EFFECTS OF PHARMACEUTICAL PROMOTION. THE CASE OF A FIRM WITHIN THE MARKET OF HEPATOPROTECTORS IN UKRAINE

by

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Kyiv School of Economics

Abstract

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This paper has two major objectives. The first objective is to identify what effect has the DTCA, brand-switching or market-expanding. The second objective is to determine what type of promotion has the stronger effect on market share, DTCA or detailing. There is no similar study that investigated the effect of pharmaceutical promotion in Ukraine. This paper finds that DTCA has the market-expanding effect rather than business-stealing. Empirical results show that managers should use detailing more often than DTCA.

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Chapter 1

INTRODUCTION

In 2014 the consumption of health products was adversely affected by the tense situation in Ukraine. The fact that overall market (in value terms) has increased explained by rising prices rather than the increase in demand. This is because of strong devaluation of Hryvnia in 2014. The imposed tax on medicines of 7% additionally increases the price. However, Euromonitor[1] suggests that the demand for health products should accelerate in the future, taking into account Ukrainians' self-confidence in self-medication. But the start and rate of recovering depends on conflict resolving in the East of the country.

The pharmaceutical industry has its own features. Every drug must be examined and get the approval due to the Law of Ukraine on Medicine[2] of 4th April 1996 from the Ministry of Healthcare of Ukraine (MHU). Now, Ukraine simplified the registration procedure for the drugs being registered by the regulatory institution in Australia, Japan, Switzerland, USA or EU. Then MHU determines the type of the drug: whether it should be sold only on the prescription basis or could be realized over-the-counter (without prescription).

The type of drug determines the way it can be advertised. Direct-to-consumer advertisement (DTCA) of prescription drugs are allowed in Australia and the USA. However, the majority of countries allow the DTCA of OTC drugs. DTC includes TV, radio, mass and social media advertisement. DTCA is regulated by the Law of Ukraine on Advertisement[3] of 3rd July 1996.

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[1] http://www.euromonitor.com/consumer-health-in-ukraine/report

[2] http://zakon4.rada.gov.ua/laws/show/123/96-%D0%B2%D1%80

[3] http://zakon4.rada.gov.ua/laws/show/270/96-%D0%B2%D1%80/page

Companies also use direct-to-physician advertising (DTPA) in order to promote their prescription drug. It also called as detailing, because companies' representatives make the calls to physicians and explain the benefits of their product in "details". For the OTC drugs additional option is available – detailing to pharmacists. Since OTC drugs can be bought in a drugstore without prescription, companies' representatives may persuade the pharmacists to recommend their drug to the customer.

The effectiveness of DTCA and detailing is quite interesting and widespread subject to be studied. There are various studies looking into the promotion effect on the companies' performance. However, the results of studies are different. For instance, Iizuka (2004) found DTCA to have market-expanding effect, whereas the results of Kalyaranam (2009) suggest that DTCA should have the market-stealing effect. Concerning the effectiveness of detailing, Ching and Ishihara (2007) confirmed that it has a positive effect on market share of the company and ought to be increased by the managers.

One should mention that health care and health care products are substantial parts of our economy, thus studying the effect of pharmaceutical promotion is of importance and should be implemented.

For my thesis I chose to study the case of one of the leading companies within the market of hepatoprotectors in Ukraine. Hepatoprotectors (hepatoprotective drugs) protect the liver from the damaging effects of exogenous or endogenous factors that reduce inflammatory activity of the liver. This kind of drugs is specific and less likely to have substitutes in other categories of drugs. Also the usage of OTC brand allows me to study the effect of detailing to pharmacists.

I make use the data from Morion database. The data are given for me by the representative of the Ukrainian pharmaceutical firm. Due to the privacy of information, the name of this company and drug are concealed.

My study has the following research questions:

1) What promotion effect has DTCA, brand-switching or market-expanding?
2) What kind of promotion is more effective for firms, DTCA or detailing?
3) Does the firm make its advertising decision endogenously?

The first and second questions are of my interest while for the 3rd question I expect to receive a positive answer.

The paper is structured as follows. Chapter 2 provides a literature review concerning the effect of different types of promotion. Chapter 3 outlines the methodology used in the research. Next, Chapter 4 describes the data used in this paper. Empirical results are presented in Chapter 5 and Chapter 6 provides the conclusions and managers' implications.

Chapter 2

LITERATURE REVIEW

We start from the general overview of the literature related to promotion and advertising. The second part of the review is dedicated to the theoretical approach for promotion. The third part is focused on empirical evidence regarding DTCA and detailing effectiveness.

Effects of promotion and advertisement

Hurwitz and Cave (1988) investigated the effect of promotion and price discounts on market share of new entry to the pharmaceutical market. They found that promotion increases market share, however, the short-run effect of price discounts on market share is weak. That means that market share grows up along with the accumulation of advertising stock.

