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# THE IMPACT OF RETAIL REGULATION ON CONSUMER PRICES

This paper studies the impact of the regulation of the retail sector on competition and consumer prices. We first perform an international analysis using OECD data. Our findings indicate that there is correlation between changes in retail regulation and changes in food prices, which suggests that regulation has an impact on competition between companies, and in turn has an impact on consumer prices. After this we look at two specific regulatory measures: the Sunday shopping ban and the regulation restricting the building of new stores with large floor area (known in Hungary as the "plaza-stop" act). In our study we analyse the average consumer price changes of 17 food products between 2006 and 2017 based on monthly data using FGLS panel regression method. Our findings show that the compulsory Sunday closing had no significant impact on consumer prices during the one year the regulation was in effect. On the other hand, modern retail formats and the penetration of international chains significantly reduced consumer prices. Based on this result, establishing entry barriers in retail had an unfavorable effect on consumers materializing in higher prices.

## INTRODUCTION

Only a couple of sectors are as heterogeneous as retailing. Retail outlets range widely from the corner shop operated by one family to hypermarkets employing 800 staff. In this sector one can find sole traders, domestic small and medium-sized enterprises as well as international corporations. Additionally, the retail sector is constantly changing. In addition to the continued expansion of large store formats, e-commerce is rapidly growing as well. In such a dynamic business environment various external factors and state regulations can produce very different outcomes.

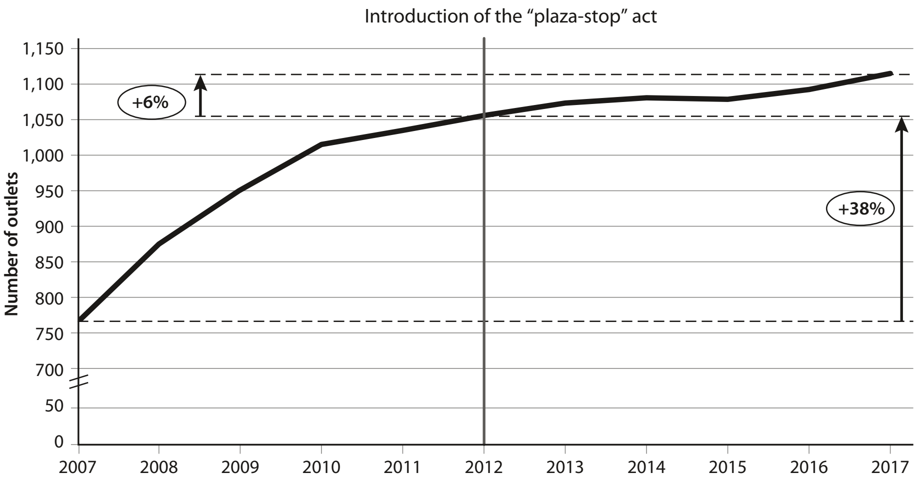
The retail sector is regulated in each and every developed country; however, to very different extent. The most typical arguments for the regulation of the retail sector are that it serves to protect the interests of consumers, employees and the environment, but in some cases the argument that small shops should be supported also appears.

The differences in the regulatory environment may have an impact on the structure, concentration and through this the competition between retailers in the given countries. And this ultimately manifests itself in consumer prices. The objective of our study is to examine and quantify these effects. For this purpose, we look at two aspects. First, we examine the correlation between retail regulation and consumer prices in OECD countries. This gives a general overview of what impact regulation can have. After this we look closely at two regulatory measures that had a profound impact on food retail in Hungary in recent years.

The government introduced the regulation that has become known in Hungary as “plaza-stop” act in 2012, which stipulated that a special permit was required for the construction of retail outlets with a floor area of more than 300 squaremeters. The regulation affected mainly foreign-owned retail chains as Hungarian-owned retailers were often granted exemption from the ban (*OECD* [2016]). This meant that it became very hard for modern retail chains to expand, and consequently their planned expansion slowed down significantly. *Figure 1* illustrates this well; it shows that the number of outlets practically stagnated after 2012. This is especially remarkable since even during the global economic crisis the number of retail outlets grew significantly, which was mainly due to the expansion of Aldi and Lidl. The “plaza-stop” regulation halted the expansion of mainly these two chains.

The second regulation we studied was the compulsory Sunday closing of retail outlets introduced in March 2015 and lifted one year later, in April 2016. This affected customers even more and run into considerable resistance. The regulation had a profound effect on the shopping habits of consumers, and impacted the competition between stores, as it reduced the time available for shopping by a whole day.

Examining these two regulations makes it possible not only to analyse the correlation between regulation and prices in general but distinguish the effects of different types of regulatory measures. On the other hand, we can also study the effects of the two types of regulation in relation to one another.




*Note:* Data show the total number of outlets of Tesco, Spar (not including franchise partners), Auchan, Penny Market, Lidl, Cora and Aldi.
*Source:* Based on annual top lists compiled by Trade Magazin (https://trademagazin.hu/en/kereskedelmi-toplistak/).

FIGURE 1 • **Total number of outlets belonging to modern food retail chains in Hungary**

In the next section we provide a literature review. Then the correlation between retail regulation and consumer prices is analysed in the OECD countries. This is followed by a brief description of the Hungarian retail sector. Next, we give an overview of the methods used in the analysis of the two regulatory measures presented above as well as the sources of data used. In the following section, we present the estimation results, and then we discuss them. Finally, we conclude the paper with a summary.

## LITERATURE REVIEW

Very few researchers have studied the relationship between retail regulation and prices. On the other hand, the expansion of modern retail formats (especially super- and hypermarkets as well as discount stores) and their effect on consumer prices have been studied extensively. In the following section we provide a summary of these two streams of literature.

### *The relationship between retail regulation and prices*

Every country regulates retail market activities to varying degrees, which affects competition in the sector as well. There are two methods to analyse the effects of these regulations: 1) empirical analysis of a regulatory change; 2) estimation of the effects using theoretical models (mainly game theory and industrial organization). As changes in regulations occur rarely, we are often left with the theoretical approach.

