**Price dispersion and online markets maturity – case of Poland**

Dyspersja cenowa i dojrzałość rynków online w Polsce

ABSTRACT

This paper is dedicated to the issue of persistent price dispersion in real markets in the context of Polish online market development. The two channels of retail (online and offline) are observed and compared with regard to price variations determinants and its values comparison. Market efficiency comparison between both markets is also provided on the basis of theoretical background. The data collected from shops representing the two channel of retail (online and offline) for number of commodities from home appliance product category in Poland has been used as a sample for the analysis.

Generally, result for the Polish market goes in line with similar tests performed for EU as a whole and confirms the maturity of Polish online market.

KEYWORDS

Price dispersion, Poland, market maturity, online markets, e-commerce, Internet.

STRESZCZENIE

Artykuł dotyczy zjawiska trwałej dyspersji cenowej w kontekście rozwoju rynków online w Polsce. Obserwacja dwóch kanałów sprzedaży (online i offline) ma na celu dokonanie porównania determinantów zmienności cenowej i ich kompozycji. Bazując na przesłankach teoretycznych dokonano również porównania efektywności obu rynków. Dane do analizy zostały zabrane w sieciach dystrybucji dóbr AGD zarówno online i offline.

Uzyskane rezultaty są zbliżone do podobnych uzyskiwanych na innych rynkach Unii Europejskiej i wskazują na dojrzałość polskiego rynku sprzedaży online.

SŁOWA KLUCZOWE

Dyspersja cenowa, Polska, dojrzałość rynku, rynki online, e-handel, Internet.

1. **INTRODUCTION**

Online markets in Eastern Europe develop with enormous speed. Average annual online sales growth since 2010 achieved 35,1% comparing to 18% average for whole Europe (Ecommerce, 2015). Particularly in Poland percentage of individuals ordering or purchasing goods of services over the Internet for private use in the last 12 months increase from 28,9% in 2010 to 34,2% in 2014 (GUS, 2014), while estimated share of online retail of goods in total retail of goods reached 5,4% in 2014. However, the question remains: to what extend this market is already developed and what is its “quality”? This paper investigates price variation in real market as a measure for market maturity, with respect to Poland. The issue of price dispersion is relevant in both traditional and online markets. Price dispersion refers to deviation of prices from the average value. This problem concerns both demand and supply holders as well as whole market equilibrium. While electronic markets become more mature, there appears more and more empirical evidence of higher efficiency of online markets and lower price variation rate. As a case study, in this papers commodities referring to home appliance category in Poland are considered as a ground for analysis: 468 price observations were obtained at end of data gathering period. Both online and offline markets are compared with regard to price variations rates. The hypotheses are generated on the basis of theoretical expectations and are classified into two groups. The first group concentrates on measure of price dispersion in both retail channels; the second group testifies drivers of dispersion and its relationship with prices.

The paper is built as follows: the first part provides the theoretical framework of price dispersion and expectations regarding price dispersion presence in real markets. Empirical evidence of persistent price dispersion in both online and traditional markets is presented based on literature review on previous studies; after all, brief conclusion on price dispersion as a microeconomic phenomenon which can serve as an estimator of market efficiency is presented. The remaining part is dedicated to empirical analysis and testimony of price dispersion on the example of home appliance and consumer electronics in Poland. This section also collates achieved result to previous findings. A final conclusion mentions limitations of the study and obstacles that have been faced together with recommendations for future research.

