

Conference Proceedings

DOKBAT

**14th Annual International Bata Conference
for Ph.D. Students and Young Researchers**



International Bata Conference

**Tomas Bata University in Zlín
Faculty of Management and Economics
Mostní 5139 – Zlín, 760 01
Czech Republic**

THE EXISTING CORRELATION BETWEEN THE CPI OF OTC DRUGS AND OTHER GOODS AND SERVICES

Eva Loubalová

Abstract

This paper examines the link between the consumer price index (CPI) of over-the-counter (OTC) drugs and other goods and services in the Czech Republic. Private label OTC drugs have been sold on the Czech market since 2013. Taking their brief historic overview into consideration, their advantage is a lower price compared to OTC brand drugs. A lower price should produce a greater benefit over time in the period of an increasing CPI, especially the CPI of categories with the highest weight. To discover if there is a relation between the OTC drug category and some of the highest weight categories, a linear correlation analysis among CPI variables was used. Although the results indicate that the CPI of OTC drugs correlates with the CPI of some of the categories with the highest weight, it is not a general rule applicable to all categories. The inverse relation appears in the categories of communication, transport, prescription drugs, food and non-alcoholic beverages and furnishings, household equipment and routine maintenance of the house. According to these results, consumers tend to pay less for the OTC drugs in the periods of time when they pay more for the categories mentioned above. Contrarily, a correlation with miscellaneous goods and services, alcoholic beverages and tobacco, restaurants and hotels, education, clothing and footwear and recreation and culture exists. After linking these results with the weight of individual categories, the results confirmed that the inverse relationship shows up in the category of food and non-alcoholic beverages and transport category and vice versa mainly in the category of alcoholic beverages and tobacco. However, considering the success of the private label products in other categories private label drugs have potential on the Czech market regardless if there is an increase in CPI or not.

Keywords: over-the-counter (OTC) drugs, consumer price index (CPI), private label brands, linear correlation, economics, health expenditure

1 INTRODUCTION

In this paper the analysis of the Czech Republic's Consumer Price Index within the context of OTC drugs was performed. More specifically the linear correlation between the OTC drugs category and other goods and services was applied. The first stage of the correlation analysis provided results about the existing correlation among the categories within CZ-COICOP. The follow-up analysis then indicated if there is a relation between the resulting correlation coefficients and the weight of particular categories in the consumer basket.

Based on the previous research elaborated in the detail in the theoretical background, many prices of goods and services interact with each other. If one category changes, another category have also tendency to change.

This leads us to hypothesize the following:

H1: There is an inverse linear relationship between the consumer price index (CPI) of OTC drugs and the categories with the highest weight in the COICOP calculation.

The identification of consumer motivators for OTC drug purchases is strongly related to the price level of a given category, other goods and services. Therefore, this paper has a detailed focus on the CPI methodology within the category of health.

1.1 Theoretical Background

The first private label products were introduced in the Czech market in 1994 and since then they have seen a steep rise in consumer interest (Hesková, 2006). Since 2013 onwards, we can also find this increase among over-the-counter (OTC) drugs. In the literature, we can see the OTC abbreviation, which stands for "over the counter". According to Švihovec, J. (2000), in Czech terminology we can see the term medicine, which is not based on the prescription and is therefore freely available. We can include OTC human medicines, traditional herbal preparations, homeopathics, nutritional supplements (vitamins, minerals, probiotics, fatty acids, amino acids), parapharmaceuticals (medical cosmetics, special nutrition), medical devices and biocidal products. It should be noted that the classification of the preparations may vary from country to country depending on the composition and the applicable local legislation.

