Analysis of Slovakia's Conventional and Emerging Nicotine Products Market Structure

Report

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Abstract

The expansion of emerging nicotine products in Slovakia has significantly reshaped the tobacco market over the past decade, raising important questions for public health and fiscal policy. This study examines the relationships between manufactured cigarettes and emerging nicotine products in Slovakia, focusing on estimation of own- and cross-price elasticities of respective demands using a fixed-effects panel model for manufactured cigarettes, heated tobacco products (HTPs), and nicotine pouches. Monthly retail scanner data collected from electronic registry cashiers and aggregated at the district level for the period January 2022 to June 2025 were utilized.

The results indicate that the demands for manufactured cigarettes and HTPs are price inelastic and statistically significant, while the estimated own-price elasticity for nicotine pouches is negative but not statistically significant. Cross-price elasticity estimates suggest asymmetric relationships between product categories, with a circular, one-directional relationship among examined products. Specifically, HTPs are economic substitutes for manufactured cigarettes, which are economic complements for nicotine pouches, which in turn are economic substitutes for HTPs. Income elasticities are positive across all product categories, indicating that cigarettes and emerging nicotine products behave as ordinary goods.

Overall, the findings suggest that price changes in one nicotine product category may have spillover effects on other categories, which is relevant for designing effective tobacco taxation policies and forecasting excise revenue in Slovakia. Additionally, the estimation based on the data from retail scanners serves to both complement and validate previous estimates of own-price elasticities of cigarette consumption (for example, Lichner & Ostrihoň, 2025). The estimated degree of own-price elasticity of cigarettes, however, is somewhat lower than in previous research, which was based on survey data.

Introduction

Recent dramatic changes in the tobacco-related product marketplace are driven particularly by sharp increases in the use of emerging nicotine products. Many of these are potential substitutes and/or complements to manufactured cigarettes, and these changes have captured the interest of policy makers and researchers (for example, Chaloupka & Tauras, 2020; Irvine, 2021; and Cho et al., 2024). However, there is still limited research on consumers' reactions to price changes for those products and cigarettes, including in Slovakia.

As of 2025, taxation of e-cigarettes and nicotine pouches is already part of the Slovak legislation. This analysis is highly relevant from the perspective of public health and budget concerns, chiefly due to the negative health and economic impacts of nicotine addiction as well as recent concerns from the Council for Budget Responsibility over rapidly rising sustainability risks for the Slovak public budget in the near future.

One of the main goals of this report is to unveil the potential underlying relations within and between the different product categories in the Slovak tobacco smoking and emerging nicotine product market. Additionally, the findings can contribute to the important and developing discussion about the potential effects of emerging nicotine products on tax revenues. The proposed topic of this research is highly relevant due to the increasing share of emerging nicotine products in the consumer basket and the recent decision to levy taxes on those products. Results of the elasticity estimates may serve as inputs to future forecasts of the related tax revenues.

The analysis presented in this report draws on the data from registry cashiers in Slovakia, collected by the Financial Administration of the Slovak Republic, and made available for research by the Ministry of Finance of the Slovak Republic. The data cover all purchases made as captured by the registry cashiers within the territory of the Slovak Republic. For simplicity, these data are hereafter referred to as the retail scanner data.

Table 1. Structure of nicotine products market in Slovakia, millions of units

	2022				2023				2024				2025	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
HTPs	3.5	3.8	4.1	4.0	3.9	4.8	4.7	4.7	4.4	4.8	4.8	5.1	4.2	4.6
Cigarettes	20.8	23.4	25.0	21.1	18.5	23.3	24.1	22.1	19.8	22.2	23.1	20.9	18.6	21.0
E-cigarettes	0.0	0.1	0.2	0.3	0.3	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7

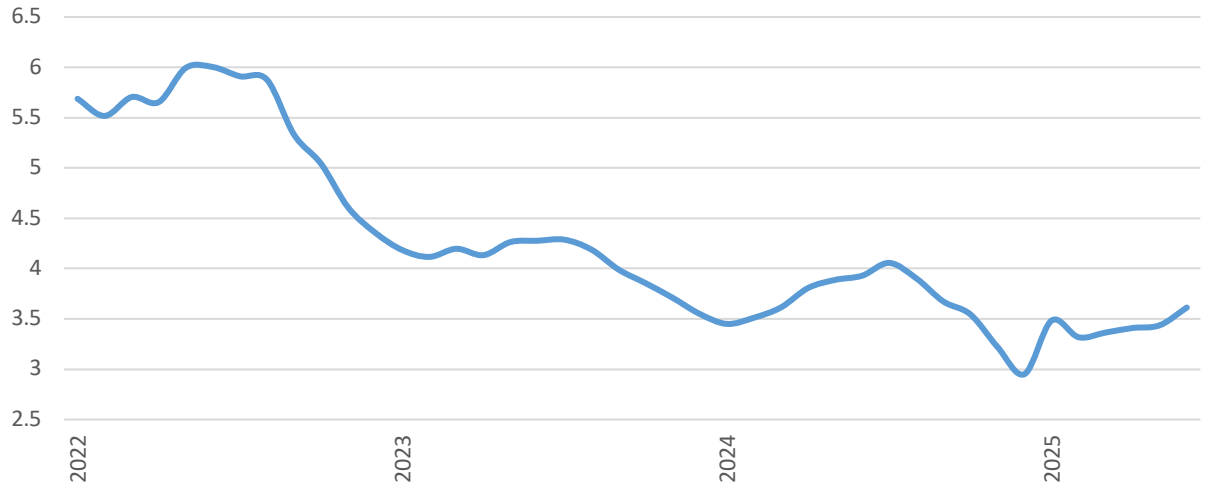
E-liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Nicotine pouches	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7