Two significant areas of state regulation are the imposition of restrictions on the opening of new stores and the limitation of the opening hours of existing ones. Based on empirical analyses the effect of regulation restricting the opening of new stores is clearly negative. *Schivardi–Viviano* [2011] has proved using Italian data that entry barriers in retailing are associated with larger retail profit margins and lower level of productivity of the incumbent firms. *Hoffmaister* [2010] came to a similar conclusion when he looked at the effects of barriers to entry regulations in Spain. A special permit from the administration of the autonomous region is required to open a large-format store in Spain. The governments of several regions issued only very few such permits in order to protect the interests of small local retailers. When analysing the effects of entry regulations in Sweden *Maican–Orth* [2015] found also that more liberal entry regulations increase the productivity of retailers, moreover the increase in productivity is larger for small stores and small markets than for larger ones.

Therefore, one unfavourable effect of regulation is price increase, while it does not even protect small local retail outlets, which could justify such regulations. *Sadun* [2015] who looked at the effect of entry barriers in the United Kingdom found that such restrictions, which were meant to protect independent retailers, actually harmed them. As the entry barriers prevented large retail chains from opening larger outlets, they invested in smaller and more centrally located formats, which competed more directly with independent shops.

The effect of regulating the opening hours is less obvious. The reason being that it creates two effects that act in opposite directions. The first one is that longer opening hours mean higher operating costs for retailers (e.g. more staff is needed, payment of shift allowance to employees). Based on these the liberalisation of opening hours increases prices. According to the theoretical analysis performed by *Wenzel* [2010] applying the Salop model, deregulation of the opening hours on the short term leads to no changes in either prices or the number of retailers. However, due to the cost of extended opening hours, prices increase whereas the number of retailers decreases, i.e. the industry becomes more concentrated. The findings of another theoretical analysis conducted by *Shy–Stenbacka* [2008] are quite similar: retailers with longer opening hours charge higher prices in the market equilibrium. The model developed by *Inderst–Irmen* [2005] shows that prices rise; however, they argue that it is caused by the increased differentiation of the stores, which reduces price competition. *Flores–Wenzel* [2016] have also found that prices increase, the reason being that with longer opening hours the demand of (at least one segment of) consumers increases, and increased demand in turn increases equilibrium prices.

On the other hand, longer opening hours give consumers more time to collect price information, which increases competition. According to the theoretical results of *Clemenz* [1990] and *de Meza* [1984] liberalisation leads to price reduction.

Similarly to the results of theoretical analyses, the findings of empirical studies do not show a uniform picture either. According to the results of the study conducted by *Tanguay et al.* [1995] after the deregulation of opening hours in Québec, the price level at shops with a large floor area increased by around 5 per cent. On the other hand, *Reddy* [2012] showed a decrease in prices using data collected in Germany in the aftermath of the liberalisation taking place in 2006 and 2007. *Kay–Morris* [1987] found the same when analysing British data. However, *Genakos–Danchev* [2015] in their comprehensive study collecting data from 30 European countries found that lifting the restriction on the opening hours of shops did not have a significant impact on price level.

### *The impact of the expansion of modern store formats*

In recent decades modern store formats and international retail chains have had considerable impact on the retail sector. According to *Hortaçsu–Syverson* [2015] the appearance of modern store formats has reshaped the retail sector even more than the appearance of e-commerce. Online retail is unlikely to extinguish physical stores for many years to come; therefore, it poses limited threat to the existence of modern store formats.

This major change has piqued the interest of several researchers. *Leibtag* [2006] looked at Nielsen data for the period between 1998 and 2003, and found that as a result of the expansion of Wal-Mart and other shops following an EDLP (everyday low prices) strategy the grocery spending of consumers increased at a rate much below the inflation rate of food products. The findings of the study conducted by *Volpe–Lavoie* [2008] confirm this; they argue that the appearance of Wal-Mart Supercenters decreased the price of manufacturer branded products by 6 to 7 per cent and the price of private label products by 3 to 8 per cent in the vicinity of the stores.

It is no accident that the market share of non-traditional chains, especially the ones following and EDLP pricing strategy grew the most intensively in the United States in the course of the six-year period mentioned above (*Leibtag* [2006]). Wal-Mart became the biggest grocery retailer in the United States as well as globally (*Volpe–Lavoie* [2008]).

The changes have also reached developing countries. As of the 1990s supermarkets started spreading in developing countries (*Minten–Reardon* [2008]). The penetration in these countries is characterised by a rapid growth in market share of these chains. When investigating the reasons, the authors have made several conclusions. One of them being that foreign-owned retail chains – as they had more advanced procurement systems and quality standards – were more competitive than local businesses. In addition, these chains sell a wide assortment of processed food products in one place, which consumers find more convenient. Using a dataset of 103 developing countries *Tandon et al.* [2011] found that of the price and non-price characteristics (like convenience and wider product assortment) the latter were more important for the customers.

The entry and expansion of modern retail chains resulted in the concentration of retailing as smaller retail shops were forced out of the market. *Martens* [2008] found that the entry of Wal-Mart significantly increased concentration in grocery retailing.

The relationship between retail concentration and prices was the subject of several studies (e.g. *Yu–Connor* [2002], *Stiegert–Sharkey* [2007], *Hovhannisyan–Bozic* [2016]). The findings suggest very much the same: retail concentration increases the price level. So there seems to be consensus that there is a positive correlation between concentration and price level.

Modern retail formats therefore have two opposing effects on consumer prices. On the one hand, due to their more effective supply chains the prices are reduced, but on the other hand they increase prices due to higher concentration. A study by *Podpiera–Raková* [2009] attempts to separate the two effects. Their findings suggest that the expansion of large retailers lowered the consumer price index by 0.8 percentage point annually in the Czech Republic due to the increased upstream market power of retailers. However, due to the increasing number of acquisitions the largest retailers are expected to become even stronger, which would increase the yearly inflation of food products by 1.2 percentage points, which in turn would substantially affect the overall inflation as well.

As can be seen from the above, the impact of the market penetration of modern store formats is not unambiguous, and it is likely to vary by markets as well as by time. The impact of the Hungarian "plaza-stop" act on consumers mainly depends on which of the various effects becomes dominant. If the expansion of modern store formats drives down consumer prices, the regulation curbing the penetration of such formats is not beneficial to the public. If, though, the regulation prevents the further concentration of the sector and consequently stunting the increase in prices, it is tenable. However, no empirical analysis has been conducted in Hungary yet to answer this question.

## RELATIONSHIP BETWEEN RETAIL REGULATION AND PRICES IN OECD COUNTRIES

The literature review shows that there is a correlation between the regulation of the retail sector and price levels, but very few research studies have been undertaken to empirically analyse this relationship. In our study we first conduct an international comparison of OECD countries.