Dr. Max and Benu pharmacies pertain among the largest vendors of OTC private label drugs on the Czech market. Both brands have shown an increase in sales of their private label products. In case of Dr. Max, sales grew by 230% in 2014 and accounted for 15% of the total turnover. In case of Benu, it is a 437% increase in sales and a 2% turnover share (Hrdličková, & Bednařík, 2014). In their portfolio, Dr. Max pharmacies have over 200 and Benu pharmacies own over 40 private label products (Čechová, 2013). Private brands such as Dr. Max, My Pharmacy, Benu, Nuance, Equilibria, Amilk Bifido can be found in their portfolios. The most common representatives of OTC private label drugs are vitamins, dietary supplements, teas, pregnancy tests and cosmetics. In contrast to prescription drugs, the OTC drug category is specific due to the full decision-making power of the consumer. In addition, OTC drugs are often not covered by health insurance, so patients must pay for them. Contradictory to the above, price influences the decision-making process when buying OTC drugs (Wieringa, 2015). This is confirmed by Zhou et al. (2012), who mentions that price is one of the most important motivators for purchasing private label OTC products. Gönül (1999) indicates that shoppers have price expectations for OTC drugs, which are mainly based on their previous purchases of OTC drugs. The low-price sensitivity connected to the demand for OTC drugs is also confirmed by Akçura et al. (2004). Price is an important indicator of quality, especially if other qualitative indicators are missing. As a result, shoppers tend to choose more expensive OTC drugs. In the minds of consumers, private label products have been the symbol of lower prices redeemed by lower quality goods (Thomassen, Aconis, & Lincoln, 2009).

The pharmaceutical market is on the rise and with 7.5% growth rate of OTC drugs plays a crucial role for private brands (Akçura, Gönül, & Petrova, 2004; Narayanan, & Manchanda, 2007). The increase is caused by the fact that most patients use food supplements in parallel with the prescription drugs. 86% of Czech consumers buy food supplements, and 64% of them believe in their positive health effects (Sadílek, 2016).

Taking the prescription drugs as well as OTC drugs into account, data from SÚKL (2014-2017) suggests that 264.23 million packages of pharmaceuticals were delivered to pharmacies, healthcare establishments and retailers of the drugs in 2014 in the Czech Republic. From financial value point of view, the value of the pharmaceuticals reached 55.45 billion CZK. In 2015, both delivered packages (+ 1.10%) and financial value (+ 9.77%) increased. On the other hand, 2016 meant a slight decline in both indicators (-2.37%, -3.71%). However, the growth was resumed in 2017, delivering 262.48 million packages of pharmaceuticals (0.64% increase) worth 67.87 billion CZK (5.56% increase). The financial value is not calculated based on the price for the final consumer, taking the changing amount of VAT and trade surcharges over the years into consideration.

According to the amount of money spent on health products and services (CSO, 2017), household expenditures for health care amounted to 45 billion CZK in 2015, equivalent to 2.1%

of total household expenditures. A 27% share of healthcare spending falls under OTC drugs. On average, each inhabitant of the Czech Republic spent 1 161 CZK on OTC drugs in 2015. The Czech Statistical Office further includes the direct household costs for health care regarding this data. On the other hand, payments that are reimbursed have been excluded (e.g. reimbursement from health insurance companies when paying for urgent health care abroad).

As Gao (2013) mentions, in a real economic system, many prices of goods and services interact with each other. Changes in one tend to drive changes in another. The assumption is that if consumers need to pay more for the goods and services with the highest share in the Czech Classification of Individual Consumption by Purpose (CZ - COICOP) calculation, they tend to pay less for OTC drugs.

Since 2016, the price reference period of December 2013 for the price indices was changed to December 2015. As of January 2017, they have been linked together for all levels of the consumer basket with a base average of 100 since 2015.

According to the methodological manual of the CPI (2017) issued annually by the Czech Statistical Office, drugs are divided into prescription and OTC drugs within the COICOP at the 4th international classification level. The first group includes drugs that must be prescribed by a physician and are fully or partially reimbursed to patients. The second group contains drugs at full cost. The weight of these groups is based on household account statistics corrected by national accounts data. There are about 50 000 different drugs registered in the Czech Republic, which makes the selection of specific price representatives difficult, in relation to their relatively low weight in the consumer basket. Therefore, since 2011, a sub-index of both groups of drugs has been introduced into the consumer basket. The basis for calculating these two sub-indices is price or a surcharge survey of prescription drugs. This includes the prices of OTC drugs sold by pharmacists in all regional cities. The selection of specific representatives was made on the basis of the data of the State Institute for Drug Control, which keeps a register of drugs offered on the Czech market (as well as the volume of their supplies). According to the list of the most frequently sold drugs, specific types of drugs were selected for a price survey and their weight was determined. In addition, the calculation of the price/surcharge index of the 2 500 most distributed medicines in terms of the number of packages and 2 500 more medicines in terms of their value is completed each month.