Source: Ministry of Finance SR, scanner data

According to the retail scanner data, expenditures on emerging nicotine products increased significantly from January 2022 to June 2025 (Figure 1). While at the beginning of 2022 the ratio was 1 EUR of alternatives purchased to almost 6 EUR of expenditures on manufactured cigarettes, at the beginning of 2025 this ratio had reduced to approximately 1 to 3.5.

From the perspective of total retail sale volumes, the period between the first quarter of 2022 and first quarter of 2025 was characterized by substantial shifts across nicotine product categories. The most pronounced increases were observed for e-cigarettes and e-liquids, whose retail sales rose dramatically by 1,747 percent and 1,378 percent, respectively. Over the same time period, sales of manufactured cigarettes declined by approximately 11 percent, suggesting a reduction in their consumption (Table 1). In parallel, nicotine pouch sales increased by 170 percent, indicating that market volumes almost tripled, while consumption of heated tobacco products (HTPs) also grew markedly, rising by 20 percent between Q1 2022 and Q1 2025.

Figure 1. Ratio of EUR spent on manufactured cigarettes per 1 EUR spent for alternative products



Source: Ministry of Finance SR, scanner data

The main outcomes of this research include the quantification of own- and cross- price elasticities of emerging nicotine products (HTPs and nicotine pouches[1]) and manufactured cigarettes. These results are complemented by an overview of recent developments in the regional smoking and emerging nicotine products market, an area where evidence is currently limited but increasingly relevant given the significant uptake of emerging nicotine products in recent years (Hudcovský & Morvay, 2026).

The expected contribution to the field is two-fold. First, the results should help to provide insight into whether the relationships among these products on the Slovak market constitute complementarity, substitution, being unrelated, or some combination of the above. Additionally, the estimation based on the data from retail scanners serve to complement estimates of the previous own-price elasticities of cigarette consumption (for example, Lichner & Ostrihoň, 2025). Nevertheless, it is important to stress that the new findings on the sign and size of cross-price product elasticities are, to the best of the authors' knowledge, absent in the literature focusing on the Slovak context.

Literature review

Recent research provides important insights into trends in consumer behaviour and the general relationship of emerging nicotine products to manufactured cigarettes. Some of the findings presented in the literature are, however, ambiguous which likely stems from both data availability and definitional inconsistencies. This is a result of a very heterogeneous marketplace of emerging nicotine products, wherein it is not easy to identify comparable products even in the same class of products. For example, unlike cigarettes which are generally uniform, electronic cigarette products vary enormously in terms of their characteristics (such as base liquid, nicotine content, nicotine type, or heating device voltage).

Dauchy and Shang (2024), using proprietary sales data from Philip Morris International (PMI), estimated own-price and cross-price elasticities for heated tobacco products (HTPs) and cigarettes across 33 countries where PMI marketed both between 2014 and 2022. The authors report that HTP demand is more sensitive to own-price changes and cigarette (cross-) price changes than cigarette demand is to analogous price changes (HTP cross-price elasticity of

[1] Scanner data indicated that sales of e-cigarettes and e-liquids were initially very low and comprised only a marginal market share. Consequently, increases in sales generated very steep growth rates, which led to questioning the uncertainty regarding market share observed and did not allow for reliable estimation of the elasticities.

cigarette demand estimates were deemed inconclusive), which they interpret as evidence of these products being weak economic substitutes.

Huang et al. (2018) examined the own-price elasticity of 14 non-cigarette tobacco products, as well as their cross-price elasticity with manufactured cigarettes, within the United States (US) of America. The authors used a fixed-effects model on a panel data set constructed from the Nielsen retail store scanner database, which covered 52 food, drug, and mass merchandise stores at quarterly frequency in 44 US states over the period 2007–2014, as well as 30 convenience stores over the period 2010–2014. Their results indicate that cigarettes are substitutes for little cigars, loose and pipe tobacco, and dissolvable lozenges.

Similarly, Yao et al. (2020) used a fixed-effects model to examine the effects of e-cigarette and cigarette prices on disposable e-cigarette demand, reusable e-cigarette demand, and regular cigarette sales in California. To this purpose, they also used Nielsen Retail Scanner Data over the period 2012–2017. Among the examined relationships, there appears to be evidence that only reusable e-cigarettes are serving as one-directional substitutes for manufactured cigarettes, and disposable e-cigarettes are one-directional substitutes for reusable e-cigarettes. Further expanding on the established knowledge, Cotti et al. (2022) used NielsenIQ Retail Scanner Data to construct a balanced panel dataset of US stores for 2013–2019, to estimate the effects of e-cigarette taxes on e-cigarette prices and sales of e-cigarettes and other tobacco products. The authors utilized a two-way fixed-effects model and a panel two-stage least squares regression. Their results suggest that e-cigarettes and cigarettes are economic substitutes, although this relationship was statistically significant only for e-cigarette demand.