Rosenthal et al. (2003) found that DTCA effect is greater at the class level than at individual product sales. Therefore, spending on DTCA may fail to increase demand for a firm's own drug, but still increase class demand.

Bala and Bhardwaj (2007) distinguished two types of effects of DTCA: informative and persuasive. They found that when firms are homogeneous in terms of their detailing productivity, they use detailing as well as informative DTCA if the market is pretty large. If the market is small, firms rather use detailing and persuasive DTCA. When the companies adopt informative DTCA, level of detailing goes up. In contrast, level of detailing goes down when the firms use persuasive DTCA.

David and Markowitz (2011) studied the role of advertisement and promotion in the pharmaceutical industry. They developed a model, which predicts the optimal

level of advertisement depending on the level of competition (monopoly or oligopoly). Their model confirmed the fact that DTCA of a company increases its own market share while competitors spending on advertisement decrease own market share. They also found that high spending on detailing can lead to adverse drugs events, which increase the probability of regulatory actions against the firm. These results are similar to what found David et al. (2010).

Theoretical model

Kalyaranam (2009) investigated the effect of direct-to-consumer advertisement (DTCA) on market share in the pharmaceutical industry suggesting that firms make their advertising decisions endogenously. The second purpose of his study was to find empirical evidence for the fact that DTCA leads to brand switching. He used data about sales, price, direct-to-physician advertising and the average cost of consumption per usage for three prescriptions, obtained for 1998 and 1999 years. The major finding is that there is a positive effect of DTCA and detailing on market share of a firm which makes its advertising decision endogenously. Empirical results support the claim of medical insurers and providers that DTCA encourages brand switching (increasing the market share of one firm while decreasing relatively to other firms) rather than increasing the total demand for drugs.

As opposed to Kalyaranam (2009), Iizuka (2004) found that DTCA has the market-expanding effect rather than business-stealing (brand-switching) effect, whereas detailing has business-stealing effect. The results suggest that firms will use DTCA in the markets, which have a high potential to grow up. At the same time, firms will spend money on DTCA less in the market with high level of competition. He also found that new, high-quality drugs, for under-treated diseases are more frequently advertise.

Both studies use the 2SLS model with DTCA as instrumental variable explained by the market share lags.

Empirical evidence

Iizuka and Jin (2002) used data on anti-cholesterol and anti-allergy drugs to study DTCA effect. The results show that DTC advertisement has a little effect on the choice of drug. This is opposite to the effect of direct-to-physician advertising (detailing), which has significant positive effect on the choice of drug). It means that these two types of advertisement play different roles in promoting the drugs. The aim of DTC advertisement is to increase the aggregate demand while detailing influences the brand choice of a customer.

Narayanan et al. (2003) explored the interactions between pairs of the marketing mix and its effect on return on investment in the advertisement. They found that the more detailing the company is providing, the more sensitive demand to higher prices is. DTCA and detailing go at the same direction; however, their model reveals that while DTC has a significant effect on category sales, detailing does not. But both detailing and DTCA affect brand shares and, moreover, detailing has a much bigger effect than DTCA. It supports the fact that the advertisement is more related to brand-switching rather than to increasing the aggregate demand of drugs.

Liu (2007) used a dynamic approach to determine optimal detailing levels for the firms by maximizing their long-term profits. His model shows the evidence of concentration at high levels of detailing stock. Empirical results suggest that the optimal detailing level decreases in own detailing stock. In addition, firms act as the following: increase detailing in their rivals' detailing stock when their rivals have low detailing stock, but reduce their efforts when their rivals have high detailing stock.

Ching and Ishihara (2007) developed a model of detailing and prescribing decisions under the condition of uncertainty about the quality of the drugs. They used product level data on the ACE-inhibitor with the diuretic market in Canada in order to estimate their model. The empirical model shows that the detailing efforts have a positive effect and, thus, should be increased by the managers. Another important finding is that the effectiveness of detailing depends on how well the physicians were informed, Authors also suggest that their findings can be used in many other markets, like films, software etc.

Lim and Ching(2012) examined the case of anti-cholesterol drug (statin) of Pfizer. They found the positive significant effect of detailing on the success of this drug. Their results suggest that there is an information spill-over of landmark clinical trial results across drugs. Another useful implication of this study is that improving medicinal properties of the drug leads to increase in sales of this drug. This suggests the importance of R&D.

Berndt et al. (2007) conduct a study, which investigates the rate at which new medicines are promoted across fifteen countries and three types of drugs (antihypertensives, antidepressants and antiepileptics). Antihypertensives are found to be highly promoted to physicians than the others. The empirical results suggest that direct-to-consumer advertising and direct-to-physician promotion of new drugs positively influences new drugs' market share, while promotion of old ones leads to a decrease of new drugs' market share.