690 price representatives are included in the consumer basket and 18 representatives pertain to the health category. The weight of the whole category is 2.3% (2014). The list of representatives within the category of OTC drugs (06.112) can be seen in Table 1.

Table 1: A Set of OTC Drug Representatives. Source: CSO, 2017

06.112	OVER-THE-COUNTER (OTC) DRUGS
06.112.01	ACYLPYRIN
06.112.02	ATARALGIN
06.112.03	PARALEN 500
06.112.04	CILKANOL
06.112.05	BROMHEXIN
06.112.06	CELASKON 250
06.112.07	B KOMPLEX FORTE LÉČIVA

06.112.08	PHARMATON GERIAVIT
06.112.09	IBALGIN 400
06.112.10	VITAMÍNOVÉ ŠUMIVÉ TABLETY
06.112.11	FAKTU
06.112.12	COLDREX HORKÝ NÁPOJ
06.112.13	OLYNTH 0.1% DOSIERSPRAY
06.112.14	VALETOL
06.112.15	MODAFEN
06.112.16	MUCOSOLVAN
06.112.17	WOBENZYM DRG 200
06.112.19	OSCILLOCOCCINUM GLO 6X1GMO
06.112.20	GS CONDRIO FORTE
06.112.21	VOLTAREN EMULGEL
06.112.22	ACC LONG
06.112.23	KORYLAN

2 METHODS

In order to discover the relation between the CPI of these categories in the Czech Republic, CPI data from the Czech Statistical Office database was used. The existence of a linear correlation among the CPI variables was tested on the data from November 2013 to March 2017.

2.1 Time and Location Determination

To test the relation between the CPI of OTC drugs and the other categories, data provided by the Czech Statistical Office (CSO) was used. The data spanned over a period of 41 months (from November 2013 to March 2017) when the Czech National Bank performed foreign exchange interventions as part of their exchange rate commitment (CNB, 2017). The data was collected only from pharmacies in the Czech Republic.

2.2 Variable Definition

Thirteen independent variables according to the CZ - COICOP classification based on the international COICOP were used in this test. The categories are food and non-alcoholic beverages, alcoholic beverages and tobacco, clothing and footwear, housing, water, electricity, gas and other fuels, furnishings, household equipment and routine home maintenance, prescription drugs (a health subcategory), OTC drugs (another health subcategory), transport, communication, recreation and culture and education.

2.3 Data Processing

The data was analysed by employing a correlation analysis. A correlation analysis means finding any kind of relation among the categories. If one of them changes, the other one changes

and vice versa. If there is a correlation between the two processes, it is likely that they depend on one another, but it can not be concluded that one of them has to be the cause and the second one has to be the effect. However, before initiating the correlation analysis, it was necessary to clear the time series of the individual categories from the overall trend. The problem of measuring the relation of the time series lies in the relation of their real values. This is a relation seemingly caused by their trend and seasonal similarity. After this indispensable adjustment, the correlation coefficients of the categories, with a special emphasis on the category of OTC drugs, could be tested. The correlation coefficients, the results of this analysis, are denoted in Table 2.

