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# Problems in measuring price dispersion
# in e-commerce

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# Problems in measuring price dispersion in e-commerce

**Abstract:** Until recently, Internet was considered as technology that will make the trade in goods frictionless. Online retailers' margins were to fall to zero and prices - according to theory of economics - were to equalize as a result of buyers comparing prices more easily (e.g. using shop bots). Empirical research performed so far has not proven these expectations right. Studies in many countries show that online prices vary significantly (sometimes price dispersion in the Internet is higher than that in traditional trade). The purpose of this article is to present a critical view on the methods of measuring price dispersion in e-commerce. Researchers of this area use different measures of price differentials, include shipping costs or not, use the proposed price or try to determine transaction prices, reject part of the data considered as outliers that may indicate a hidden heterogeneity of a product. Some scientists also try to justify price dispersion with the reputation of a vendor, and also additional features of the sellers such as the amount of information presented in the offer, convenience of shopping, user-friendly interface, etc. All these factors are problematic for the research due to lack of a clear (and proper) way of measuring the mentioned attributes. Most of the previous studies also ignored the pricing strategy of vendors, which is a very important factor for price dispersion – it may involve reduction in prices of several products in order to attract customers to the store to buy other products with a much higher margin.

## Introduction

The classical theory of economics assumes zero transaction costs, as the perfect competition markets include many small buyers and sellers that are well informed. Information is spread in zero time and without any costs. As a result, homogenous goods are sold at the same price.

Further theories assume that every economic exchange requires incurring some transaction costs. Referring to Coase's theory one may say that the sum of costs attached to all transactions equals the friction forces in a

physical system (Sobiecki, Pietrewicz, 2011). In this approach the most important elements are the costs of: determining adequate prices, negotiations and making contracts.

J. Stiglitz postulates moving from the competition paradigm to the information paradigm. He claims that assuming imperfect information, often there is no equilibrium on the perfect competition market and enterprises can establish prices above the marginal cost (Boehlke, 2010).

Gathering information is quite an expensive process. Additionally, very often partial information is not worth buying (up to a certain amount of information its value equals zero). Differences in attitudes towards buying information result in information asymmetry on the markets. Part of the buyers will be aware of more offers and will have a better view on the price distribution than the buyers with e.g. higher alternative costs of time.

According to many researchers, Internet was supposed to turn the trade in goods into a frictionless process. Lower search costs (one-click distance), increased number of sellers and tools like shop bots were supposed to reduce the price dispersion significantly, resulting in fact in one market price for a product set on a marginal cost level. Although in many countries e-commerce has not yet reached full maturity and not all the buyers use shop bots, some researchers already decided to conduct empirical studies in price dispersion on the Internet. Unfortunately these studies have not confirmed the initial assumptions. Moreover, recent studies often indicate that price dispersion is even higher online than on traditional markets.

The goal of the article is to present some chosen (often inconclusive) results of empirical studies in price dispersion of homogeneous goods and to explain the research methods used in each case in order to indicate potential challenges in this area. Price dispersion set as a result of the mentioned studies does not necessarily correspond with the real price distribution on a certain market. This paper aims to list the most important comments regarding the way of measuring price dispersion in e-commerce.


## Methodology of the research

The aim of the paper is to show the challenges of research methods used for measuring price dispersion. The article is based on existing papers presenting particular problems and their proposed solutions. Conclusions described in the article will be used by the author in the consequent work on an own research method for measuring price dispersion of the homogeneous goods online.

**Results of empirical studies in price dispersion of homogenous goods sold online**

There were many attempts of measuring online price distribution in different countries, taking into consideration different products and various periods. The table below presents some of the results of these studies.