## PRICE DISPERSION PHENOMENON

The term “price dispersion” is relatively new in modern economy. Stigler was the first to mention the phenomena of price dispersion in his article “Economics of Information” (Stigler, 1961, pp. 213). Stigler considers search costs by market agents, property of information to become outdated over time, changing identity of buyers and sellers, and the size of the market, and products heterogeneity as the main sources of price variation in real markets. Price dispersion is thus defined as a variation of prices for homogeneous products across various sellers in a given market. Dispersion rate can serve as a determinant of purchase behaviour from the perspective of buyers since the variation of prices represents the presence or absence of alternative beneficial offerings. A low rate of dispersion indicates smaller probability of buying whatever good less expensive since all the prices are close to the average and there are no picky ones; nevertheless, when dispersion is high, it is very likely to put more efforts into search for product at a lower price and benefit from this purchase. From the sellers` side, dispersion reflects competitors` pricing strategies. For the whole market, the rate of price dispersion can show how the market is close to or far from full efficiency; the lower dispersion rate is, the closer the market to perfectly competitive is, hence, the higher the market efficiency is. Thus investigation of the price dispersion level can be used as a benchmark for the level of given market development.

Imperfect information forces consumers to search and face considerable costs; meanwhile, any cost is a discouraging feature of any activity. If we put the discussion of price dispersion in terms of prospects theory (Kahneman & Tversky 1979), in real markets, people underestimate possible benefits of search and overestimate any costs; therefore, byers agree for first listed prices and forget about marginal savings assuming that they avoid losses. Independent of time, there is always a flow of new uninformed sellers and buyers; as they enter the market, information and prices that have already been investigated become outdated and irrelevant. Obsolete information changes conditions for search costs and the whole market equilibrium and makes sellers incapable of maintaining a perfect correlation of prices. In such a way, the buyers are also not aware of time, efforts and costs they should devote to search and adapt to new equilibrium. Hence, market conditions and market stability affect price variations. As the market grows, dispersion becomes smaller as firms that specialize in information collection arrive. Moreover, there are no purely homogeneous products across various sellers in real markets. Every seller is different from each other; hence, the service they offer and the commodities themselves are considered unique from different sellers. Thus, information is the key issue of price dispersion. Even in terms of theoretical framework, price dispersion definitely exists and is persistent.

The emergence of e-commerce has brought to economic theory a lot of things to discuss. Whatever concerns price dispersion in online markets, theoretical framework aims to predict its lower rate if to compare with traditional markets. The simplest logic behind this expectation is that increased availability of information and decreased search costs give a prior advantage to buyers to choose whatever seller, whereas sellers in these conditions seek to be price competitive; hence, no extreme markups are predicted to occur. Nevertheless, the results of empirical studies suggest various results and findings.

Relying on theoretical background, Bacos (1997) expected that prices in offline stores should be higher for the same items than in online shops; the author argues on search costs and how they differ in these two channels of retail with regard to changes in information flow and consumers` price sensitivity. The appearance of online markets is crucial for the information flow since now consumers have to put a lower effort to obtain prices information from different sellers as well as about product characteristics and alternative offerings in the market for a given good. Lower effort for buyers relates to smaller search costs; comparing two channels of purchase, consumer search costs in online market are lower. Sellers do know that now buyers can compare prices from several retailers so that there is no sense to put too high markups in order to be price competitive in the rivalry.

Bailey (1998) was probably the first to investigate price dispersion in the online retail channel. He took books, CDs and software items as product categories for comparison of prices between online and traditional markets (all the chosen products were considered fully homogenous). The prices were corresponding to each other in both markets. The point of his analysis was that search costs and the level of competition in the market were the determinants of dispersion rate. During the period of data (prices) collection in 1996-1997, online prices were detected higher than for the same products in traditional market. As Bailey explained, his first findings may conflict with hypothetical expectations as a result of higher search costs in immature online market with a few numbers of sellers. Little competition among e-retailers and consumers search intensity was expected to increase over the time so that more mature market would let empirically reaffirm the theory and achieve lower dispersion rates.

Later, a similar study on books and CDs by Brynjolfsson and Smith (2000) also seeking to compare dispersion on the electronics and in traditional markets emphasizes that e-commerce brought any market for whatever goods and services a possibility to have lower barriers to entry due to alleviated infrastructure which is simply a website page in browser. Advantages of electronic market such as lower menu and absence of infrastructure issues of traditional markets attribute to lower rate of dispersion among e-retailers. Moreover, the authors have documented a new tendency according to which sellers in online markets tend to change prices more often with lesser difference than traditional retailers. This finding can also serve as an attributor to more competitive market and expected lower price dispersion. An empirical part dedicated to measure of posted prices by a proxy for market share accepts the hypothesis of lower dispersion favouring electronic markets.