Table 2: The Value of the Correlation Coefficients of Each Category. Source: Own Calculations

	Food and Non-Alcoholic Beverages	Alcoholic Beverages and Tobacco	Clothing and Footwear	Housing, Water, Electricity, Gas and	Furnishings, Household Equipment and Routine	Prescription Drugs	Over-the-Counter Drugs	Transport	Communication	Recreation and Culture	Education	Restaurants and Hotels	Miscellaneous Goods and Services
Food and Non-Alcoholic Beverages	x	-0.7	-0.65	-0.48	0.27	0.48	-0.71	0.67	0.56	-0.56	-0.67	-0.47	-0.68
Alcoholic Beverages and Tobacco	-0.7	x	0.5	0.09	-0.63	-0.8	0.83	-0.9	-0.85	0.48	0.67	0.79	0.78
Clothing and Footwear	-0.65	0.5	x	0.46	-0.19	-0.39	0.59	-0.54	-0.47	-0.12	0.7	0.4	0.63
Housing, Water, Electricity, Gas and	-0.48	0.09	0.46	x	0.35	-0.3	0.15	-0.39	0.11	0.09	0.41	-0.11	0.32
Furnishings, Household Equipment and Routine	0.27	-0.63	-0.19	0.35	x	0.33	-0.45	0.38	0.81	-0.15	-0.42	-0.87	-0.29
Prescription Drugs	0.48	-0.8	-0.39	-0.3	0.33	x	-0.75	0.86	0.64	-0.46	-0.5	-0.58	-0.74
Over-the-Counter Drugs	-0.71	0.83	0.59	0.15	-0.45	-0.75	x	-0.8	-0.84	0.5	0.65	0.73	0.9
Transport	0.67	-0.9	-0.54	-0.39	0.38	0.86	-0.8	x	0.71	-0.49	-0.69	-0.66	-0.83
Communication	0.56	-0.85	-0.47	0.11	0.81	0.64	-0.84	0.71	x	-0.39	-0.59	-0.92	-0.7
Recreation and Culture	-0.56	0.48	-0.12	0.09	-0.15	-0.46	0.5	-0.49	-0.39	x	0.12	0.28	0.39
Education	-0.67	0.67	0.7	0.41	-0.42	-0.5	0.65	-0.69	-0.59	0.65	x	0.28	0.39
Restaurants and Hotels	-0.47	0.79	0.4	-0.11	-0.87	-0.58	0.73	-0.66	-0.92	0.73	-0.66	x	0.39
Miscellaneous Goods and Services	-0.68	0.78	0.63	0.32	-0.29	-0.74	0.9	-0.83	-0.7	0.9	-0.83	0.39	x

Miscellaneous	-0.68	0.78	0.63	0.32	-0.29	-0.74	0.9	-0.83	-0.7	0.39	0.7	0.57	x
Restaurants and Entertainment	-0.47	0.79	0.4	-0.11	-0.87	-0.58	0.73	-0.66	-0.92	0.28	0.66	x	0.57
Educational	-0.67	0.67	0.7	0.41	-0.42	-0.5	0.65	-0.69	-0.59	0.12	x	0.66	0.7