Table 1. Results of empirical studies in online price dispersion

| | Research period | Product category and item number | Number of sellers included in the research | Relative differentiation (%) | Variance (%) |
|---|---|---|---|---|---|
| Bailey (1998) | 1997 | Flight tickets | - | Over 28 | - |
| | 02.1997-01.1998 | Books (125) | 8 | - | 13,3 |
| | 02.1997-03. 1997 | CDs (108) | 9 | - | 17,61 |
| | | Software (104) | 35 | - | 7,07 |
| Brynjolfson and Smith (2000) | 02.1998-05.1999 | Books (20) | 8 | 33 | - |
| | 02.1998-05.1999 | CDs (20) | 8 | 25 | - |
| Lee and Gosain (2002) | 02.1999 –01.2000 | CDs (22 old) | 9 | 31 | - |
| | 02.1999 –01.2000 | CDs (21 new) | 9 | 19 | - |
| Clay and others (2002) | 04.1999 | Books (107) | 13 | 27-73 | - |
| Clay, Krishnan and Wolff (2001) | 09.1999-01.2000 | Books (399) | 32 | 32-65 | 12,9-27,7 |
| Clay and Tray (2001) | 2001 | Books (95) | 9 | 23-42 | - |
| Baye, Morgan, Schelten (2004) | 11.1999 – 05.2001 | Electronics (36) | 20 on average | 57* | 12,6 |
| Baye, Morgan, | 08. 2000-03.2001 | Electronics (1000) | 2-40 | 40* | 10 |

| | | | | | |
|---|---|---|---|---|---|
| Schelten (2003) | | | | | |
| Scholten and Smith (2002) | 2000 | Books, electronics | - | - | 12,87 |
| Pan, Ratchford and Shankar (2003) | 11.2000 | Books (105) | 12 on average | 48,9 | 13,8 |
| | | CDs (43) | | 51 | 18,4 |
| | | DVDs (96) | | 43,7 | 16,7 |
| | | PCs (105) | | 34,4 | 27,1 |
| Pan, Ratchford and Shankar (2003) | 11. 2000 | Laptops (105) | 12 on average | 25,7 | 13,9 |
| | | Palmtops (37) | | 37,1 | 14,4 |
| | | Software (51) | | 35,6 | 25,9 |
| | | Electronics (66) | | 31 | 11,7 |
| | | 8 categories in total | | 38,5 | 11,8 |
| Ratchford and others (2003) | 11.2001 | Books (134) | 8 on average | 48 | 16,6 |
| | | CDs (120) | | 39,3 | 13,2 |
| | | DVDs (103) | | 32,29 | 10,22 |
| | | PCs (107) | | 15,01 | 5,46 |
| | | Laptops (96) | | 17,87 | 6,11 |
| | | Palmtops (52) | | 30,26 | 9,86 |
| | | Software (120) | | 18,95 | 6,51 |
| | | Electronics (94) | | 22,12 | 8,22 |
| | | 8 categories in total (826) | | 28,7 | 9,8 |
| Pan and others | 02.2003 | Books (141) | 9 on average | 48,9 | 14,21 |

| (2003) | | CDs (108) | | 51,04 | 8,79 |
|---|---|---|---|---|---|
| | | DVDs (110) | | 43,67 | 10,31 |
| | | PCs(41) | | 34,39 | 7,03 |
| | | Laptops (110) | | 25,7 | 7,32 |
| | | Palmtops (49) | | 37,1 | 14,13 |
| | | Software (100) | | 35,58 | 9,22 |
| | | Electronics (110) | | 30,99 | 10,83 |
| | | 8 categories in total (769) | | 28,8 | 10,4 |

*Based on a difference between the lowest and the highest price divided by the minimum price of the product

Source: M. Krzesaj, Rozproszenie cen produktów homogenicznych w internecie. Retrieved from ttp://mikroekonomia.net/system/publication_files/741/original/4.pdf?1315213995

Results of the studies listed above indicate that the online price dispersion exists and additionally, very often its level is not minimal. However, it is very important to realize that the level of price dispersion depends significantly on the research method chosen for a particular study. Some data presented in the table above may already raise following questions:

- is price dispersion going to decrease as a result of Internet development?

- does price dispersion depend on types of products chosen for a research?

- do time and location of the study impact price dispersion?

A deeper analysis of the results and the research methods applied can lead to further questions and doubts:

- how is all data collected? Is it assumed that the buyers use shop bots or simply finds the offers using a search engine?

- which statistical measure is used to quantify price dispersion?

- what price should be considered for the study purposes – with or without delivery costs?

