stability of the main results. First, Winsorization of the dependent variable at the 1st and 99th percentile levels yielded qualitatively unchanged results, with the coefficient on tourist regions remaining positive but statistically insignificant. Second, the use of a logarithmic transformation of price growth also led to similar conclusions. Third, to reduce the influence of potential outliers, robust regression was estimated and yielded a statistically significant positive coefficient on the tourist-region variable. This finding suggests that extreme observations may partially attenuate the estimated relationship in the baseline OLS specification. Finally, the quantile regression indicates that the association between tourist regions and price growth is strongest in the lower and middle parts of the conditional price-growth distribution, while no statistically significant effect is observed in the upper part of the distribution. In addition, aggregating the data at the restaurant level produced qualitatively similar results. As an additional robustness check, an analysis of treatment effects was conducted using the inverse probability weighted regression adjustment (IPWRA) method. Given that the main independent variable in this study is dichotomous, tourist regions were defined as the treated group and non-tourist regions as the control group. The aim of the analysis was to estimate the average effect of belonging to a tourism region on price growth while controlling for the initial product price and product group—that is, adjusting for observed differences between restaurants (StataCorp 2019).

Overall, the robustness checks consistently yield positive estimated effects for tourist-region status, although statistical significance varies across estimation methods and is not robust across all specifications. The results of the robustness checks are reported in Table 4.

Table 4. Robustness Checks

Specification	Coefficient (Tourist region)	Std. Error	Observations
Baseline OLS	3.651	2.987	406
Winsorized outcome (1st–99th percentile)	3.452	2.880	406
Log-transformed dependent variable	0.0310	0.0235	406
Robust regression	4.189**	1.630	406
Quantile regression (Q25)	4.468***	1.451	406
Quantile regression (Median)	4.582**	2.155	406
Quantile regression (Q75)	3.187	2.471	406
Restaurant-level aggregation	3.650	2.987	58
IPWRA treatment-effects estimator (ATE)	5.009***	1.709	406

Note: The table reports robustness checks for the estimated association between tourist-region status and fast-food price growth. All specifications include product-group controls, unless otherwise noted. Standard errors are clustered at the restaurant level where applicable. Winsorization limits extreme observations to the 1st and 99th percentiles of the distribution. Quantile regressions are estimated at the 25th percentile (Q25), median (Q50), and 75th percentile (Q75) of the conditional price-growth distribution. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Because the log-transformed model uses a different scale, the coefficient is reported only to assess the robustness of the sign and statistical significance rather than its magnitude.

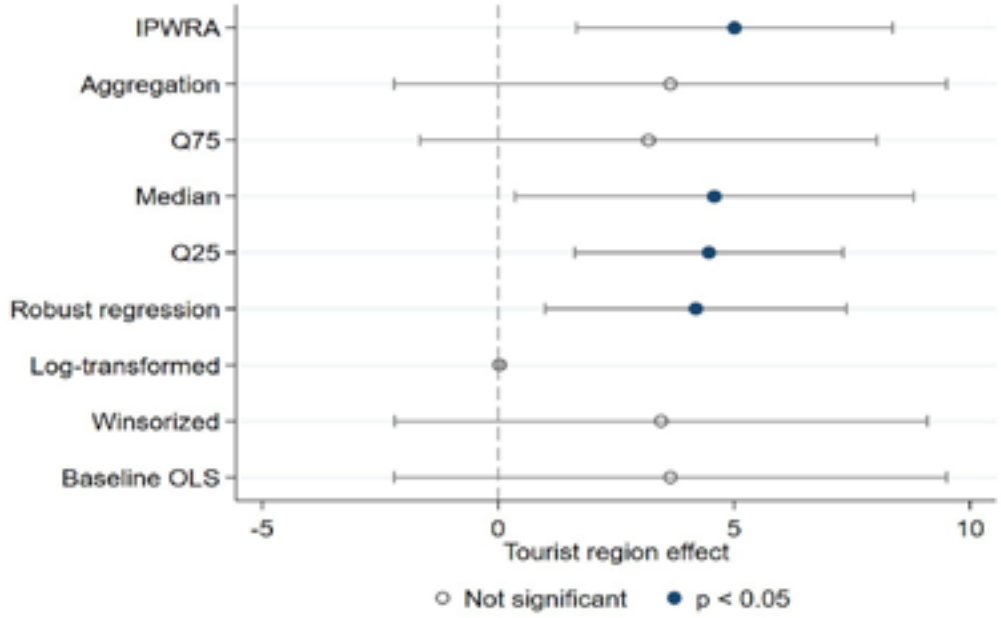
Source: Author's own calculation

The estimated coefficients are positive in all specifications, but their statistical significance varies across estimation methods. Robust regression and quantile regressions for the lower and middle parts of the distribution (Q25 and Q50) yield statistically significant results, whereas the baseline OLS, winsorized, log-transformed, restaurant-level aggregation, and upper-quantile (Q75) specifications yield statistically insignificant estimates. As an additional robustness check, the IPWRA treatment-effects estimator also yields a positive and statistically significant average treatment effect (ATE = 5.009, $p < 0.01$), indicating that the positive association between tourist-region status and price growth remains after adjusting for observable differences between tourist and non-tourist restaurants. Although IPWRA adjusts for measurable differences (e.g., initial price and product type), it cannot account for factors that were not observed or measured. Therefore, the result should not be interpreted as definitive proof of a causal relationship, but rather as further confirmation that the observed association remains stable after controlling for measured differences.