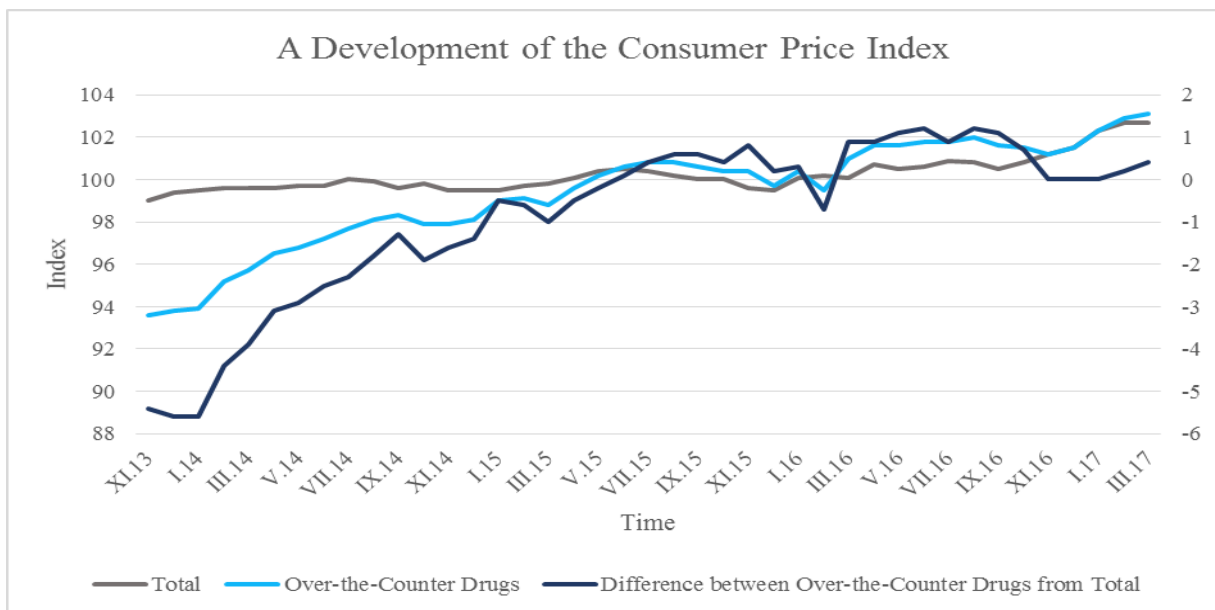
This study aimed to define and quantify the relation of particular CPI categories. Therefore, the correlation coefficients were used to represent the correlation degree between the CPI of the categories. The correlation coefficient, also known as the Pearson correlation coefficient, is an indicator that measures the degree of correlation between changing trends of variables, with a range of $[-1,1]$. According to Pearson (1895), the higher the absolute value of the correlation coefficient, the greater the degree of correlation between the variables.

3 RESULTS

Consumer price index (CPI) measures changes in the prices of goods and services consumed by households. The changes in the prices affect the real purchasing power of consumers. If the CPI of one category increases, it means that consumers are forced to spend more money on the same volume of goods and services, which they may subsequently miss in another category. By increasing the real prices of the categories that have a higher share of the CPI, consumers may tend to reduce the amount of money that was originally intended to be spent on other (dispensable) categories. During this period of time, there may be potential for the purchase of private label OTC drugs.

As it can be seen in Figure 1, both total CPI as well as the OTC drug CPI increased (from November 2013 to March 2017). However, the CPI growth rate of OTC drugs was higher and it even exceeded the total CPI in mid-2015.

Figure 1: The CPI - OTC Drugs (November 2013 – March 2017), year 2015 = 100. Source: CSO, 2017 and Own Calculations



After removing the overall trend from each category, the data was subjected to a correlation test among the individual categories. The results of this statistical analysis are shown in Table 2. In the first column of the table, the individual CPI sections are found. From the health section, there is only prescription drug subcategory. The second column shows the resulting correlation coefficients based on the correlation analysis between the OTC drugs category and the remaining categories. The categories with the highest value of the coefficient (meaning the categories with the highest mutual positive relationship) are highlighted in green. On the other hand, the categories with the lowest value of the coefficient (meaning the categories with the highest inverse relationship) are highlighted in red. In the third column, the weight of the individual categories in the CPI index, based on the household account statistics corrected by national accounts data, are shown. Again, here is the rule that green colour means higher values (the categories with the largest weight in the CPI calculation), in other words the categories the average Czech household spends the most money on and the red colour means the opposite. The results indicate the existing anti-correlation between the CPI of the OTC drugs category and categories of communication, transport, prescription drugs, food and non-alcoholic beverages and furnishings, household equipment and routine home maintenance.

This means that there is an inverse linear relationship between the average price that Czech households spent on OTC drugs and the average price that Czech households spent on the mentioned categories.