As for online market for electronics, Baye, Morgan and Shulton (2001) found that the number of companies posting prices tends to vary with the rate of price dispersion. An interesting case of price dispersion has been described through analysis of online auctions by Sun and Hsu (2002), which detects another factor influencing dispersion rate. The paper concludes that sellers` reputation has the most significant impact on auction prices but on the different degrees of prices. Such auction features as duration of bargain, opening bid and Buy-it-now option (BIN) have a significant impact on online auction prices. In later study regarding prices in online auctions, Pate (2006) gained the results that also confirm sellers` reputation contributing to changes in auction prices.

Shankar, Pan and Ratchford (2002) attempt to determine the drivers of price dispersion over time as well as to discover if these drivers can change. Empirical analysis showed that the provision of product information, shipping, handling and reliability were main the attributors to dispersion among e-retailors characteristics. As for market characteristics, the number of sellers was negatively correlated with the rate of dispersion; nevertheless, the authors emphasize that empirically it works only at a diminishing rate over time, and later this effect is likely to be insignificant. Even when considering approximately similar reasons for price dispersion such as search costs, product characteristics, channel of retail, shopping convenience, brand loyalty, or level of competition, as long as e-commerce market matures, the more studies suggest that price dispersion streams at diminishing rate favoring online channel. Bailey (1998), Clemons, Hann, and Hitt (1998), Erevelles, Rolland, and Srinivasan (2001), Lee and Gosain (2002) detected higher prices on the internet and higher price dispersion in online markets in comparison to traditional. All these studies use different approaches in evidence parts as well as different subjects of analysis, but still their results empirically find higher price variations among e-retailers. The only similarity observed is time period in between 1998 and 2002. This was a very early period of e-commerce development so that market maturity is to be mentioned again.

Nevertheless, early evidence of lower price variation in electronic markets also exists. For instance, Brynjolfsson and Smith (2000), Morton, Zettelmeyer, and Risso (2001), Tang and Xing (2001) have documented lower dispersion rates in online markets. The study by Ancarani and Shankar (2004) discovers price dispersion for books and compact discs between three retail channels: among pure-play Internet, traditional, and multichannel. Cooper (2006) has chosen an unusual subject of analysis when comparing dispersion rates in traditional and online markets. Consistent with previous papers, he finds evidence of lower dispersion rate in the market for disposable contact lenses. The idea behind it was that traditional shops set prices assuming that buyers are not aware of opportunity of buying lenses online. As a result of facilitated search costs, online price dispersion was revealed less than offline with nearly 11% difference. Basically, the results showed that buyers seem to be not much aware about their options.

The paper by Rosello and Riera (2012) compares online and offline price levels and variation rates for tourism expenditures among emerging online tour agencies and existing traditional travel operators. Despite the fact that results have found persistent online price dispersion, it has been detected considerably lower among new e-retailors.

With regard to studies on the issue of price dispersion on Eastern European markets, only the paper by Szopiński and Nowacki (2014) investigates price variation rates between domestics and foreign flight carriers in Poland on the basis of posted prices for airline tickets from internet websites for the most popular connections. The paper detected persistent price dispersion in the market for airline tickets varying from 5.63 % to 8.07 % between Polish carriers and 7.70% to 20.3 % between carriers from destination countries. The highest differential between absolute value of standard deviation among the two different carriers has accounted for 13.885%. The conclusion suggests that dispersion is much lower among Polish carriers than in corresponding foreign for the same routes. The authors do not mention a single reason for such a big gap between prices.

Table 1.