Wosińska (2002) investigated the role of DTCA on demand for drugs. She found that DTCA increases the chances of the drug to be prescribed only if it is listed in the formulary. Another important finding is that marginal effect of detailing is higher than the marginal effect of DTCA

Summarizing, there are evidence that DTCA and detailing have a positive effect on market share of a company, but there still concerns which effect does DTCA has, brand-switching or market-expanding. Also, detailing is found to be more effective than DTCA.

Chapter 3

METHODOLOGY

To study the effects of pharmaceutical promotion on market share of the company, I use the model, which was built upon the empirical research done by Kalyanaram (2009).

Market share of each period is modeled as a function of direct-to-consumer advertisement (DTCA), detailing (representatives' visits to doctors/pharmacists), price and intensity of competition as represented by the number of competitors.

The study of Kalyanaram (2009) shows that firms make their marketing decisions (money spent on advertisement, number of representatives' visits to doctors/pharmacists) endogenously. This means that the advertisement/ promotion decision of the companies depends on previous revenues, sales or market share. Typically, pharmaceutical companies follow the next rule: advertisement budget for the next period is set as the percentage of the previous sales/market shares. This makes their decision endogenous.

In order to avoid possible endogeneity problem, I use two-stage least squares (2SLS) model. The only instrumental variable in this model is DTCA, which is constructed as a function of market share.

To estimate the optimal number of lags to include in 2SLS model, goodness-of-fit measure is implemented. It is calculated as the square of the correlation coefficient between the fitted and raw values of the dependent variable. In the regression, this measure is equal to R^2.

Equations of the model are the following:

$$lnMS_t = \alpha_1 * \ln DTCA_t + \alpha_2 * \ln RP_t + \alpha_3 * \ln N_t + \\ + a_4 * \ln Dd_t + \alpha_5 * \ln Pd_t \quad (1)$$

$$lnDTCA_t = \beta_0 + \beta_1 * \ln \mathrm{MS}_{t-1} + \beta_2 * \ln \mathrm{MS}_{t-2} + \cdots \\ \ldots + \beta_{12} * \ln \mathrm{MS}_{t-12} \quad (2)$$

All variables and their sources described in Table1.

MS_t is the dependent variable in the first equation. It is calculated as a ratio of the firms' sales in natural terms (packs) to the total sales.

$DTCA_t$ shows the advertisement effort of the company. I use GRP (gross rating point)in order to explain this effort. The coefficient of this variable shows how direct-to-consumer-advertisement influences the market share of the company. I expect it to be positive and statistically significant.

RP_t is the real price of the drug in hryvnias. (It is adjusted by CPI (2010=100)). Typically, the higher price set up a company, the less its sales in natural terms should be in the future. I expect the coefficient of this variable to be negative and statistically significant.

The coefficient of N_t characterizes the effect of competition. Increasing number of competitors on the market should reduce the market shares of the existing companies. Thus, I expect the coefficient to be negatively correlated with the dependent variable.

Dd_t explains the effect of the company representatives' visits to the doctor. The higher number of visits will be made by the company, the more recommendations to buy the particular drug they will give to patients. Thus, I expect the effect of this variable to be positive.

Pd_t explains the effect of company representatives' visits to a physician. Since the drug is over-the-counter, it might be sold without prescription of the doctor. As a doctors' detailing, I expect the coefficient of this variable to be positive. The effect of this variable should be the same order as the effect of representatives' visits to the doctor.

MS_{t-i} ,$i=1..5$ stands for the lagged values of market share. Since it is usually impossible to get information about total sales up to date, I expect first few lags to be insignificant, and others to have a positive effect on DTCA. However, since the data about DTCA isn't in monetary term results might be ambiguous.

Since there is a controversy among the authors concerning the effect of a promotion, whether it is business-stealing (Kalyaranam, 2009; David and Markowitz, 2011) or market-expanding (Iizuka, 2004), I also investigate the effect of promotion on the sales of the company. I use for this purpose the same methodology as for the market share model, except the dependent variable in the first equation and independent variables in the second one. They've been replaced by the corresponding sales' volumes. Equations are the following:

$$lnSunit_t = \alpha_1 * \ln DTCA_t + \alpha_2 * \ln RP_t + \alpha_3 * \ln N_t + \\ + \alpha_4 * \ln Dd_t + \alpha_5 * \ln Pd_t \quad (3)$$

$$lnDTCA_t = \beta_0 + \beta_1 * \ln Sunit_{t-1} + \beta_2 * \ln Sunit_{t-2} + \cdots \\ \ldots + \beta_{12} * \ln Sunit_{t-12} \quad (4)$$

$DTCA_t$,Pd_t,Dd_t,N_t, RP_t mean the same as in the equations for market share. The coefficients of these variables are expected to have the same sign as in equations (1), and (2).