Table 2: The Value of the Correlation Coefficients between OTC Drugs and Other Categories and the Weight of the Particular Categories in the CPI Calculation. Source: CSO, 2017 and Own Calculations

	Correlation Coefficient	Category Weight
Food and Non-Alcoholic Beverages	-0.71	180.6
Alcoholic Beverages and Tobacco	0.83	93.4
Clothing and Footwear	0.59	39.2
Housing, Water, Electricity, Gas and Other Fuels	0.15	251.3
Furnishings, Household Equipment and Routine Maintenance of the House	-0.45	57.8
Prescription Drugs	-0.75	not available
Transport	-0.80	100.9
Communication	-0.84	30.7
Recreation and Culture	0.50	89.6
Education	0.65	6.2
Restaurants and Hotels	0.73	58.1
Miscellaneous Goods and Services	0.90	69.2

When the results of the correlation coefficients in the OTC drug category were compared to the shares of individual categories in total CPI, no rule was found that would support the hypothesis

of this paper. The hypothesis that there is an inverse linear relationship between the consumer price index (CPI) of OTC drugs and the categories with the highest weight in the COICOP calculation was rejected.

4 CONCLUSIONS

The present paper introduces CPI in the Czech Republic from private label drugs point of view. The existing literature highlights the positive trend that private label products are currently experiencing. Their market share is steadily increasing, even in the health category. Private label products are represented in the health category mainly by OTC drugs. Together with rising pharmaceutical industry this area reveals a strong potential for the future development.

While more expensive private label products (compared to national brands) began to appear, private label products with a lower price still dominate on the Czech market including the health category. Therefore, this research addressed the question whether in a situation when consumers are forced to spend more of their budget for the categories that have the highest weight in the consumer basket, it will affect their spending for the category of OTC drugs. If so, it could uncover the potential for OTC private label drugs. In order to achieve the desired results, the CZ – COICOP data from the Czech Statistical Office was used applying the correlation analysis. The largest share belongs to the category of housing, water, electricity, gas and other fuels, category of food and non-alcoholic beverages, followed by transport category.

In conclusion, to answer the question of whether there is an existing correlation between OTC drugs and other categories of goods or services, this research investigated the mutual influence of the CZ – COICOP categories. The findings suggest that there is an anti-correlation between OTC drugs and categories of communication, transport, prescription drugs, food and non-alcoholic beverages and furnishings, household equipment and routine maintenance of the house. The anti-correlation indicates that there is an inverse relation between the price that consumers pay for these categories and the price that consumers pay for the category of OTC drugs. On the other hand, there appears to be a correlation with miscellaneous goods and services, alcoholic beverages and tobacco, restaurants and hotels, education, clothing and footwear and recreation and culture.

Nevertheless, the hypothesis that there is an inverse linear relationship between the consumer price index (CPI) of OTC drugs and the categories with the highest weight in the COICOP calculation was finally rejected. Although there is an inverse relation between the correlation coefficient of the OTC drugs category and some of the categories with the highest weights, it is not a general rule applicable to all categories. The inverse relationship is visible in the category of food and non-alcoholic beverages (180.6 category weight) and transport category (100.9 category weight). On the contrary, the strong relation appears mainly in the category of alcoholic beverages and tobacco (93.4 category weight).

Therefore, this data examination has not uncovered an obvious rule applying to all categories and clearly predicting the future success of OTC drugs sales when consumers are forced to allocate a significant proportion of their budget to other areas. However, these findings are preliminary and future study shall examine consumer motivators (not only price) for purchasing private label OTC drugs in detail.

4.1 Limitations and Future Research

The limitations of this study should be noted. Firstly, the results of this paper only include data from the Czech market. Possible follow-up research could expand on an international level. Secondly, future research could focus on different periods of time, possibly without the Czech

National Bank foreign exchange interventions. Finally, a deeper look into similar existing research in other countries and markets could also further improve future studies in this field.

Acknowledgment

The author would like to thank the Internal Grant Agency of FaME for providing financial support to carry out this research. Funding was extended through: TBU No.IGA/FaME/2018/002 - Using of Marketing 4.0 principles for customer relationship management in the Czech Republic.

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Contact Information

Ing. Eva Loubalová
Tomas Bata University in Zlin, Faculty of Management and Economics
Mostni 5139, 760 01 Zlin
University: +420 576 032 120
Eva Loubalova: +420 737 864 879
Eva.loubalova@seznam.cz
ORCID: 0000-0003-3997-338X

DOI ID: <https://www.doi.org/10.7441/dokbat.2018.15>