The OECD Product Market Regulation Indicators – updated every five years – serve as the basis of the analysis. The values on the scale range from 0 to 6 with higher values corresponding to stricter state regulation. The value of the index is an aggregate value averaging the values of the following six indicators:

- Licences or permits needed to engage in commercial activity,
- Specific regulation of large outlet,
- Protection of existing firms,
- Regulation of shop opening hours,
- Price controls,
- Promotions/discounts.

The extent of regulation varies by country (*Figure 2*). Hungary with its 2.06 value was in the middle, nearing the OECD average. In general, we can say that regulation is becoming more and more liberalized over time, and it applies approximately to the same degree to each of the above areas (*Koske et al.* [2015]).

The OECD first published the indicators of the retail sector regulation in 1998 and has updated it every five years since. This means that so far there have been four editions of the survey, in 1998, 2003, 2008 and 2013 with an ever-expanding number of countries. In 2013 the indicators for some non-OECD countries were also included. However, due to the differences of less developed countries we looked at OECD member states exclusively in our study (22 countries[1] as we only looked

[1] Australia, Austria, Belgium, Canada, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Mexico, Netherlands, Norway, Poland, South Korea, Spain, Switzerland.


*Note*: 0 corresponds to virtually no regulation, while 6 means there is substantial regulation in all areas.
*Source:* OECD Product Market Regulation Indicators.

FIGURE 2 • **The degree of retail regulation in European countries in 2013**

at those countries where all data were available for every year the product market regulation indicators were measured.)

We measured the effect of regulation on the inflation of food products, as consumers get food nearly completely from retail. If because of state regulation competition in the retail sector decreases, this will lead to an increase in food prices. As our objective is to measure minor changes in real value, we examined the ratio of food inflation and overall inflation (consumer price index) in our analysis. By looking at the overall consumer price index we can eliminate the differences in price fluctuations caused by the varied fiscal and monetary policies of different countries, which when using a dataset containing data for many years and many countries would cause significant differences. This is in accordance with the method used by *Mizik et al.* [2007].

However, the relative increase or decrease of food prices in relation to the overall basket of consumer goods is affected not as much by the degree of regulation but by changes in regulation. Changes in retail regulation affect competition between companies, which may modify their behaviour as well as their optimal pricing strategy. This may result in either a decrease or an increase in prices until a new equilibrium point is reached. This is the potential effect that we would like to identify.

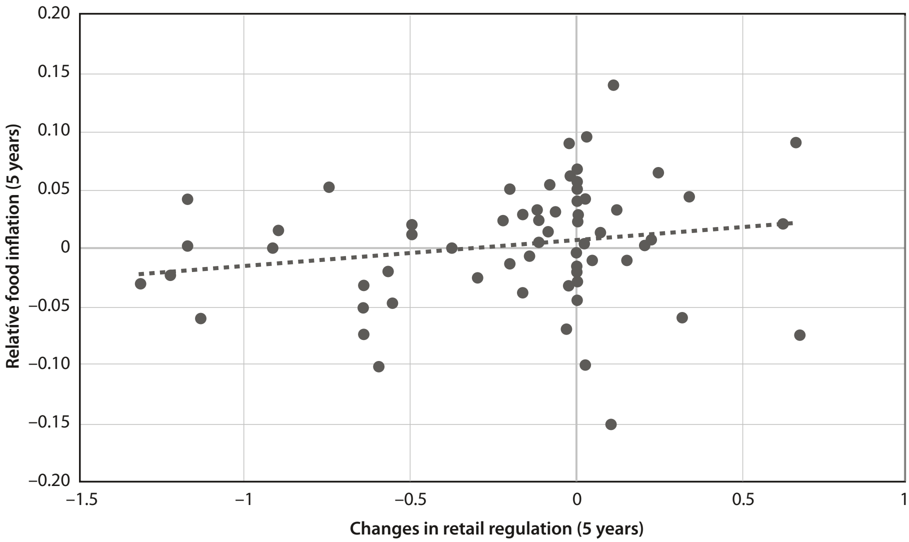
*Figure 3* illustrates the relationship between the two main variables. As can be seen there have been some changes in retail regulation over the five-year periods, which means there is sufficient variance to identify causal effects. Also a weak but positive relationship can be seen between the degree of change in regulation and the increase in food price inflation exceeding the overall inflation rate, therefore the data show that stricter regulation of the retail sector is followed by some increase in prices. However, there are numerous other factors that influence food prices, and these have to be controlled, so we have added control variables into the regression model:

$$\frac{1 + CPIFood_{it}}{1 + CPI_{it}} - 1 \tag{1}$$
$$= \alpha + \beta_1 \Delta RetailReg_{it} + \beta_3 \Delta GDP_{it} + \beta_4 \Delta Wage_{it} + \beta_5 \Delta Pop_{it}$$
$$+ \beta_6 \Delta TaxRev_{it} + D_t + u_{it},$$

where $CPIFood_{it}$ stands for food inflation in country $i$ in the period between $t$ and $t-1$, $CPI_{it}$ is the change of the overall consumer price index, $\Delta RetailReg_{it}$ is the change in the degree of retail regulation, $\Delta GDP_{it}$ is the change in the volume of gross domestic product, $\Delta Wage_{it}$ is the annual average real wage change, $\Delta Pop_{it}$ is the change in the number of inhabitants, $\Delta TaxRev_{it}$ is the change in tax revenue to GDP ratio, and finally $D_t$ dummy variables mark the time fixed effects. In the analysis we also specifically looked at the effects of opening hour regulations, where we used this sub-index instead of the $\Delta RetailReg_{it}$ variable.

Another advantage of using a first difference approach is to eliminate the country-specific (and time independent) effects from the variables, so they cannot distort the results. However, other time dependent variables not included in the regression can still cause distortions, therefore the results should be interpreted with this caveat. When we looked at the changes of GDP, real wage and population, we considered the degree of changes, while in the case of other variables we calculated the difference in order to make the interpretation of results as easy as possible.

We collected the data to estimate equation (1) from OECD iLibrary and the OECD Product Market Regulation (PMR) database. The OECD places special emphasis on ensuring that the data series can be compared both by time period and country. This is especially advantageous and helps minimize analytical bias. *Table 1* contains the descriptive statistics of the variables.




*Source:* author's own calculation based on OECD data.