*Summary of studies that compare price dispersion rates between electronic and traditional markets.*

|  |  |  |  |
| --- | --- | --- | --- |
| AUTHORS | YEAR | SUBJECT INVESTIGATED | PRICE DISPERSION IS HIGHER: |
| Bailey | 1998 | Books, CDs, Software | Online |
| Clemons, Hann, and Hitt | 1998 | Airline tickets | Online |
| Brynjolfsson and Smith | 2000 | Books and CDs | **Offline** |
| Erevelles, Rolland, and Srinivasan | 2001 | Vitamins | Online |
| Morton, Zettelmeyer, and Risso | 2001 | Cars | **Offline** |
| Tang and Xing | 2001 | DVDS | **Offline** |
| Clay, Krishnan, Wolff and Fernandes | 2002 | Books | Online |
| Lee and Gosain | 2002 | CDs | Online |
| Brown and Goolsbee | 2002 | Insurance sevices | **Offline** |
| Ancarani and Shankar | 2004 | Books and CDs | **Offline** |
| Cooper | 2006 | Contact linses | **Offline** |
| Rosello and Riera | 2012 | Travel agency services | **Offline** |
| Sengupta and Wiggins | 2012 | Airline tickets | **Offline** |
| Duch-Brown and Martens | 2014 | Consumer goods | **Offline** |

Source: own research based on the literature review.

When reviewing studies on price dispersion chronologically, more recent papers go against the results of findings at the times when e-commerce was in its very infancy. For instance, earlier papers detect higher online dispersion; however, the results of more recent papers meet the initial theoretical expectations regarding lower online dispersion. In more mature electronic markets, market players adopt to the conditions of perfect information and very low search costs, which makes supply side aim to be price-competitive and still survive in the whole market so that sellers keeping prices on approximately equal level without considerable markups. This notion can be treated as one of online markets maturity characteristics: mature markets face a decrease in price variations rate.

1. **EMPIRICAL EVIDENCE FROM POLAND**

The main objective of this paper is to investigate price dispersion in real markets as well as to apply basic theoretical expectations into practice and to collate the results to previous studies. Specifically, the case of household appliance electronics in Poland is observed. Household appliance goods are divided into three subgroups: major home appliance, or white goods; small house appliance; consumer electronics, or brown goods. The point is to use a dataset consisting of prices for chosen types of electronic goods as the main subject of the analysis in order to detect the presence of dispersions and highlight external and internal factors that may influence prices. By the term “external”, market factors are basically implied whereas internal determinant may underlie in the specification of the commodities.

Relying of the theoretical background provided in the previous section, the most obvious and relevant is actually to achieve empirical evidence of lower dispersion rate in online markets and finding out its main determinants. The set of the hypotheses is divided into dispersion rate measurements and its comparison () and checking for sources of dispersion (). Table 2 represents hypothesis classification.

Table 2.

**Hypotheses classification.**

|  |  |  |  |
| --- | --- | --- | --- |
| PRICE DISPERSION MEASUREMENTS AND COMPARISON | | SOURCES AND INFLUENCE | |
| |  | | --- | |  | | Price dispersion is present in both electronic and traditional markets. | |  | | --- | |  | | Sellers` reputation impacts on price variation rate. |
|  | The rate of price dispersion is lower in online shops than in corresponding offline. |  | Product reputation does affect price variation. |
|  | |  | Number of sellers is negatively correlated with price dispersion rate. |

Source: own research.

As long as hypotheses are classified with regard to the aims of the analysis, two different methodological approaches will be applied for each group of hypotheses.

Methodological approaches in studies for price dispersion vary, however the coefficient of variation has been used by Ghose and Yao (2011), Sengupta and Wiggins (2012), Duch-Brown and Martins (2014), Szopiński and Nowacki (2014), so that probably it is the best known estimation method. In this analysis of price dispersion, relative standard deviation is considered a primary method of measurement. All the hypotheses from the group one will be tested with descriptive statistics calculations. When calculating relative standard deviation, actual prices will be put in one dataset and analysed with software. With respect to hypotheses from group two on the basis of literature review, there has been observed a common tool of investigating sources of price variation using econometric modelling. Shankar, Pan, and Ratchford (2002), Cooper (2006), Leong (2013), Sengupta and Wiggins (2012), Duch-Brown and Martens (2014) used linear regression models as a methodology approach of detecting factors influencing price variation. Following the study by Shankar, Pan and Ratchford (2002), cluster analysis of the regression will be used as a helping feature. The following log-linear equation has been generated:

Model 1.