- prices offered by the online sellers are not necessarily final, so perhaps only transactional prices should be used for the research purposes?

In the next part of the article the author will try to answer all the above and several additional questions.

## Methods of measuring price dispersion on the Internet - methodology challenges

The main methodology challenges in price dispersion studies are listed below.

- Offered prices vs. transaction prices

Almost all studies in online price dispersion are based on the offered prices. Researchers use shop bots or other sources enabling comparisons between the e-shop offers and assess the price distribution of all the collected prices. Using offered prices is one of the most criticized assumptions for measuring  price dispersion on the Internet because it results in fact in measuring dispersion of offered prices, not the final ones established at the end of transactions.

Research results can be significantly impacted by several shops that for some reasons decided to try to sell their products at overestimated prices. Higher price can be also a result of certain price strategy (described later on in this article). According to E. Hopkins it should be verified if the vendors offering higher prices do actually sell their products (Hopkins, 2006). The only research that attempted to be based on transactional prices was the study of Bounie et al from 2012. It was an analysis of Amazon offers, where a transaction was considered finalized after the offer disappeared from the web portal and did not appear again within the next two days (Bounie et al., 2012). The authors were aware of some drawbacks of the method applied – the fact that an offer disappeared from Amazon might as well mean that the product was sold in other place at a different price. On the other hand, some online services supporting the sellers on internet auctions offer exposing a product once again after the product was sold or after unsuccessful auction. In such case if the seller renews the offer within the next two days, the previous end of the offer it will not be considered as a successful transaction.

- Internet store as an advertising channel, not a selling place.

Online stores can be divided into two categories: the ones that operate only on the Internet (dotcoms) and shops that have also their stationary branch (MCR - Multi Channel Retailer). K. Clay et al recognize that in case of MCR sometimes an online store may be only a form of advertisement

(Clay et al., 2001). Such a conclusion may result from the fact that the research was performed in 2001 when the Internet (especially e-commerce) was not yet mature and some of the retailers did not fully understand the nature of online competition. However, the study by Xing from 2010 confirmed that MCRs have higher prices than dotcoms (Xing, 2010). The research was conducted on five MCRs and five dotcoms in China, using data about 51 DVD titles. Results clearly indicate that dotcom prices are lower than MCRs and the price dispersion among the MCRs is higher than within dotcoms. Higher dispersion is explained by the fact that prices of part of the MCRs are equal to dotcom prices and part of the MCRS is trying to sell their products online at the same prices as in their stationary shops. This research has also shown an important role of the time spent on the study. MCR prices go down slower than the dotcom prices, so the difference between the two types of shops decreases with time.

- Time and place of the study

It is probably the most important decision that has to be taken while planning price dispersion research. Scientists choose concrete products; check their prices in a certain country, state (USA) or city. There are many possible mistakes that can be made during this process. Limiting the territory may cause that a researcher sees only part of the picture – part of the buyers can search for the products e.g. outside of their own country, state etc. Studies regarding English-language books, electronics, CD-s and DVD-s cannot be limited only to the Polish market because buyers have the possibility of buying these products abroad. Despite higher shipping costs, differences in prices often encourage to purchase products in other countries (especially in case of buying more than 1 item).

Companies may have different price strategies on different markets. One of the recent examples was reported by a customer who compared prices of the same sport jacket in LIDL between Poland and UK. The price in Poland was 75 PLN (approximately 15 GBP) and 6,99 GBP in UK (Przyłapał Lidla…, 2014). In this case widening the research territory from Poland to e.g. Europe would give completely different results.

A second example of challenges for price dispersion studies is the research conducted for the Polish web site dlahandlu.pl. The largest retailers are regularily checked in terms of the price of a certain basket of grocery products. The main problem of this research is that the retailers are being informed about a pollster visiting the store at a given date, which gives the stores the opportunity to set discounts on the checked products. One time when the pollsters visited the shops without previous announcements it turned out that the basket price (50 products in) was higher by up to 50 PLN comparing to the previous month (Sieci handlowe…, 2013). The ranking of retailers is different when it is

preprared after informing the stores than performed by surprise, so is the price dispersion.