FIGURE 3 • **The relationship between the retail regulation indicator and relative food inflation**

TABLE 1 • **Descriptive statistics of the variables used to estimate the model**
(the average of the three five-year periods between 1998 and 2013, number of observations: 66)

| Variable | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| Food inflation (over 5 years, per cent) | 13.9 | 10.5 | –5.3 | 43.6 |
| Overall inflation (over 5 years, per cent) | 13.6 | 9.7 | –2.9 | 49.1 |
| Retail regulation indicator | 2.18 | 1.10 | 0.60 | 4.68 |
| Changes in retail regulation indicator (over 5 years) | –0.19 | 0.43 | –1.31 | 0.67 |
| Regulation of opening hours (sub-index) | 1.48 | 1.64 | 0 | 5.14 |
| Changes in regulation of opening hours (over 5 years, sub-index) | –0.24 | 1.00 | –6 | 0.07 |
| GDP volume change (over 5 years, per cent) | 11.1 | 10.9 | –26.3 | 40.6 |
| Average real wage increase (over 5 years, per cent) | 5.5 | 7.7 | –21.8 | 29.2 |
| Population growth (over 5 years, per cent) | 2.9 | 2.8 | –1.8 | 12.7 |
| Changes in tax revenue to GDP ratio (over 5 years, percentage points) | 0.06 | 1.66 | –3.34 | 4.48 |

*Source:* author's own calculation based on OECD iLibrary data.

*Table 2* contains the estimation results. Columns (1) and (2) show the effects of the changes in retail regulation indicators with and without time fixed effect, while columns (3) and (4) show the results for only one sub-index, the regulation of shop opening hours.

TABLE 2 • **The relationship between retail regulation and prices in OECD countries (panel regression estimation results)**

| Independent variable | Relative changes in food prices | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Changes in retail regulation indicator | 0.032*<br>(0.008) | 0.022*<br>(0.005) | – | – |
| Changes in regulation of opening hours (sub-index) | – | – | 0.009*<br>(0.002) | 0.007<br>(0.003) |
| Average real wage increase | –0.297<br>(0.210) | –0.234<br>(0.222) | –0.279<br>(0.190) | –0.215<br>(0.206) |
| GDP volume change | 0.102<br>(0.116) | 0.149<br>(0.155) | 0.120<br>(0.110) | 0.169<br>(0.159) |
| Population growth | –0.272<br>(0.289) | –0.369<br>(0.274) | –0.216<br>(0.298) | –0.342<br>(0.289) |
| Changes in tax revenue to GDP ratio | 0.002<br>(0.005) | –0.000<br>(0.005) | 0.002<br>(0.006) | –0.000<br>(0.005) |
| Constant | –0.023<br>(0.014) | –0.006<br>(0.013) | 0.014<br>(0.018) | –0.016<br>(0.015) |
| Period fix effects | no | yes | no | yes |
| *N* | 66 | 66 | 66 | 66 |
| $R^2$ | 0.1831 | 0.2478 | 0.1455 | 0.2360 |

*Note*: cluster robust standard errors for time periods in parentheses;
***significant at 1 per cent level, **significant at 5 per cent level, *significant at 10 per cent level.

The results show that except for the retail regulation indicators none of the other explanatory variables were significant in the model. The retail regulation indicator is only significant at 10 per cent level;[2] however, this is primarily due to the standard errors clustered for the time period, as by this the degree of freedom dropped significantly. For other explanatory variables this is not an important consideration, their significance level is very high. The effect of the opening hours regulation is smaller and is only significant (at 10 per cent level) if the time-fixed effects are not included in the model. *Bloch* [2012] also found that product market regulation in the United States and France are an exogenous source of inflation, therefore no feedback mechanisms can be detected. Furthermore, our findings are in line with the results of *Égert* [2016] who found that product market regulation negatively affects productivity; however, this is no longer the case if year fixed effects are also included in the regression.

The effect of the retail regulation indicators is not negligible. Considering the average five-year inflation (13.6 per cent) a 1-point increase of the retail regulation indicator is expected to increase food inflation by 3.6 percentage points. And in the model including time fixed effects it increases food inflation by 2.5 percentage points within a five-year period. Considering actual changes in retail regulation indicators *(Table 1)* the real impact could vary between –4.8 percentage point and 2.4 percent-

[2] The $p$-value is 0.058 in both model (1) and (2).

age point with a mean of –0.7 percentage point. This degree is reconcileable with the average food inflation for five years (13.9 per cent).

The effects are much smaller, between 0.8 and 1 percentage points if we look at the opening hours regulation only. This suggests that other regulatory measures probably affect inflation as well.

According to the analysis conducted by *Koske et al.* [2015] product market regulation is on the decrease in OECD countries, so the relationship between time-fixed effects and retail regulation indicators is not surprising. This is why leaving time-fixed effects out of the regression does not necessarily cause distortion in the estimation; therefore, product market regulation does have an impact on the changes in consumer prices.

However, the retail regulation indicator does not make it possible to examine specific regulations individually. The indicators do not specify the various regulatory measures, even though their effect can vary significantly. In the next section we attempt to find answers to the questions raised here using longitudinal analysis of the Hungarian retail sector by examining the effects of the "plaza-stop" act and the compulsory Sunday closing.

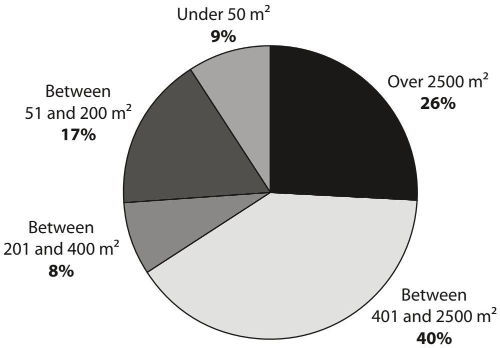
## A BRIEF OVERVIEW OF THE RETAIL SECTOR IN HUNGARY

In 2016 the retail sector produced 4 per cent of the Hungarian GDP according to the data published by the Hungarian Central Statistics Office (HCSO). However, the sector plays a much more important role in the national economy, as it employs 6 per cent of the total workforce, and in addition, it is the source of livelihood of many self-employed professionals. The retail sector is characterized by being fixed to the location, which applies to most of its services.

Our study focuses on food and other daily grocery retail. In 2016, based on the data by the market research company Nielsen, food retail trade reached a turnover of around HUF 1,620 billion, two thirds of which was realized by modern retail outlets with a floor area over 400 squaremeters (i.e. hypermarkets, supermarkets and discount stores) *(Figure 4).*

The retail sector started to change around the time of the political transition in Hungary. The privatisation of state-owned businesses boosted the expansion of foreign retail chains, but at the same time, domestic chains operating in a franchise system were set up as well.