Price is used as a dependent variable of the model since the primary interest lies in finding out which factors and how much affect it. Price has been put into logarithmic terms in order to observe percentage change in dependent variable with each unit change in independent (explanatory) variables. Sellers` reputations, product reputations, level of competition and dummies for product characteristics and channel of retail have been chosen as explanatory variables.

Table 3.

**Variables description.**

|  |  |
| --- | --- |
| VARIABLE NAME | EXPLANATION |
|  | Price for a good j in the shop k |
| sh\_r(k) | Seller`s reputation measured as a rate of shop k |
|  | Product reputation measured as a rate of product j |
|  | Number of sellers that offer a good j as a measure of competition level |
|  | Dummy that indicates whether the shop performs on electronic market or on traditional one.  1 – indicates that the shop is online  0 – indicates that the shop is in-store |
|  | Dummy that indicates whether a commodities refers to specific group of products categories (7) such as refrigerators, washing machines, dish washing machines, TV sets, smartphones, small home appliance (indicated as sma), and ovens.  1 – indicates that the good is in its category  0 – otherwise |
|  | Regression coefficients |
|  | Error term that measures unobservable factors and model bias |

Source: own research.

Dummies for product characteristics and channel of retail are plugged in on purpose: for the first group of hypotheses (in order to use “sort by” functions), and for the second group of hypotheses (with a view to check if product category may impact on price variation).

A primary source of data has been used in this study in order to gain empirical results for the set of hypotheses; all the data has been collected manually. All in all, 396 price observations have been collected for the analysis. These are the observations for 33 product categories from 8 online and 4 physical shops in Poland. Availability of the commodity from all the stores has been a mandatory requirement. Initial list of commodities comprised 72 goods; after all, the list has been filtered out in order to gain cross section data between 12 shops. All the price observations have been collected in domestic currency, i.e. Polish zloty on the end of the first quarter of 2015. Data gathering process consisted of several steps. The first one is the choice of shops and creation of the list of commodities. Only purely retail shops and commodities referring to the house appliance match the field of study. Initially, the number of units from each of three commodities group had the same number of units; however, as long as the filter has sorted out the results, among leftover 33 commodities suiting to cross-section data distribution, 11 form a group of consumer electronics, or brown goods, 4 refer to small home appliance, and the rest 18 are major home appliance, or white goods. The prices from in-stores like Komputronik, Saturn, Media Markt, and RTV Euro AGD have been collected manually with the help of shop assistants, shop catalogue either direct call to the shop. Each shop has been visited directly or contacted by the phone, and all the prices added into final list of observations. Whatever concerns online shops, things were pretty easier due to existence of website comparing prices; in this case, Ceneo.pl has been used as a source of data (Ceneo.pl 2015). Basically, a collecting price from prices-comparing websites is a common practice when investigating price dispersion rates. For instance, Shankar, Pan, and Ratchford (2002) used Bizrate.com, Baye, Morgan and Shulton (2001) referred to Shopping.com in their studies. Following their example, Polish analogue of such website has been found and used as a data source. Sellers reputation (shop rate), Product reputation (product rate), product reputation (product rate) values have been also collected from ceneo.pl platform.

## *Empirical evidence of the hypotheses of the first group*

Table 4 represents final results of price dispersion rates in both markets.

Table 4.