Figure 3 summarizes the results of the robustness tests. In all models, the estimated effect of tourist regions on price growth is positive, although the level of statistical significance varies across specifications.

Figure 3 graphically presents the estimated effects across robustness specifications. It is evident that the estimated effects are positive across all specifications, while their statistical significance varies depending on the estimation method applied. Statistically significant results were obtained using robust regression, quantile regressions for the lower (Q25) and median (Q50) parts of the distribution, and the IPWRA method, with confidence intervals excluding the zero value. In contrast, for the baseline OLS model, the winsorized specification, the log-transformed specification, the restaurant-level aggregation, and the upper quantile (Q75), the confidence intervals include zero, indicating a lack of statistical significance. The figure thus allows for a simple visual comparison of the stability and precision of the estimated effects across the different estimation methods.

Figure 3. Robustness Checks of the Tourist Region Effect



Source: Authors

All point estimates are nonnegative. Robust regression, the 25th-percentile and median quantile regressions, and IPWRA are marked statistically significant. Baseline OLS, winsorized, log-transformed, 75th-percentile, and restaurant-level aggregation estimates are marked not significant. Horizontal confidence intervals are shown against a dashed vertical zero line.

5. Discussion

This study examines price dynamics in the fast food sector between 2022 and 2023. The sample includes 33 coastal (tourist) and 25 continental (non-tourist) restaurants. The dataset covers the year before and after the introduction of the euro with data on tourist regions collected from menus available between April and October. This period is characteristic of the tourist season in Mediterranean countries (Krabokoukis and Polyzos 2024). When interpreting the findings, it is important to consider that the Croatian economy is strongly oriented towards tourism and that there are large regional differences in demands and needs.

Although the euro was introduced only three years ago, its impact on prices has already been the subject of several studies. Sorić (2024) concludes that the introduction of the euro did not significantly contribute to inflation, which was mainly driven by higher raw material costs and external shocks. More pronounced effects were observed only in the food, non-alcoholic beverages and hospitality sectors. This finding is largely in line with previous evidence from other euro area countries. Studies such as Berardi, Eife, and Gautier (2014) for France, Bojnec and Gričar (2009) for Slovenia and Kerem et al. (2013) for Estonia report price increases after the introduction of the euro in the service sectors, especially in restaurants and bars. One possible explanation is that tourist regions were more susceptible to such effects due to the pronounced seasonal demand, which provides more room for price changes. This suggests that price adjustment processes may differ between regions within the same country. Such an interpretation supports the view that location plays an important role in shaping pricing outcomes. It can amplify price reactions during currency transition periods (Bartik 1987; Chin and Chau 2003).

In this context, the fast-food sector represents a useful context for examining price adjustments after the euro. Given its strong links to local demand and seasonal consumption patterns, the fast-food sector represents an area where regional differences in price movements could be more visible. Taken together, these findings add to existing evidence on regional determinants of price movements by suggesting that local demand conditions may reflect differences in price dynamics within the Croatian fast-food sector. More specifically, the observed differences between tourist and non-tourist regions point to the potential importance of local market conditions in shaping price adjustments after the euro. Although the estimated coefficients are consistently positive across model specifications, statistical support for regional differences is limited and depends on the specification employed. The additional IPWRA treatment-effects analysis also yields a positive and statistically significant average treatment effect, suggesting that the observed association between tourist-region status and price growth persists after adjusting for observable differences in initial product prices and product composition. Nevertheless, this result should be interpreted alongside the regression evidence, which remains sensitive to model specification.

One possible explanation concerns the costs of changing prices and the freedom of firms to set them during the currency period. Studies such as Gaiotti and Lippi (2004), which analyze the behavior of firms in monopolistic competition, suggest that currency changes can create opportunities for firms to review and adjust existing prices. Furthermore, the introduction of the euro required restaurants to convert and display prices in the new currency, which made individual price adjustments less visible, which may have made price changes less noticeable to consumers and easier to implement. Another factor may be the demand conditions in tourist regions. In tourist-intensive regions characterized by a significant influx of visitors and frequent consumer turnover, restaurants may face less price-sensitive demand during the tourist season. Under such conditions, firms may have greater scope to increase prices than those operating in non-tourist regions. In addition, tourists often have a lower perception of the usual prices in a destination than the local population, which may make them less sensitive to moderate price changes, giving firms greater flexibility in setting prices (Berardi, Eife, and Gautier 2014). Gaiotti

and Lippi (2004) found that the introduction of the euro was associated with price increases in the Italian restaurant sector. The price increases were more pronounced in markets with higher concentration, suggesting the importance of local market power in the price adjustment process. Together, stronger tourism demand and the broader post-euro environment may help explain the positive, but statistically limited, association between tourist-region status and price growth.