The research conducted for dlahandlu.pl does not take into consideration any discounts (e.g. granted for bigger purchases) which influence the price dispersion.

Among the studies in Internet price dispersion there are also examples showing how choosing a certain time and place of the research can impact its results. For instance, in the research conducted by Clay at al a group of stores was selected by using two shop bots (Clay, 2001). If a store was found out by both shop bots, it was included in the study – this way many companies that were not cooperating with both or even one of the bots, were omitted.

J. Lindsey-Mulikin and D. Grewal performed a research of TV sets (77 models) and VCR prices (64 models). The trial was based on one day data and information abpit prices were collected only via one shop bot - Bizrate (Lindsey-Mulikin, Grewal, 2006).

Z. Ge and Y. Shao limited the scope of their research to five largest Chinese online book stores (dangdang.com, joyo.com, bjbb.com, china-pub.com, welan.com) (Ge Shao, 2005). Taking into account the fact that the study included only 50 titles, the results can be considered flawed.

The research conducted by W. LUO and Q.B. Chung is a counterexample of the above cases. Prices of electronic devices were gathered not via shop bots like in other studies, but by simulating purchases (Luo Chung, 2010). This way enabled collecting up to date prices, including discounts, shipping costs etc.

A similar method of collecting data was chosen by A. Civan et al in their research from 2007. These scientists simulated purchases of 80 products in 8 categories. Here on the other hand the main objection can be raised around popularity as a criterion for choosing products for the study. Goods were added to the research database if the number of offers was higher than a certain level (Civan et al., 2008).

In two articles (from 2009 and 2012) Bounie et al described result of studies based on the top 100 books, CD-s and DVD-s on Amazon in USA, UK and France. This was also not the best approach – as described by Clay et al. (2001 paper), price dispersion of bestsellers is higher than the rest of books. It can be assumed that the more popular the book, the more some sellers are trying to raise the price. Bounie's conclusions are also instructive for a different reason – price dispersion measured in France was significantly lower than in USA or UK (all results for Amazon). This result is caused by the French law – in France it is not allowed to sell a book at a price lower by more than 5% from the level officially set (Bounie et al., 2009 and Bounie et al., 2012).

Data for the Baily's research were gathered only in Boston. Brynjolfsson collected data in several states, but here the data from stationary stores for comparisons was difficult to collect due to holiday period (no volunteers). Missing data were replaced with data from Boston and September was not included at all (Brynjolfsson., 2000). Moreover, the cost of a traditional purchase was calculated based on a distance to the nearest book store – this variable may differ depending on the country (different distances and fuel costs).

- Dispersion measures

There is a wide range of statistical measures that can be used to quantify price dispersion – beginning with standard deviation, gap, quartile deviation, ending with variability index. Standard deviation and variability index are the most common in price dispersion studies, but other measures are also quite often used. One of them is a difference between maximum and minimum prices divided by the minimum (or maximum) price. A second, more interesting example is the study of Baye et al, where price dispersion is calculated as the difference between the two lowest prices (quoted from: Civan et al., 2008).

Depending on which measure of variability is chosen, some data may have a significant impact on the study results. The crucial role is played here by the so-called outliers. In case of using the spread between maximum and minimum price, or dividing this spread by the minimum or maximum price, the presence of outliers will have a significant impact on the results. Applying the Baye's measure on the other hand will cause that the maximum price (no matter how high it is) will not affect the size of dispersion.

Another important decision in price dispersion studies is the approach to weights used for calculating dispersion. A researcher has to decide whether any offer has identical share or stores that sell more items should have higher weights and therefore bigger impact on the results. Unfortunately, it is difficult to get to know the number of transactions in an online store. One method to overcome this problem is using the number of comments on the internet shops' websites. Not every transaction ends up with a comment, but previous studies indicate that the correlation between the number of comments and the number of transactions is 0.9 (Bounie et al., 2012).

- Product avaibility

Most of the researchers measuring price dispersion use shopbots to gather input data, but in many cases the results don't contain any information about the product availability. As a consequence, the study may be partially based on offers that are no longer valid. The work of shopbots is based on checking from time to time (usually once per day) if the offer on a store's website has not changed. It is possible then that the

price changes in online stores are not reflected in the shopbots results – in a certain point of time the price or the product may be different or the item is no longer available.