Delving into specific aspects of e-cigarettes, Diaz et al. (2024) estimated a variety of three-way fixed-effects models and instrumental variable models to determine the price elasticity of e-cigarettes in the US based on their nicotine content. For these purposes, the authors also used NielsenIQ Retail Scanner Data to construct a quarterly panel dataset for 23 states over the period 2015–2021. The authors did not find evidence of traditional cigarettes affecting e-cigarette demand.

On the other hand, Huang et al. (2021) used a fixed-effects model and the Nielsen retail store scanner database to estimate the impact of e-cigarette prices and TV advertising on replacement therapy products demand in the US over the period 2010–2017. Based on the obtained results, the authors surmise a potential "one-way substitution/complementarity" relationship between nicotine gums and patches, to describe a situation where gum may be a complement for a patch, while a patch may substitute for gum.

Data and methodology

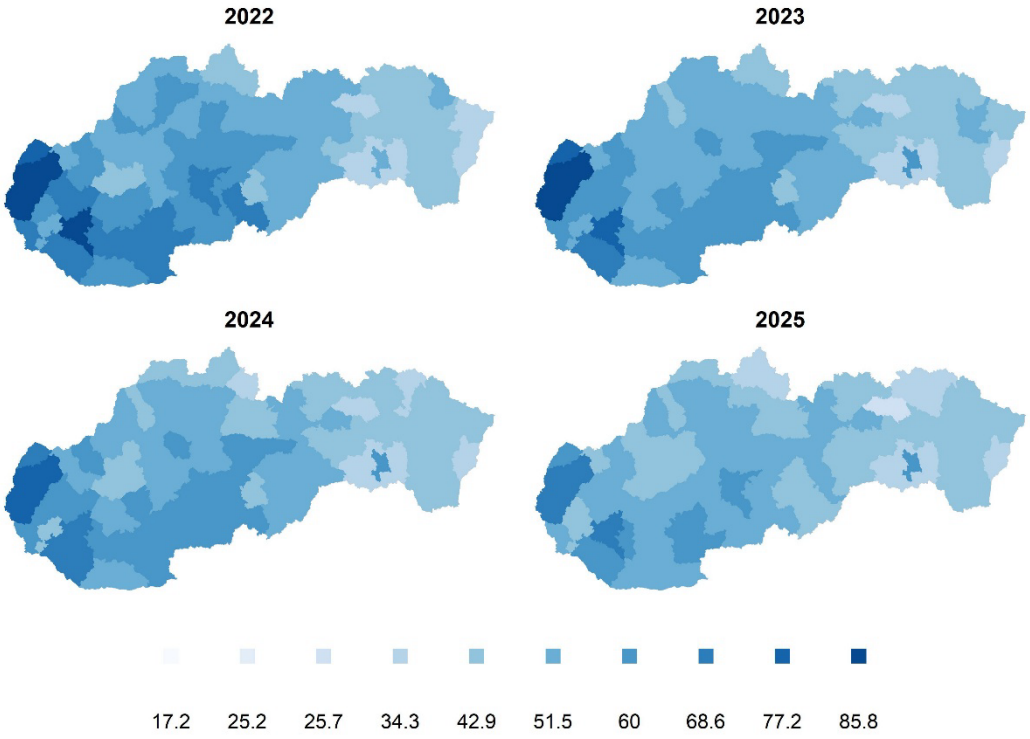
Data

This research draws mainly on the aggregated retail scanner data of electronic registry cashiers. These data are automatically collected by the Tax Authority in accordance with tax law for all retail purchases made in Slovakia. The data were provided for the purposes of this research under contractual terms by the Institute for Financial Policy (IFP) of the Ministry of Finance of the Slovak Republic (MFSR). The IFP provided the database aggregated to the item level, derived from the individual cashier data for each month. The data included products that can be in general described as HTPs, manufactured cigarettes, e-cigarettes, e-liquids, and nicotine pouches. The monthly data for the identified abovementioned product types, which were made available for the research, cover the period from January 2022 to June 2025, with a total of almost 10 million entries of more than 400 thousand unique items. The data include information on item name, number of units sold, total price of the sold units, and the month and place of sale. After cleaning, the number of entries used for analysis was 8.95 million.

Due to a lack of standardization in item naming, it was expected that a certain proportion of total sales could not be identified, even if they were e-cigarettes, regular cigarettes, or other emerging nicotine products (mainly in cases when retailers decided to use generic names such as “Item #”). Despite this, the identifiable entries provided a robust indication of the development of aggregate smoking and nicotine demand on the local level. For this reason, the available scanner data were aggregated from identifiable entries to product type groups, including manufactured cigarettes and emerging nicotine products, to the district level, to 71 Slovak districts and 2 large cities (Bratislava and Kosice). By this approach, the analysis was based on a panel dataset with the time dimension of at least 42 months and spatial dimension of 73 districts. This panel dataset was subsequently augmented by district-level consumer characteristics of unemployment and average income.

The available underlying database allowed us to look into the heterogeneity of consumption across Slovak districts for manufactured cigarettes and the different types of emerging nicotine products. For manufactured cigarettes, presented in Figure 2, there are some regional and geographical patterns visible. From a temporal point of view and importantly for public health demand for cigarettes, the consumption is decreasing (Institute of Financial Policy, 2026).