**Descriptive statistics of price in electronic and traditional markets.**

|  |  |  |  |
| --- | --- | --- | --- |
| DESCRIPTIVE STATISTICS | ONLINE (264) | OFFLINE (132) | LOWER VALUE IS: |
| Mean | 1449.82 | 1450.6 | online |
| Medium | 1299.495 | 1309 | online |
| Minimum | 61 | 67.9 | online |
| Maximum | 4022.22 | 4049 | online |
| Range | 3961.22 | 3981.1 | online |
| Standard Deviation | 872.468 | 865.468 | offline |
| Relative standard deviation,% | 60.1775 | 59.6628 | offline |

Source: own calculations.

This step allows us to conclude that zero hypothesis is accepted since relative coefficient of variations does not equal zero in both retail channels: 60.2% for online markets and 59.7% in traditional one (table 4). Generally speaking, it is really high if to compare for instance to 5.63% and 20.3 % of price variations in airline tickets in previous study by Szopiński, and Nowacki (2014). When discussing hypothesis which picks out the market with a lower rate of dispersion, the last column in table 4, shows that price variation is higher in the online market. However, it is good to mention that the first run of descriptive statistics does not account for different product categories and its heterogeneity; so that in order to gain more reliable and accurate results, the problem of product classification should be solved.

The second run is going to distinguish prices by product category with the use of dummies indicating retail channel and commodity characteristics. Table 5 shows the rates achieved from the second run of descriptive statistics.

Table 5.

**Descriptive statistics of price in electronic and traditional markets by product category.**

|  |  |  |  |
| --- | --- | --- | --- |
| DESCRIPTIVE STATISTICS | ONLINE (264) | OFFLINE (132) | LOWER VALUE IS: |
| SMALL HOME APPLIANCE | | | |
| Mean | 488.3797 | 530.7975 | Online |
| Medium | 424 | 487.7 | Online |
| Range | 1138 | 1131.1 | **Offline** |
| Relative standard deviation, % | 76.20433 | 77.50612 | Online |
| SMARTPHONES | | | |
| Mean | 1278.128 | 1247.25 | **Offline** |
| Medium | 1231.25 | 1198.5 | **Offline** |
| Range | 2343.98 | 1960 | **Offline** |
| Relative standard deviation, % | 58.38473 | 56.82995 | **Offline** |
| TV-SETS | | | |
| Mean | 2267.161 | 2278.74 | Online |
| Medium | 1661.4 | 1691.89 | Online |
| Range | 2793.23 | 2810 | Online |
| Relative standard deviation, % | 50.75589 | 51.23243 | Online |
| REFRIGIRATORS | | | |
| Mean | 2130.8 | 2139.736 | Online |
| Medium | 2187.4 | 2177.99 | **Offline** |
| Range | 2333.09 | 2408.02 | Online |
| Relative standard deviation, % | 37.09722 | 38.15863 | Online |
| DISH WASHING MACHINES | | | |
| Mean | 1299.669 | 1299.291 | **Offline** |
| Medium | 1322 | 1319 | **Offline** |
| Range | 660.5601 | 694 | Online |
| Relative standard deviation, % | 21.809 | 22.11982 | Online |
| WASHING MACHINES | | | |
| Mean | 1180.493 | 1189.498 | Online |
| Medium | 1259.96 | 1240.65 | **Offline** |
| Range | 927 | 706.16 | **Offline** |
| Relative standard deviation, % | 19.81226 | 18.0838 | **Offline** |
| OVENS | | | |
| Mean | 1515.514 | 1509.58 | **Offline** |
| Medium | 1399.05 | 1359.05 | **Offline** |
| Range | 2123.05 | 2070 | **Offline** |
| Relative standard deviation, % | 52.26113 | 52.91494 | Online |

Note: the number in brackets in columns` names indicating the channel of retail shows the number of price observations

Source: own calculations.

After commodities characteristics held fixed, five out of seven product categories indicate a lower relative deviation rate than in corresponding offline except for goods from smartphones and washing machines category (table 5.). Yet, the lowest rate of price variation is found as 18.10% for washing machines and the highest rate of dispersion found accounts for 77.5 % for small house appliance category (both in physical stores). As long as majority of product categories favour lower rate of dispersion in electronic markets, the hypothesis one is accepted.