- Homogeneity of products

In the studies in price dispersion the most frequently used products are: books, CDs and DVDs. That is because of their homogeneity and popularity in terms of Internet sales. However, sometimes even these products are not as homogeneous as they appear. Some books and CD-s offered on the online auctions are signed by the authors or artists, which significantly increases their value and definitely shows that we no longer deal with a homogeneous product (Bounie et al., 2009). Sellers can also add different kind of freebies to their product, which again causes that the product is not homogenous anymore. In order to unify the products, items which are not homogenous have to be rejected, but performing such a rejection may be challenging. It is difficult to eliminate offers manually, so researchers often apply some rules to automate this process. In the study already quoted, Bounie et al. rejected the top percentile of prices (Bounie et al., 2009) or offers with prices that were 2 times lower or higher than the median (Bounie et al., 2012).

- Shipping costs

Cost of the delivery is one of the major problems of Internet price dispersion studies. Firstly, some researchers often ignore the fact that the products bought online have to be delivered to the customer and focus only on the so-called pure prices. This approach obfuscates the online price dispersion, as the pure price is only one of the components of the whole service and should not be considered separately. Secondly, shipping costs are much more complicated than the pure price – usually there are several shipping options available in a store or auction, and the user has to decide which version is the most profitable in a particular case. The options depend e.g. on the product size, weight, number of purchased and the location of the buyer and seller. Part of the shops allows the buyers to collect the products themselves from the offline shops (at no additional costs). Some areas have packstations, but in other places customer can only use the national postal service or courier services. All this diversity of delivery costs seems to be an underrated factor influencing the size of price dispersion on the Internet. Search costs of the pure prices are effectively reduced thanks to Internet, but the costs of seeking additional information may reduce the sensitivity of the price and consequently increase the prices (Ancarani, 2002).

Price dispersion is often higher in studies based on prices that include delivery costs (Ancarani, 2002). Sometimes the results are contradictory (Nelson et al., 2007) because vendors pricing strategies assume offering

lower prices for products themselves and higher shipping costs to make up for this loss of margin. Part of the shop bots and auction services now allows comparing the offers by both pure prices and prices including shipping costs. It does not solve the problem completely, as the cheapest delivery option is usually collecting the product from a traditional (offline) store, which is uncomfortable and unprofitable for most of the users.

Another factor that seems to be completely overlooked by researchers is the possibility of buying a few items at a time - most of the studies focuses e.g. on the purchase of a single book or CD. This aspect may be less important in case of dispersion studies, but researchers often combine price dispersion analysis with the price level study and in this area the results often show that buying products online is not profitable because of a high delivery cost. This conclusion would be different if purchasing more products was considered.

- Product selection

The most common products used for price dispersion studies are goods of a relatively low cost like books, CDs and DVDs. There are no studies that analyse more luxury homogeneous goods to check whether the product price level does not affect the price dispersion. According to Civan, luxury goods may have a greater dispersion of prices because they are bought by people who are less sensitive to price and have higher opportunity costs of time (Civan et al., 2008). As already mentioned, in case of selecting books or CDs as subjects of price dispersion studies, there is a difference in price dispersion between bestsellers and other books. Other challenge that can be met here is choosing sufficient number of comparable products and their apparent random selection. Test samples often contain approximately 20-30 titles and this size may be assessed as not representative. Price dispersion can also vary depending on the group of books, e.g. in poetry, reportage, guides, etc. There is no research so far that would take into account this diversity.

- Price changes over time

This issue is related to the choice of testing time. The key factor for the study results is the frequency of measuring prices (e.g. daily, several times a week or once a month). This topic is related to the development of tools for dynamic pricing. Such tools are used by companies for positioning their offers in the shop bots results. Change in the competitors' price often causes automatic reaction of other sellers - such changes may take even place several times an hour (Price wars…, 2012). The authors of Price wars quote the example of the microwave oven which price on Amazon changed

9 times in one day, it cost from 744 to $ 871. BestBuy responded immediately to almost all these changes (Price wars…, 2012).