Coop has the largest store network. In addition to Coop, CBA and Reál have an extensive nationwide store network. All these three chains operate in a franchise system. This system makes it possible for all three companies to have many partners and several thousands of stores, which means they have a significant market share. However, besides the partially unified image, certain joint promotions and private label brands, the pricing as well as the assortment are decided by the owners of




*Source:* Nielsen
(http://trademagazin.hu/hu/nielsen-nott-nagy-uzletek-sulya-az-elelmiszer-kiskereskedelemben).

FIGURE 4 • **The market share of different store formats in ninety food product categories measured by Nielsen in 2016**

the shops. This is why such chains should be categorised as local traditional retail outlets, as there are huge differences between them regarding floor area as well as business strategy even within one chain.

Foreign-owned businesses operate three major formats that are very distinct from one another: hypermarkets, supermarkets and discount stores. Some companies are present in several categories. Hypermarkets include (in descending order of the number of stores) Tesco, Interspar and Auchan. Tesco is without any doubt the most significant, as it is the leading food retailer in Hungary. Hypermarkets are characterised by large floor space (between 3,000 and 15,000 squaremeters) and a wide range of products.

Out of the hypermarket chains Tesco and Spar also have a network of supermarkets. In this format Spar is the most important player with about 370 outlets. It doubled the number of its stores in 2008 by acquiring the Plus discount store chain. There used to be an additional foreign-owned retail chain, the Belgian-owned Match that operated this format, but withdrew from the Hungarian market in 2013.

In the discount format foreign retail chains entered the market in several waves, but their expansion has become even stronger in recent years. Profi appeared in Hungary after the political transition. Soon after Plus followed in 1992. Both companies have since left the Hungarian market, Plus withdrew in 2008 and Profi left the country in 2013. Penny Market, owned by the German Rewe group, entered the Hungarian market in 1996.

After Hungary's accession to the European Union German-owned hard discount chains started their expansion in the country. The first of them was Lidl, a chain belonging to the largest European retailer, the Schwarz Group. As a result of its intensive expansion Lidl currently has over 160 stores nationwide. Another German retailer, Aldi arrived in Hungary with a little delay, opening its first store in Hungary in 2008, but it has been expanding rapidly, and the number of its outlets now exceeds 100, which is considered a milestone.

With the entry of foreign retail chains, concentration steadily and significantly increased in the sector. *Juhász et al.* [2005] have found that the revenue share of the large corporations increased from 24 per cent to 37 per cent, while that of microbusinesses dropped from 40 per cent to 32 per cent between 1999 and 2003. This tendency continued throughout the late 2000s and 2010s. While at the end of 2007 there were 45,599 grocery stores in Hungary according to HCSO data, this figure went down to 40,329 in ten years, which means more than one per cent decrease annually. At the same time, the number of stores operated by international chains increased gradually *(Figure 1).*

## METHODOLOGY AND DATA

We examined the relationship between retail regulation and consumer prices by analysing the monthly average prices of 17 food products.[3] The monthly nationwide average consumer prices of the 17 products were sourced from the HCSO, while the manufacturer's selling prices were downloaded from the Market Price Information System of the Research Institute of Agricultural Economics (RIAE MPIS). The manufacturer's selling prices show the purchase prices of retailers, while consumer prices show the sales prices of them. The difference between the two is the gross margin of the retailer. This is to cover the expenses of the retailer and ensures its profit as well. If the market environment changed as a result of regulation, and competition became either stronger or weaker, it had an impact on the gross margin, which implies that the best way to examine the subject of this study is to look at the gross margin.

Due to the differences in the turnover rate of the products, the inventory policy of the retailers as well as the differences in the contracts between retailers and manufacturers, there is no guarantee that changes in the manufacturer's selling price impact immediately the expenses of the retailers. Therefore, when estimating the model, it was not the gross margin, but the net consumer price that we used as dependent variable. We calculated this by subtracting the VAT from the gross consumer price published by the HCSO.

We used monthly data for the months between January 2006 and December 2017 for the purposes of this analysis. In order to avoid modelling inflation, we deflated all data using the monthly consumer price index published by the HCSO. With this transformation, the changes in real prices can be examined. For the analysis we used the logarithm of the prices.

[3] White flour, pastry flour, cooking oil, fresh/ESL milk (2.8% fat), UHT milk, sour cream (20% fat), kefir, sweet cream butter, cottage cheese, unflavoured whipped butter spread, fruit yoghurt, egg, turkey breast, chicken leg, pork leg, pork loin, pork shoulder.

In our study we quantified the impacts of two regulatory measures: the so-called "plaza-stop" act passed in 2012 and the compulsory Sunday closing in force between 2015 and 2016. The aim of the "plaza-stop" act was to restrict the number of stores with a floor area of more than 300 $m^2$ (later raised to 400 $m^2$), which was relatively successful, as shown in *Figure 1* with a visible decline in the number of new stores after 2012. This is why we used the number of discount stores, super- and hypermarkets as an independent variable in our analysis. However, no historical monthly time series are available regarding the number of stores. The top list of the retailers published by Trade Magazin contains only annual data, whereas the HCSO published the number of domestic outlets only every six months. Therefore, we used the number of Aldi discount stores as a proxy variable; the monthly data was made available to us by Aldi Hungary. The number of Aldi stores serves as a good proxy variable for two reasons. First, Aldi opened stores more or less simultaneously in all parts of the country. Within the first month of entering Hungary (in April 2008) it opened eight stores covering the whole country (in Bonyhád, Budaörs, Debrecen, Dunaföldvár, Mosonmagyaróvár, Nyíregyháza, Pécs and Piliscsaba). Even if these outlets had an effect on the price levels of their close vicinity only, due to their wide geographical distribution the effect could be felt all over the country. And due to their intensive expansion, they appeared in more and more places all over the country, which meant that they had an impact on prices nationwide.

On the other hand, the number of Aldi stores shows strong correlation with both the number of hypermarkets as published by the HCSO and the annual data published by Trade Magazin *(Table 3)*. In addition, the number of Aldi stores shows strong negative correlation with the total number of grocery stores *(Table 3)* illustrating the impact of modern retail chains on concentration (*Juhász et al.* [2005], *Martens* [2008]). Based on this it is not only the expansion of Aldi discount stores that is shown by the variable used, but that of modern food retail chains in Hungary, therefore it seems to be an appropriate proxy variable to use.