Figure 2. Number of cigarette packs (in units) sold per capita, annually

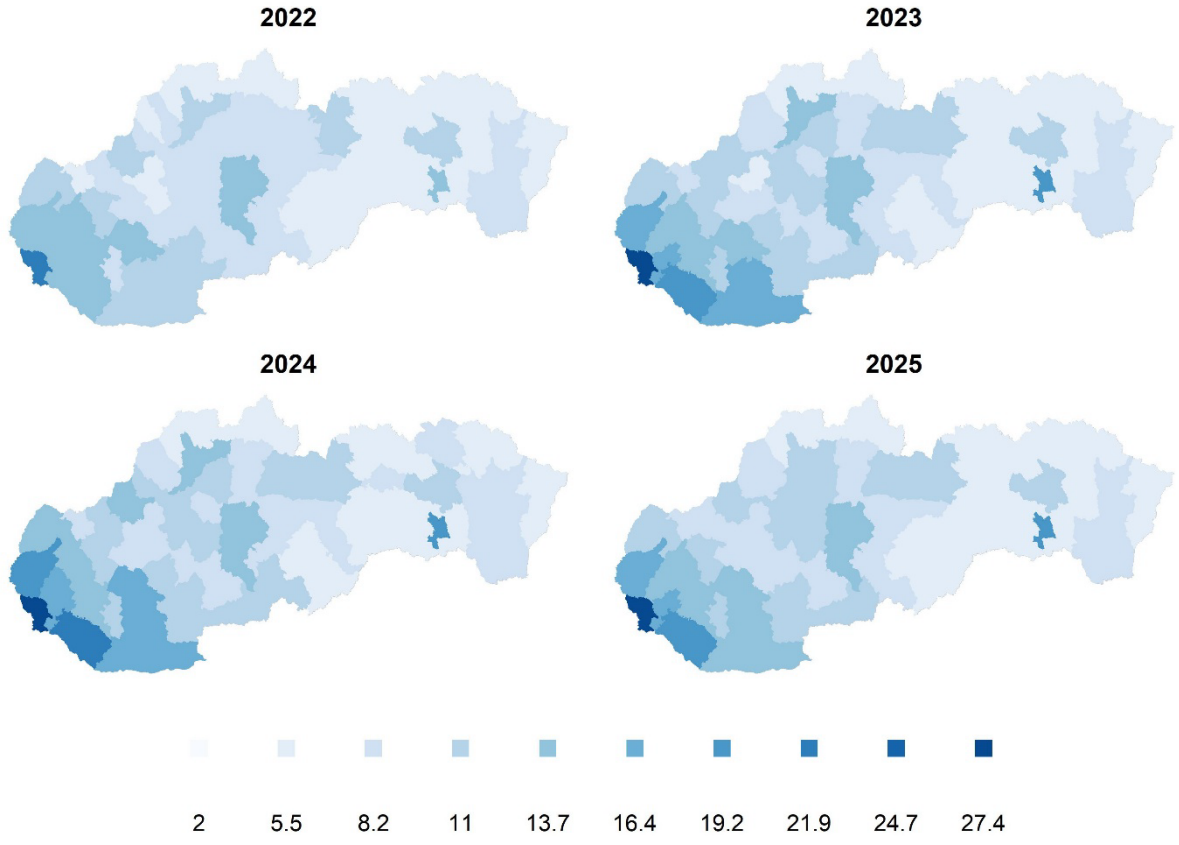


Source: Ministry of Finance SR, scanner data

From a spatial perspective, there is a clear east–west division. A much higher consumption in the bordering regions with Austria suggests the possibility of cross-border shopping (that is, Austrians crossing the border to buy cigarettes). On the other hand, lower consumption per capita on the Ukrainian border likely indicates the availability of cheaper cigarettes from Ukraine. Additionally, less affluent households in this area may be more likely to resort to the consumption of illicit products.[2]

[2] An above-average prevalence of counterfeit and contraband (C&C) cigarette was also estimated in 2018 for the eastern Slovak regions by the KPMG EU flows model 2014–2018 (for more details see https://public.tableau.com/views/CountryReport-TOUPLOAD/CountryTCInflowsandOutflows?%3Aembed=y&%3AshowVizHome=no&%3Adisplay_count=yes&%3Atoolbar=no#3). Specifically, NUTS3 Kosicky kraj and Presovsky kraj regions had 10.4 percent and 7.6 percent maximum shares of C&C, while the national average was five percent. The weighted average price (WAP) per pack in that year for Slovakia was 3.23 EUR, while for Ukraine it was 0.93 EUR.