However, Bounie et al. concluded in their studies that dynamic price-fixing tools are not so popular yet (in some countries shop bots do not allow for such procedures). In the aforementioned studies on Amazon in the US, UK and France prices remained unchanged by approx. 90% of the duration of the offer. An interesting observation was that the Amazon prices were likely to remain at the same level, and if they changed, it was often an increase. The rest of the sellers changed prices more frequently and it was rather reduction of the price (generally the smallest changes were noticed in France because of the already mentioned law regulations) (Bounie et al., 2009).

For the price dispersion studies it is also crucial if the analysed book is new or not. When introducing a new product to the market it sometimes happens that a publisher has a monopoly for a given period of time (dispersion is then equal to zero). After that more companies will try to get their share of the market, e.g. using lower prices, so the price dispersion increases. In a study of Nelson et al prices were collected weekly and researchers decided to include the variable "Week" in their model to see if dispersion is changing each week or not. It turned out that the variable is relevant and the longer the period, the higher dispersion (Nelson et al., 2007). Perhaps it can be explained by the fact that after the first wave of selling, some bidders are trying to use lower prices to get rid of the rest of the stock and thus raise cash for the next purchase.

- Price strategies

In theoretical models and in many empirical studies it is assumed that the lowest price at which one can sell a given good is the marginal cost (in practice the researchers do not know this cost). Hence the idea of Baye to measure price dispersion as the difference between the two lowest prices. Companies however apply different pricing strategies and sometimes may sell part of the products below marginal cost, e.g. when an item is meant to attract buyers who will purchase also other items, with standard margins. Companies may have different goals at a certain point of time - e.g. to maximize profit in the short or long term, to maximize sales, gain market share or maintain price leadership. Based on that, firms set their pricing strategies that include: the choice of pricing tactics, the method of calculating price discounts, payment methods, reactions to the competitors' moves, etc. (Rogoda, 2004).

Preparing pricing strategies is typical for larger companies, and research on the price dispersion generally concerns books and records, traded mostly by small entities. The research shows that these companies use in practice

only one pricing strategy - cost plus. This strategy is based on adding a margin to the calculated unit cost. It has a huge advantage over the other methods in case of selling large amount of products (e.g. books or CDs and DVDs), because it is very easy to use. In such a situation the existence of price dispersion can be explained by the fact that companies simply do not check competitors' prices very often, they rather carry out their cost-plus strategy with a few exceptions, e.g. to attract the customers. In order to understand this topic in more details, perhaps a survey of online retailers should be carried out to find out what are their pricing strategies and what does it mean for the price dispersion.

The fact that the seller use different pricing strategies was noticed in the research conducted by Nelson et al. The prices of all bidders were sorted from lowest to highest and they have been given a rank - 1 for the cheapest offer, and 10 for the most expensive. Afterwards the researchers calculated the average rank of each bidder, taking into account all the products. If a company has always offered the lowest prices, it would rank 1. The lowest average ranks received in the survey were: 3.45 for books, 3.73 for DVDs and 2.41 for CDs. This study has shown that there are no firms which have the lowest prices for all their goods (Nelson et al., 2007).

- The ways of searching for offers and information processing

The appearance of the Internet and tools like shop bots caused that some of the scientists predicted that the price dispersion will quickly disappear. It turns out that one of the important factors limiting this process is differences between the customers buying products online. Data on the number of Internet users in the world do not contain information about the level of their information literacy. Not every internet user searches for information in the same way and has the same knowledge about such tools as search engines and shop bots. The studies presented in this article are in general limited to the use of shop bots, but perhaps the researchers should also take into account the fact that some users will buy a book by typing the title to search engines or will use the auction sites. Gathering these data could give other results in terms of price dispersion. Apart from that, even using the shop bots one may get different results depending on a concrete shop bot. There are several shop bots on every market and each of them has signed an agreement with the other group companies. On the Polish market we can use e.g. Ceneo.pl, Radar.pl, Nokaut.pl, Skąpiec.pl, Tanio.pl or Okazje.info.pl.