TABLE 3 • **The correlation between the number of outlets of retail chains in Hungary and the number of Aldi stores**

| Chain/group | Period, frequency | Correlation value |
|---|---|---|
| Tesco | 2007–2017, annual | 0.854 |
| Auchan | 2007–2017, annual | 0.860 |
| Interspar | 2007–2017, annual | 0.924 |
| Hypermarkets total | December 2007–December 2017, biannual | 0.827 |
| Spar | 2007–2017, annual | 0.641 |
| Penny Market | 2007–2017, annual | 0.975 |
| Lidl | 2007–2017, annual | 0.962 |
| Modern retail total | 2007–2017, annual | 0.970 |
| Food & grocery total | December 2007– December 2017, biannual | –0.961 |

*Source:* Aldi Hungary, Trade Magazin annual retail top lists, HCSO.

We encoded the effect of compulsory Sunday closure of shops using a dummy variable, which had a value of 1 in a month when it was compulsory for shops to be closed on Sunday and a value of 0 at any other time. This, however, presupposes that when the restriction was lifted, the pre-restriction situation was restored. This can be overly restrictive in some cases, so we have defined two dummy variables, one for the period of compulsory Sunday closure, and one for the period following it.

We used the average monthly net salary as a control variable, which can affect the margin of retailers in two ways. On the one hand, lower income increases the price sensitivity of consumers; this is when the pricing strategy of retail chains becomes of key importance. During the 2008–2009 crisis retail chains operated with low prices and had high promotional activity, mainly in the form of price promotions, which negatively affected their margin (*Berezvai* [2015]). On the other hand, higher wages mean greater expenses for retailers, who in turn have to apply higher gross margins to compensate it. The labour shortage appearing recently forced players in the retail sector (just like in any other sector) to increase salaries significantly, which in turn might increased gross margin. The effect of the two channels are identical, if salaries are higher, consumer prices are likely to increase as well. The descriptive statistics of the data are shown in *Table 4*.

TABLE 4 • **Descriptive statistics used to estimate the model**
(144 months between January 2006 and December 2017)

| Variable | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| *Net consumer prices* (deflated to January, 2004) | | | | |
| Chicken leg (HUF/kilogram) | 421 | 30 | 367 | 489 |
| Cooking oil (HUF/litre) | 246 | 33 | 187 | 351 |
| White flour (HUF/kilogram) | 75 | 11 | 56 | 103 |
| Fresh milk, 2.8% fat (HUF/litre) | 128 | 8 | 112 | 148 |
| Fruit yoghurt, 150 grams (HUF/cup) | 51 | 3 | 44 | 61 |
| Kefir, 175 grams (HUF/cup) | 46 | 3 | 40 | 53 |
| Turkey breast (HUF/kilogram) | 955 | 51 | 839 | 1,081 |
| Pastry flour (HUF/kilogram) | 95 | 13 | 71 | 125 |
| Pork leg (HUF/kilogram) | 688 | 45 | 605 | 854 |
| Pork loin (HUF/kilogram) | 765 | 67 | 662 | 927 |
| Pork shoulder (HUF/kilogram) | 676 | 72 | 571 | 859 |
| UHT milk (HUF/litre) | 148 | 12 | 125 | 177 |
| Sweet cream butter, 100 grams (HUF/unit) | 133 | 10 | 116 | 167 |
| Sour cream, 20%, 175 grams (HUF/cup) | 74 | 4 | 67 | 84 |
| Egg, pack of 10 (HUF/unit) | 193 | 20 | 164 | 322 |
| Cottage cheese, 250 grams (HUF/unit) | 164 | 11 | 147 | 196 |
| Unflavoured whipped butter spread, 250 grams (HUF/unit) | 188 | 6 | 175 | 200 |

TABLE 4 • **Descriptive statistics used to estimate the model** (continued)

| Variable | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| *Manufacturer's net selling prices* (deflated to January, 2004) | | | | |
| Chicken leg (HUF/kilogram) | 325 | 42 | 248 | 414 |
| Cooking oil (HUF/litre) | 188 | 38 | 130 | 322 |
| White flour (HUF/kilogram) | 52 | 9 | 37 | 75 |
| Fresh milk, 2.8 % (HUF/litre) | 96 | 7 | 82 | 113 |
| Fruit yoghurt, 150 grams (HUF/cup) | 37 | 5 | 28 | 53 |
| Kefir, 175grams (HUF/cup) | 32 | 5 | 23 | 41 |
| Turkey breast (HUF/kilogram) | 805 | 77 | 645 | 1,011 |
| Pastry flour (HUF/kilogram) | 59 | 8 | 44 | 83 |
| Pork leg (HUF/kilogram) | 580 | 50 | 493 | 777 |
| Pork loin (HUF/kilogram) | 614 | 64 | 491 | 812 |
| Pork shoulder (HUF/kilogram) | 523 | 50 | 410 | 726 |
| UHT milk (HUF/litre) | 101 | 8 | 89 | 131 |
| Sweet cream butter, 100 grams (HUF/unit) | 87 | 8 | 71 | 110 |
| Sour cream, 20%, 175 grams (HUF/cup) | 43 | 3 | 36 | 49 |
| Egg, pack of 10 (HUF/unit) | 144 | 22 | 111 | 282 |
| Cottage cheese, 250 grams (HUF/unit) | 108 | 12 | 83 | 132 |
| Unflavoured whipped butter spread, 250 grams (HUF/unit) | 131 | 13 | 95 | 157 |
| Number of Aldi stores | 66 | 41 | 0 | 126 |
| Average net salary (HUF/month) | 100,935 | 9,637 | 89,690 | 135,473 |

*Source:* HCSO, RIAE MPIS and Aldi Hungary.

The data follow a panel structure, but unlike the general practice we monitored only a few (17) products for a long time (144 months). Therefore, the autocorrelation of data series became an important consideration, which raises some questions about the applicability of standard panel models (random effect or fixed effect estimation, dynamic panel models).

As a first step we examined the stationarity of the logarithmized data series using the Levin–Lin–Chu and the Hadri Lagrange multiplier (LM) panel unit root tests. The test designed by *Levin et al.* [2002] is recommended specifically for medium-sized panels, as it has proved to be significantly better according to simulation results compared to testing stationarity of data series individually. The test is based on the widely used augmented Dickey-Fuller test, this way its null hypothesis is that every time series of the panel contains a unit root. To determine the number of lags we used the Akaike information criterion starting from six lags.