## *Empirical evidence of the hypotheses of the second group*

The second group of hypothesis aims to determine drivers of price dispersion in both markets. In order to accept or reject all the hypotheses from the second group, it would be enough to run OLS regression and analyze general model reliability, statistical significance of explanatory variables and check coefficient signs in case of hypothesis four. The final equation includes price in logarithmic terms as a dependent variable, and product and sellers` reputation, level of competition, dummy indicating channel of retail and small house appliance commodities serve as independent variables:



Table 6.

**Presentation of OLS regression output.**

|  |  |  |  |
| --- | --- | --- | --- |
| Number of observations = 396  F( 5, 32) = 6.20  Prob > F = 0.0004  R-squared = 0.4330 | | | |
| lnprice | Coefficient | t-statistic | P > | t | |
| pr\_r | -0.4681863 | -2.17 | 0.037 |
| nosh | -0.0017269 | -0.15 | 0.881 |
| sh\_r | -0.1728411 | -4.16 | 0.000 |
| onoff | -0.0188441 | -2.86 | 0.007 |
| Sma | -1.33511 | -2.83 | 0.008 |
| Cons | 9.475434 | 8.33 | 0.000 |
|  | | | |

Source: own calculations.

All the p-values of coefficients are treated as statistically significant except for the level of competition variable which has not been excluded earlier since the hypothesis four focuses on its relationship with dependent variable. Product and sellers` reputation variables are treated as statistically significant. Hence, the hypotheses two and three are accepted and both product and shop rates do influence price variations. Negative signs of product and sellers` reputation, the level of competition variables show that the more popular the product and the retailer is, and the higher the number of sellers offer a commodity, the lower price dispersion is since there is a negative linear relationship between these explanatory variables and price. Hypothesis four is accepted which can be paraphrased as follows: as the number of sellers, or the rate of competition grows, price variation diminishes.

To sum up, all the hypotheses from the second group have been accepted in conformity with expectations and empirical studies dedicated to similar issues that have been mentioned earlier. Econometric analysis reaffirmed anticipation in regard of external factors that may influence price variations like product, seller`s reputations, retail channel and rate of competition as well as internal factor which underlies in commodity specification assignment in case of small house appliance goods.

If comparing exact values of price dispersion rate, Duch-Brown and Martens (2014) paper can be taken as a reference for collation since their analysis has been applied in EU boarders and house appliance goods also serve as a subject investigated. Not all the product categories from this study can be compared but for TVs, refrigerators, ovens, washing machines categories coefficients of variations can be collated.

Table 7.

**Relative standard deviation values for chosen product categories comparison, %.**

Note: A star next to some values indicates that this value refers to physical stores. The highlighted number refers to a lower value in one cell. The number in brackets is a module difference between the two values in one cell.

Source: own calculation and calculation from the report by Duch-Brown and Martens (2014).

Basically, the results from TVs, washing machines and ovens categories collate identically and prefer similar channels of retail. However, in case of refrigerators, there is a discrepancy. Moreover, all price differentials between the two papers are really small: the highest differential accounts for 0.63% difference in case of washing machines and 0.35 % is the lowest for ovens.

## CONCLUSION

All in all, as empirical price dispersion rate exists in both markets. Empirical evidence on the example of house appliance and consumer electronics commodities in Poland proves that price dispersion is lower in electronic markets. Results gained in this paper are consistent with previous studies on the issue of price variation. Nevertheless, relatively small sample size leaves a space for improvement and suggests a further investigation with increased amount of information.

If considering probable drivers of price dispersion in both physical and online markets, the results of econometric analysis suggest that product and sellers` reputation, commodity`s category and a channel of retail are perceived as drivers of price variations as it has been expected in the section about hypotheses settlement. As it has been mentioned in theoretical framework review, electronic markets maturity also has an impact on the level of price variations. In line with theoretical expectations and previous studies, this research case of electronics in Poland brings a successful evidence of mature electronic market.

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