Figure 3. Number of HTPs items (packs in units) sold per capita, annually



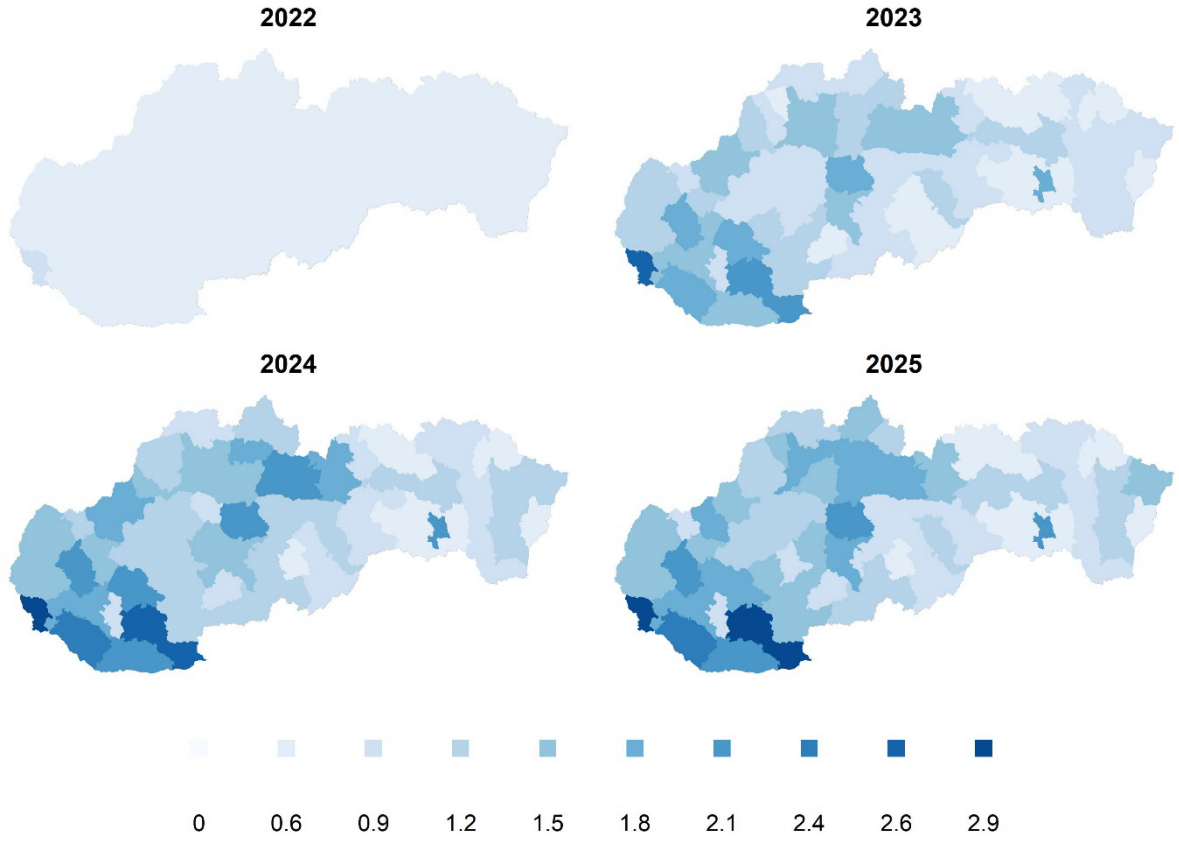
Source: Ministry of Finance SR, scanner data

Among emerging nicotine products, HTPs, as shown in Figure 3, appear well established in the market. However, some interesting spatial patterns are visible with the concentration of use in the larger cities and in the western (more developed) part of the country. Since 2023, only marginal differences in the penetration of HTPs across the territorial units are visible, which suggests that the natural market share might have been achieved. The availability of those products from retail points of sale was rather limited and only started to develop recently, with Japan Tobacco International entering with its Ploom brand in 2024 and the more aggressive marketing strategies of Philip Morris International's IQOS kiosks in shopping malls. These developments have made these products more accessible.

The data tell a slightly different story when it comes to the sales of e-cigarettes, which are depicted in Figure 4. In 2022, the sales volume per capita was very low across the country, suggesting very low uptake or higher utilization of e-commerce channels in purchasing these products. Although, single-use disposable e-cigarettes and reusable e-cigarettes are not distinguished due to the information not always being available, sales captured by the retail scanner data remain relatively low in 2025 compared with those for manufactured cigarettes

and heated tobacco products. However, from a spatial perspective the regional differences in the use of those products in 2025 resembles the patterns of HTP use, suggesting that those products might act as substitutes in the coming years.