Price comparison websites can be also divided into several categories:

- Autonomous and neutral shop bots – containing only information about the price, offers sorted by price (owner's revenue is mainly advertising),

- Autonomous biased shop bots – collecting fees for positioning the offers,
- Context shop bots - tables of prices and product information,
- Personalized shop bots - give the ability to sort listings by consumer filter (Krzesaj, 2006)

Some studies also show that the shop bot owners are not interested in redirecting the users always to the same stores. In order to achieve that, the so-called obfuscation strategies of offers are used (Ellison Ellison, 2001).

Supposing that the buyer wants to find the lowest price of the product using a search engine, the key questions are:
- How many result pages will he/she check?
- How will the query be built?
- Which search engine will he/she use (e.g. google, ask, baidu)
- Should he/she take into account the sponsored links?

The concept of reducing price dispersion on the Internet almost completely ignores the issue of processing information by the buyers. Higher availability of data or tools to process them does not necessarily mean that consumers have better knowledge. "The basic assumption of information processing is the assumption about the economics of this process. According to this assumption processing of all available information would make no sense - most of the data is useless for a person in a concrete situation. Moreover, a person is not able to process all the information available, even if it is fully useful, because the human mind has limited capacity. According to S. Fiske and S. Taylor, the man is a cognitive miser, a creature that usually involves only a part of available cognitive resources "(Nęcka et al., 2008).

While analyzing the online shopping for homogeneous goods we should also take into account the achievements of psychology of economics. Probably part of the buyers use the so-called mental accounting and has a different way of searching for the best offer when buying a book for themselves or e.g. as a gift. The attitude may also result from the fact that in a given period a person has already spent a certain amount of money on cultural goods and will plan to spend as little as possible for the next goods in this area, e.g. a next book (Piskorz Zaleśkiewicz, 2003). An important role may be also played by the reference point chosen by the buyer - perhaps some buyers at the beginning of the search set their maximum amount to spend and buy at the first store that will meet this requirement.

- Reputation of the seller

The last factor presented in this article that may affect the price dispersion is the reputation of sellers. Some researchers undertook the difficult task of checking whether a greater reputation of stores let them set the higher prices. Of course, the most difficult part of this research is to determine how to measure the reputation. Some researchers use comparisons done by the Bizrate shop bot, which in addition to the price also indicates the overall assessment of the seller in terms of the presented information about the product, quality of the service, usability of the online store, etc. In some studies shops are divided into 2 groups: sellers that advertise a lot on TV and the rest of the shops (Civan et al., 2008).

The vast majority of studies have failed to find a relationship between the reputation and the price level. One of the reasons given here is the fact that provide more information does not give the seller an opportunity to set higher prices. Since the distance between two shops is reduced to just one click, a buyer can retrieve information from one source, and then buy a product in another store at a lower price (Brynjolfsson, 2000). Up to some point there was a statement amongst the scientists that the Internet will divide shop into two groups – there will be sellers with a low price but poor service and the second group will include shops having a great level of service, but the consumer will have to pay more for it. Research of K. Baylis J. Perloff overthrew those beliefs, as it turned out that that online companies split in fact into "good" and "bad" sellers. The good ones have low prices and good service and the bad ones have high prices and a lot of inconvenience for the purchase (Baylis Perloff, 2002).

Nelson et al summarized the results of research on vendors' heterogeneity with following conclusions:
- It is not known which factors are relevant,
- In various studies the same factors interact in different ways,
- If any of the factors explained dispersion – it was minimal (Nelson et al., 2007).

## Conclusions

The studies of price dispersion of homogeneous goods sold on the Internet involve many challenges. Manufacturers and retailers are taking many actions to distinguish their products and as a result, these goods are often no longer homogeneous. Studies conducted so far focused mainly on books, CDs and DVDs, so they cannot be generalized to all products. Part of the available research results is already quite outdated because of the development of e-commerce and the increased use of tools such as shop bots. Further studies should apply a unified method of research – which means e.g. the same measure of dispersion, the same selection of products

and the same way of reaching out to the offer (search engine, shop bots or auction sites). Due to the fact that the price dispersion studies are carried out in different countries having their own specific features (e.g. law in France), meeting all these conditions does not seem to be achievable.

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