On the other hand, *Hadri* [2000] suggested a test whose null hypothesis is the stationarity of data series. The test is the Lagrange multiplier test based on the distribution of residuals, which – based on the Monte-Carlo simulations performed – does well with small sample sizes. The test can be applied with cross-sectionally correlated residuals.

*Table 5* shows the results of the stationarity tests.

TABLE 5 • **Panel unit root test results**
(based on data ranging from January 2006 to December 2017)

| Variable | Test | Null hypothesis | *p*-value | Decision (at 5 per cent level) |
|---|---|---|---|---|
| Consumer prices | Levin–Lin–Chu-test | each time series of the panel contain a unit root | 0.6578 | the data series are non-stationary |
| | Hadri LM test | each time series of the panel are stationary | 0.0000 | the data series are non-stationary |
| Changes in consumer prices | Levin–Lin–Chu-test | each time series of the panel contain a unit root | 0.0000 | the data series are stationary |
| | Hadri LM test | each time series of the panel are stationary | 0.2531 | the data series are stationary |
| Manufacturer's net selling prices | Levin–Lin–Chu-test | each time series of the panel contain a unit root | 0.0859 | the data series are non-stationary |
| | Hadri LM test | each time series of the panel are stationary | 0.0000 | the data series are non-stationary |
| Changes in manufacturer's net selling prices | Levin–Lin–Chu-test | each time series of the panel contains a unit root | 0.0000 | the data series are stationary |
| | Hadri LM test | each time series of the panel are stationary | 0.8318 | the data series are stationary |

*Note:* In the case of the Levin–Lin–Chu test the number of lags was determined using the Akaike information criterion, for the Hadri LM test cross-sectional correlations were allowed.

The results show that both the (deflated) consumer prices and the (deflated) manufacturer's selling prices contain unit root. However, the first differences of the data are stationary, therefore, we analysed these to avoid spurious regression. The estimated model is the following:

$$\Delta\log(y_{it}) = c + \sum_{j=0}^{3} \alpha_j \,\Delta\log(x_{it-j}) + \sum_{j=0}^{3} \beta_j \,\Delta Aldi_{t-j} \tag{2}$$

$$+ \sum_{j=0}^{3} \gamma_j \,\Delta Sunday_{t-j} + \sum_{j=0}^{3} \delta_j \,\Delta PostSunday_{t-j}$$

$$+ \sum_{j=0}^{3} \theta_j \,\Delta\log(inc_{t-j}) + D_t + u_{it}.$$

where $y_{it}$ and $x_{it}$ are respectively the consumer and manufacturer's selling prices of product $i$ in month $t$, while $Aldi_t$ shows the number of Aldi stores. $Sunday_t$ takes the value of 1 if the compulsory Sunday closure regulation was in force in month $t$, and 0 otherwise. The value of $PostSunday_t$ is 1 for the period following the lifting of the Sunday closure ban, and 0 otherwise, $inc_t$ is the average net salary in month $t$, and finally $D_t$ stands for month and year dummy variables. For each explanatory variable we allowed for maximum three months (one quarter of a year) delay.

When analysing differentiated data series potential autocorrelations in data as well as cross-sectional correlations have to be taken into consideration. Time clustered shocks (e.g. the financial crisis or the global increase in prices of agricultural products) can affect all products simultaneously, which might create correlation between cross-sectional residuals.

In our analysis we used feasible generalized least squares (FGLS) estimation. Similarly to the analysis by *Tanguay et al.* [1995], regarding the cross-sectional residuals we allowed for heteroscedasticity and correlation, and regarding the autocorrelation of residuals we estimated autocorrelations by products. The prerequisite for the estimation is the strict exogenity of the explanatory variables (*Wooldridge* [2002]), which we believe is met for the variables in the model.

The expansion of Aldi was determined exogenously. In the Hungarian market one needs at least 100 stores to operate effeciently, therefore Aldi had to keep expanding in the analysed time period. The fact that Aldi significantly increased the number of stores during the 2008–2009 financial crisis while generating a steady loss is the clear proof of this (*Berezvai* [2015]).

The Sunday shopping ban was the consequence of a political decision, while the reason this ban was lifted also had a lot to do with the political battles that were fought over it. Such a decision, from the perspective of changing prices should be regarded as exogenous.

The international analysis presented in the previous section as well as the current Hungarian analysis have two major differences. First, the analysis of the Hungarian situation uses much more detailed data. On the other hand, changes in regulations had an impact on all products simultaneously, therefore there is no cross-sectional control group, unlike in the international analysis, as there the individual countries had varied regulatory history.

## ESTIMATION RESULTS AND DISCUSSION

*Table 6* contains the estimation results of equation (2). In column (1) of the table the compulsory Sunday closure was quantified with one single dummy variable. The model selected by sequentially eliminating non-significant variables is shown in column (2). In column (3) we defined two separate dummy variables for the introduction and the removal of the Sunday shopping ban. By gradually eliminating variables that are not significant at 5 per cent level we got column (4), which is completely identical to column (2).

The results show that changes in the manufacturer's selling prices are not manifested completely in the changes in consumer prices. One reason may be that retailers smoothen out price fluctuations. The relative deviation of manufacturer's selling prices is higher (0.21) than that of consumer prices (0.18).

The increase in average salaries affected prices. As expected, we found a positive effect here. Over one percentage points increase in net pay rise boosted the increase in consumer prices by 0.04 percentage points.