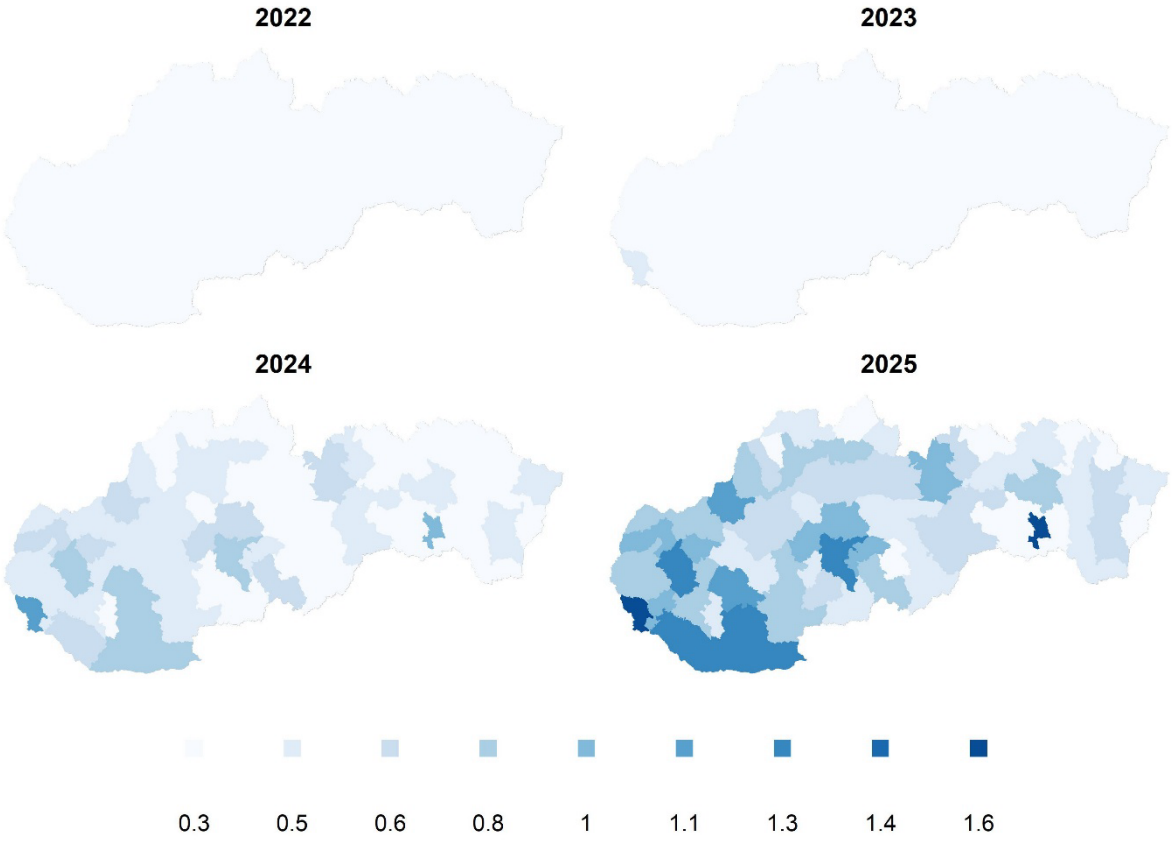
Figure 4. Number of e-cigarettes items (in units) sold per capita, annually



Source: Ministry of Finance SR, scanner data

The pattern observed for e-cigarettes (Figure 4) is to a degree mimicked by the sales of e-liquids presented in Figure 5. This category includes bottled liquids containing nicotine as well as pre-filled replacement pods, which are sealed from outside manipulation, for various vaping systems. Although the sales of e-liquids appear to be far more concentrated in several distinct metropolitan regions than the sales of e-cigarettes, the highest volume of sales of e-liquids captured by the data is only a fraction of the volume of e-cigarettes sold.

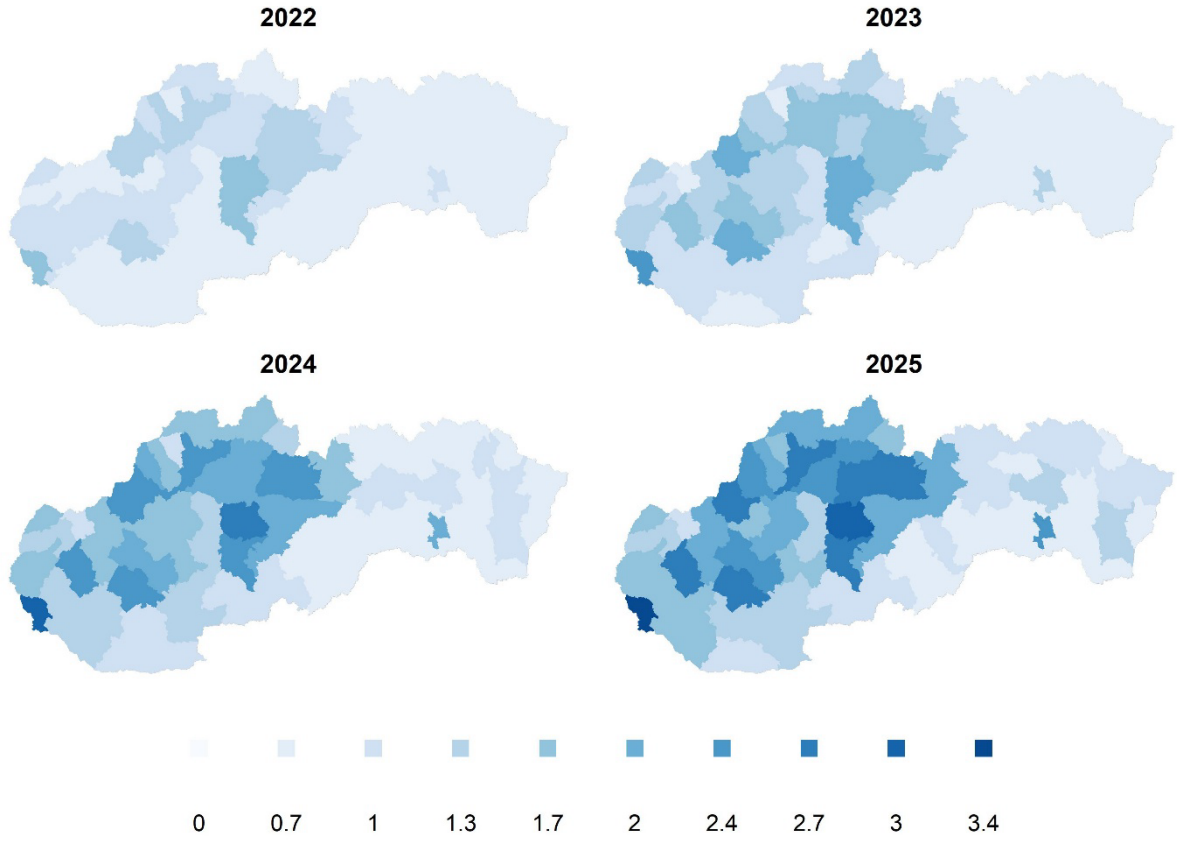
Figure 5. Number of e-liquids (in units) sold per capita, annually