The results show that products with lower initial prices recorded higher price growth, while the price growth of more expensive products was weaker. This suggests that the differences between cheaper and more expensive products decreased during the observed period. One interpretation is that lower-priced products had fewer perceived price constraints, allowing firms to implement larger relative price adjustments before reaching levels that consumers would consider excessive. Such an interpretation is in line with the findings of previous research according to which consumers perceive certain price increases as acceptable if they remain within the range of expected prices, after which sensitivity to price changes increases significantly (Ofir 2004; Han, Gupta, and Lehmann 2001). Such a mechanism may be particularly relevant during periods of high inflation, when companies face price adjustment pressure. At the same time, they try to keep prices within an acceptable range to avoid negative consumer reactions.

Although the interaction effects between tourist regions and product price groups were not statistically significant, the estimated coefficients suggest that the association between tourist-region status and price growth differs across product price groups. Since the estimates of interaction effects were not sufficiently precise, these findings should be interpreted with caution.

The results suggest that price adjustments in the Croatian fast-food sector after the introduction of the euro were related to regional market conditions and product characteristics. At the same time, the findings suggest that other product, firm or market characteristics that are not included in this analysis may also influence price movements and represent a potential area for future research.

6. Conclusion

This paper analyzes regional differences in price increases within the fast-food sector in Croatia during the period of high inflation and the introduction of the euro, with a particular emphasis on differences between tourist and non-tourist regions. The motivation for the research stems from the pronounced price increases in the food and beverage segment and the lack of previous empirical evidence on price dynamics within the fast-food sector in Croatia. The novelty of this study lies in the analysis of regional and product differences in price adjustments in the Croatian fast-food sector during the post-euro period, based on an original manually collected dataset.

The baseline specification does not provide statistical support for H1. However, the estimated coefficient for tourist-region status remains positive across all model specifications and becomes marginally statistically significant after accounting for differences in initial product price categories. Although statistical significance is not consistent across all regression specifications, several robustness checks (robust regression, quantile regression, and the IPWRA estimator) yield statistically significant positive effects. This result should be interpreted as limited and suggestive evidence rather than robust support for H1. The results support hypothesis H2, showing that products with higher initial prices experienced slower subsequent price increases. Hypothesis H3 is confirmed because products from different price groups recorded different rates of price increases, with the increase being most pronounced for products with lower initial prices. Hypothesis H4 is not confirmed. The results do not show that the association between tourist-region status and price growth differs across product price groups, although somewhat larger regional differences are observed for cheaper products.

The findings provide only limited evidence that price changes in the Croatian fast-food sector during the observed period were associated with tourist-region status, while the evidence for differences related to initial product prices is considerably stronger. The results clearly indicate heterogeneous price growth across products, while evidence

for regional differences is weaker and depends on the model specification. Therefore, aggregate price indices may not fully reflect differences in price movements across regions and product groups.

The limitations of this study primarily stem from data availability. Since there is no official database of historical prices of fast-food products in Croatia, the analysis is based on price data collected from menu photos available through the Google Reviews platform. Therefore, the sample should be viewed as a convenience sample, and not as a fully representative representation of the entire Croatian fast-food market. Furthermore, although the data were checked multiple times during the collection and entry process, the manual construction of the database may be associated with minor measurement errors. Despite the effort to compare identical or very similar products and to control for heterogeneity between product groups, certain differences in portion size, quality, or product composition cannot be completely excluded. Also, due to limited data availability, it was not possible to include some potentially important factors in the analysis, such as local operating costs, competition intensity, or more detailed indicators of regional demand. Finally, the observed period covers a relatively short time horizon, which is why the results should be interpreted as indicators of the relationship between regional characteristics and price dynamics in the observed period, and not as definitive estimates of long-term or causal effects.

Despite the limitations, this research provides new insights into price dynamics in the Croatian fast-food sector. The results highlight the importance of regional differences in the analysis of inflationary trends and show that product-level data can reveal patterns of price changes that are not visible in aggregate indicators. Future research should cover a longer period to better understand the long-term effects of the introduction of the euro and inflationary pressures on price adjustment. Future research should include additional indicators of tourism activity, such as tourist arrivals, overnight stays, and consumption patterns, to better understand the factors associated with regional price differences.

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