TABLE 6 • **Estimation results**
(FGLS panel regression based on monthly data between January 2006 and December 2017)

| Independent variable | Changes in consumer prices in month *t* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Changes in manufacturer's selling price in *t* | 0.1668*** (0.0093) | 0.1663*** (0.0093) | 0.1672*** (0.0093) | 0.1663*** (0.0093) |
| Changes in manufacturer's selling price in (*t* – 1) | 0.1829*** (0.0093) | 0.1829*** (0.0093) | 0.1833*** (0.0093) | 0.1829*** (0.0093) |
| Changes in manufacturer's selling price in (*t* – 2) | 0.0854*** (0.0094) | 0.0853*** (0.0094) | 0.0849*** (0.0094) | 0.0853*** (0.0094) |
| Changes in manufacturer's selling price in (*t* – 3) | 0.0394*** (0.0095) | 0.0387*** (0.0095) | 0.0396*** (0.0095) | 0.0387*** (0.0095) |
| Changes in the number of Aldi stores in *t* | 0.0002 (0.0004) | – | 0.0003 (0.0004) | – |
| Changes in the number of Aldi stores in (*t* – 1) | –0.0001 (0.0004) | – | –0.0001 (0.0004) | – |
| Changes in the number of Aldi stores in (*t* – 2) | 0.0001 (0.0004) | – | 0.0000 (0.0004) | – |
| Changes in the number of Aldi stores in (*t* – 3) | –0.0008** (0.0004) | –0.0008** (0.0003) | –0.0007** (0.0004) | –0.0008** (0.0003) |
| Introduction of compulsory Sunday shopping ban in *t* | –0.0008 (0.0038) | – | –0.0002 (0.0053) | – |
| Introduction of compulsory Sunday shopping ban in (*t* – 1) | –0.0012 (0.0037) | – | 0.0006 (0.0052) | – |
| Introduction of compulsory Sunday shopping ban in (*t* – 2) | 0.0015 (0.0037) | – | 0.0022 (0.0052) | – |
| Introduction of compulsory Sunday shopping ban in (*t* – 3) | 0.0015 (0.0037) | – | –0.0046 (0.0053) | – |
| Lifting of compulsory Sunday shopping ban in *t* | – | – | 0.0020 (0.0053) | – |
| Lifting of compulsory Sunday shopping ban in (*t* – 1) | – | – | –0.0030 (0.0052) | – |
| Lifting of compulsory Sunday shopping ban in (*t* – 2) | – | – | –0.0016 (0.0052) | – |
| Lifting of compulsory Sunday shopping ban in (*t* – 3) | – | – | –0.0069 (0.0053) | – |
| Changes in average net salary in *t* | 0.0417** (0.0182) | 0.0415** (0.0170) | 0.0419** (0.0182) | 0.0415** (0.0170) |
| Changes in average net salary in (*t* – 1) | –0.0104 (0.0179) | – | –0.0126 (0.0180) | – |
| Changes in average net salary in (*t* – 2) | –0.0017 (0.0179) | – | –0.0060 (0.0180) | – |
| Changes in average net salary in (*t* – 3) | 0.0067 (0.0172) | – | 0.0048 (0.0173) | – |
| Constant | 0.0062** (0.0026) | 0.0061*** (0.0023) | 0.0062** (0.0026) | 0.0061*** (0.0023) |
| Year fixed effects | yes*** | yes*** | yes*** | yes*** |
| Month fixed effects | yes*** | yes*** | yes*** | yes*** |
| $N$ | 2,380 | 2,380 | 2,380 | 2,380 |
| $R^2$ | 0.3779 | 0.3770 | 0.3791 | 0.3770 |

*Note:* FGLS regression with cross-sectionally heteroscedastic and correlated residuals, and residual autocorrelation by products. Standard errors in parentheses.
***significant at 1 per cent level, **significant at 5 per cent level, *significant at 10 per cent level.

Regarding the variables of interest, the model showed no significant impact of Sunday shopping ban on consumer prices. This is true even when we created a separate dummy variable for the introduction and lifting of the ban, respectively. Our results are consistent with the results of *Genakos–Danchev* [2015]. No substantial impact could be demonstrated even when we used a six-month lag, by which time horizon long-term effects should have become apparent as well (*Wenzel* [2010]).

On the other hand, the model attributed price reducing effects to the penetration of modern retail formats and the expansion of international retail chains, in which we used the number of Aldi stores as a proxy variable. The number of Aldi discount stores significantly reduced the average consumer prices within three months. The opening of one Aldi shop reduced the increase of consumer prices by 0.08 percentage points. And since Aldi opened 126 stores in Hungary during the period examined, its cumulative effect was a food inflation reduction of approximately 10 percentage point in the 12 years under investigation. As the expansion of Aldi took place more or less at the same time as that of other retail chains (*Table 3*), this effect is likely to be indicative of the beneficial effects of the expansion of modern retail chains in Hungary.

Our findings are consistent with those of both *Leibtag* [2006] and *Volpe–Lavoie* [2008]: the authors examined the impact of the expansion of Wal-Mart on consumer prices in the US market. Furthermore, *Podpiera–Raková* [2009] measured an impact of the same magnitude using data from the Czech Republic. The findings confirm that the "plaza-stop" act increases consumer prices (or more accurately prevents consumer prices from decreasing), therefore, it is harmful to the consumers.

Finally, based on the results of an empirical study conducted by *Sadun* [2015] using data from Great Britain, it is not even clear that such regulation would benefit smaller shops. One can observe in Hungary as well that international retail chains tend to expand more and more in the inner cities, and open smaller shops. Spar is the most prominent in this regard, as City Spar supermarkets are located specifically in the vicinity of hubs in the city centre, while the franchise program launched in September 2012 increased competition through smaller, more traditional outlets. Spar Express also deserves a mention, which appeared at OMV petrol stations. The efforts of Aldi and Lidl to expand in the inner city is also obvious, e.g. they opened retail outlets on the ground floor of residential buildings by uniting smaller shops there.

## CONCLUSION

In our study we analysed the impact of retail regulation on consumer prices. First, we executed an international comparison using OECD data to identify the general effects of retail regulation. After this we examined the impact of two specific regulatory measures in Hungary: the compulsory Sunday closure and the so-called "plaza-stop" act on consumer prices.

Our findings indicate that stricter retail regulations are likely to increase food inflation, therefore have a detrimental effect on consumers' welfare.

The analysis of specific regulatory measures in Hungary indicates that the ban on Sunday opening for shops had no demonstrable effect on consumer prices. However, it should be underlined that this regulation was in effect for merely one year, so we cannot say anything about the long-term effects. On the other hand, the expansion of modern retail formats, mainly that of discount stores drives down prices. Therefore, the "plaza-stop" act had unfavourable effect on consumer prices via delayed or lower number of new store openings.

When interpreting the findings, limitations have to be taken into account. In the international analysis we could use data from four periods only. In addition, we examined five-year intervals, in which period stricter retail regulation could be implemented and then revoked. The database used in the analysis of the Hungarian retail market was much more extensive, but we analysed the price changes of only 17 food products at national level. Further studies should be conducted performing the analysis by store formats in order to determine the exact effects more accurately. In addition, the database should be broken down geographically, and examine the impact of a newly opened store on the price level of the nearby area.

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