Source: Ministry of Finance SR, scanner data

A rather different situation is discernible for nicotine pouches, presented in Figure 6. Apart from substantially high sales in regions containing major cities in Slovakia, nicotine pouch sales are more clustered in the central north-west region, regardless of the urbanicity of the area. The observed development might indicate a different direction of cross-border shopping within the districts bordering common European market countries. The users in southern regions might prefer to make their purchases in Hungary, while northern regions might be a potential destination of cross-border shopping from Poland. Similar to e-cigarettes and e-liquids, the sales of nicotine pouches dramatically increased in the observed period, especially after 2023.

Figure 6. Number of nicotine pouches (in units) sold per capita, annually



Source: Ministry of Finance SR, scanner data

Due to the dramatic shifts in the marketplace, the co-existence of online sales that lead to questioning the observed market shares, and the low volume of per-capita sales of e-cigarettes and e-liquids captured by the registry cashiers, combined with potential bias stemming from non-standardized retailer-reported information (such as incomplete or uncertain product classification), the underlying data for the presented period were considered unreliable for elasticity estimation. Therefore, only HTPs, manufactured cigarettes, and nicotine pouches were examined in terms of their own- and cross-price elasticities.

Methods

Following Stoklosa et al. (2016), we estimated the own- and cross-price elasticities of demand for HTPs, manufactured cigarettes, and nicotine pouches at the district level of Slovakia. From a methodological point of view, fixed-effects models like those used by Stoklosa et al. (2016) and Diaz et al. (2025) are used in the following form:

$$\ln(sales_{piym}) = \beta_0 + \beta_1 \times \ln(price_{piym}) + \beta_2 \times \ln(price_{qiym}) + \mathbf{X}_{iym}\boldsymbol{\gamma} + \delta_i + \rho_y + \theta_m + \varepsilon_{ptym}$$

where β_0 is the intercept, δ_i represent region fixed effects, ρ_y are year fixed effects, θ_m are month fixed effects, and ε_{pit} is an idiosyncratic error term. As the dependent variable, we used per capita volumes sold of product *p* in the month *m*, year *y*, within the region *i*. Put differently, the explained variable is the number of units of the product *p* sold (and captured by the registry cashiers) monthly in a particular region divided by the total regional population in a given month. The explanatory variables of primary interest are in case of each examined product *p* the average sale price of the respective product *p* and, subsequently, the average sale prices of the considered product *q* in the month *m*, year *y* within the region *i*. The estimated coefficient β_1 represents own-price elasticity of demand for product *p* and coefficient β_2 represents cross-price elasticity of demand for product *p* to the change in price of product *q*. The model specification includes a vector of control variables *X*, consisting of median wage at regional level and regional unemployment, serving as a measure of regional conditions.

Results

In this section, we present the results of the preliminary estimates for the own- and cross-price elasticities of emerging nicotine products and cigarettes and accompanying covariates, including average regional wages as a proxy for income, which also allows us to quantify corresponding budget elasticity. The results of the fixed-effect model for each examined product per capita demand, which take into account potential cross-price elasticities, are presented in Table 2 below.

The own-price elasticity of demand for all presented products (HTPs, manufactured cigarettes, and nicotine pouches), appears to be, as one would expect, negative and below unity. However, the corresponding parameters are statistically significant at the five-percent level only in the case of HTPs and manufactured cigarettes. In this regard, the demand for manufactured cigarettes is the most sensitive to their own-price changes. The results for own-price elasticity for nicotine pouches was negative, however not significant. Findings should be taken with a large degree of caution as it will most likely require further investigations in the form of model specification variations and changes of the temporal dimension of the underlying data to prove the validity of the results.

Table 2. Own- and cross-price elasticities of examined product demand

Independent/Dependent variable	**HTPs**	**Cigarettes**	**Nicotine pouches**
HTPs price	***-0.325******	**0.656*****	0.300
	(0.111)	(0.063)	(0.235)
Cigarettes price	0.177	***-0.448******	-0.575**
	(0.114)	*(0.065)*	(0.228)
Nicotine pouches price	0.309**	0.029	*-0.245*
	(0.138)	(0.079)	*(0.249)*
Income	**0.315*****	**0.225*****	**0.578*****
	(0.066)	(0.044)	(0.137)
Unemployment rate	-0.214**	-0.116**	0.037
	(0.098)	(0.051)	(0.167)
obs.	2807	2807	2807
Adj. R^2:	0.97	0.936	0.967

*Note: Significance of corresponding parameter at 0.1, 0.05, and 0.01 level is indicated by *, **, and ***, respectively. Own-price elasticities are highlighted using italics. Bolded entries are significant at the one-percent level.*

The mirroring estimates of cross-price elasticity are somewhat consistent for the relationship between HTPs and manufactured cigarettes and the relationship between HTPs and nicotine pouches, suggesting that these products are economic complements. However, in the case of the relationship between HTPs and manufactured cigarettes, the elasticity is statistically significant at the five-percent level only in the case of manufactured cigarette demand. In other words, there is no evidence that a change in the price of manufactured cigarettes would affect the demand for HTPs (in contrast to the results obtained by Dauchy & Shang, 2024). Similarly, the parameter of nicotine pouch prices is statistically significant when modelling HTP demand, while the HTP price parameter is statistically not significant for the nicotine pouches' demand.

Lastly, the parameters of the relationship between manufactured cigarettes and nicotine pouches differ in signs, which implies an asymmetric relationship between the two. Such

incongruity in associated estimates is not unique and was already reported by Huang et al. (2021) for the relationship between nicotine gums and patches. However, since only the cigarettes' cross-price elasticity of the nicotine pouches' demand is statistically significant, there is not enough evidence to suggest that nicotine pouch pricing has an effect on cigarette demand. Therefore, the interpretation is that cigarettes are economic complements for nicotine pouches, but not the other way around.

Regarding the additional control variables, the estimated parameter for average income indicates positive and statistically significant associated budget elasticity. On the other hand, an increase in the district-specific unemployment rate appears to have a statistically significant negative effect on the demand for manufactured cigarettes and HTPs. In the case of nicotine pouch demand, the parameter for the unemployment rate is statistically insignificant. The most sensitive to income changes appear to be nicotine pouches, although all product demand budget elasticities are positive—that is, they can be considered ordinary goods. Furthermore, the demand for HTPs and manufactured cigarettes decreases with increasing district unemployment rates.

Conclusions

The performed analysis of cross-price elasticities among cigarettes and emerging nicotine products on the Slovak market indicates that there is a one-directional relationship among all three examined products. First, nicotine pouches are viewed as economic substitutes for HTPs. Second, HTPs are regarded as economic substitutes for manufactured cigarettes. Lastly, manufactured cigarettes are treated as economic complements for nicotine pouches. Interestingly, the reciprocal (bidirectional) relationship was not confirmed in any of these cases.

These results show that the sales of manufactured cigarettes, HTPs, and nicotine pouches are not independent from each other, as there is evidence of at least a circular network of one-directional price responses. This finding is important for policy makers aiming to curb the consumption of particular products, as it shows that individual products can react to changes in prices in the broader smoking and emerging nicotine product market.

Results regarding the regional differences in the levels of the average income suggest that all examined smoking and emerging nicotine products (manufactured cigarettes, HTPs, and nicotine pouches) are ordinary goods. This implies that an isolated increase in real income would, on average, result in an increase in the consumption of all of the examined products. If the aim of policy makers is to limit the proliferation of any of these products, then this finding

can be viewed as a potential justification for steering the prices of corresponding products by the means of related excise duty increases.

There are some limitations of the research that need to be considered. Among the main limitations stands the utilization of a panel that over the whole period covered includes also periods with very low uptake and also spatial variability. This might be a result of Slovakia potentially being a very immature market with emerging nicotine products, where additional factors such as marketing campaigns play a key role in determining demand. Alternative model specifications need to be tested to get more a robust understanding of the underlying relations among the emerging nicotine products on the Slovak market. Finally, data need to undergo thorough cleaning and classification processes to ensure the validity of the obtained results. This step is nevertheless complicated by the lack of standardization in the registry cashier receipt information, as well as with rapid development on the supply side of the emerging nicotine products (such as naming conventions, new products, or promotional bundles). However, the partial data cleaning already performed affected the resulting estimates only marginally.

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Appendix

Alternative estimates of own-price elasticities

The results of the fixed-effect model for each examined product per capita demand, which disregard any cross-price elasticities, is presented in Table A1 below.

Table A1. Own-price elasticities of examined products demand

Independent/Dependent variable	*HTPs*	*Cigarettes*	*Nicotine pouches*
HTPs price	*-0.089*		
	(0.077)		
Cigarettes price		*0.223****	
		(0.056)	
Nicotine pouches price			*-0.303*
			(0.242)
Income	0.285***	0.377***	0.578***
	(0.070)	(0.048)	(0.140)
Unemployment rate	-0.190**	-0.104**	0.017
	(0.094)	(0.048)	(0.163)
obs.	2808	2808	2807
Adj. R^2:	0.969	0.934	0.967

*Note: Significance of the corresponding parameter at 0.1, 0.05, and 0.01 level is indicated by *, **, and ***, respectively. Own-price elasticities are highlighted using italics.*

The most noticeable differences in the estimated parameters capturing own-price elasticities between Table 2 and Table A1 are for the manufactured cigarette demand. When disregarding the cross-price elasticities, the own-price elasticity of cigarette demand is positive and highly statistically significant. The differences for the own-price elasticities of HTP and nicotine

pouches demands are less prominent. However, the obtained parameters are no longer statistically significant at the five-percent level. Regarding the parameters for average income and unemployment rate, the conclusions reached would remain qualitatively the same as in the case of the models taking into account cross-price elasticities.

In regard to the explanatory power of the estimated models, the decrease in the adjusted coefficients of determination for models not accounting for cross-price elasticities appear to be marginal.