It might be an issue with the significance of estimates. One of the problem causing it – is the homoscedasticity. To avoid such a problem I run regressions with heteroskedasticity corrected errors.

The advantage of my methodology is that implementing of widely-used model, which explains the relationship between the market share and promotion. Also, I take into account feature of over-the-counter drugs – that the product could be promoted through the pharmacists.

The drawback of my methodology is the absence of promotion data in monetary terms. It might lead to insignificant estimates of the equation, which explains the advertisement solution depending on the previous market share/sales. That is why it will be difficult to compare the effect of DTCA and detailing.

Chapter 4

DATA DESCRIPTION

We use the monthly data for the one of the leading company on the market of hepatoprotectors within the pharmaceutical industry (due to the privacy of information, the name of a company is hidden) for the period from the January, 2010 to October, 2014. Thus, data sample contains 58 observations.

Dataset provides information about the sales of a company both in natural (packs) and monetary (thousands UA Hryvnias) terms. Demand (in packs) for the drugs was steadily growing till 2014 when it dramatically plummeted by 20% (Fifure1). It might be explained by the decrease of purchasing power of people after abrupt depreciation of the national currency. Also, starting from different periods of 2014, many statistics services, including State Statistics service of Ukraine, stopped to reveal the information about Crimea and area on the East of Ukraine, which temporarily aren't under control of the country.

We derive the market share of the company for period *t*, dividing sales of the company for period *t* by total sales of the market for the same period and multiplying by 100%. For this purpose data about sales in natural terms were used.

$$MS_t = \frac{Company\_Sales\_packs_t}{Total\_Sales\_packs_t} * 100\% \quad (1)$$

I cannot reveal estimated numbers about market share (due to the privacy conditions), but can show the net changes of market share over the given period (Figure2). Changes are typically pretty volatile; the strongest amplitude of changes was at the end of 2010.

The nominal price of product for period t was calculated by dividing the total sales of the company in monetary terms for period t by the total sales in natural terms for the same period:

$$P_t = \frac{Total\_Sales\_UAH_t}{Total\_Sales\_packs_t} * 1000 \quad (2)$$

It is important to study effect of real prices. Thus, nominal prices should be converted in real ones. For this purpose I used monthly data about CPI (Consumer Price Index) for the same period I have other data. The source of data is State Statistics Service of Ukraine[4]. It should be mentioned, that price changes are different for different industries. Thus, CPI for health goods was used (Figure3). All CPI's were adjusted to the 2010 price level (2010=100). Prices of pharmaceutical goods increased on average by only 14.6% for the period of 4 years. But for the period from January, 2014 to October, 2014 goods became more expensive by 41.6%.

The real price of a drug was calculated as ratio of nominal price of the product to CPI of corresponding period:

$$RP_t = \frac{P_t}{CPI_t} * 100 \quad (3)$$

Again, due to the privacy of information, I can show only the changes in real prices, not the exact numbers. We see, that companies prefer to increase the real price significantly once a year, rather than do it uniformly over the year (Figure4).

Detailing is usually described by the representatives' visits to doctors. Since my study is dedicated to OTC drugs, representatives' visits to pharmacists should be covered also.

Detailing data is represented by the numbers of such representatives' visits to doctors (Figure5) and pharmacists (Figure6). Data show the high volatility of such detailing. As could be seen from the graphs, changes in number of visits are more volatile in the case of pharmacists' detailing, while the amplitude of such changes is larger for changes in the number of visits to doctors.

The most important factor, characterizing effectiveness of direct-to-consumer advertisement is gross rating point (GRP). The gross rating point is a cumulative measure of the impressions an advertising campaign generates. It is determined by the product of the percentage of audience reached multiplied by the number of exposures per period of time. To achieve higher GRP, companies typically spend more money on TV advertisement.

Data (Figure7) shows that there is a significant amount of moments of time when the company decided not to invest in TV advertisement, because there are several moments when GRP equals to zero. The company only 3 times increased their GRP more than twice. Other times, GRP slightly changed or vanished sometimes.

One should also describe a variable, characterizing competition. It is a number of competitors at the corresponding moment of time (Figure8). I decided to count a company as a competitor if its market share (in terms of packs) is more than 0.3%. I chose this threshold because companies either exceed this level most part of a time or their market share equals to zero almost always.

[4] http://ukrstat.org/en/operativ/operativ2010/ct/is_c/arh_isc/arh_iscgr10_e.html

Chapter 5

EMPIRICAL RESULTS

This chapter is structured as follows: first, results of basic model (with market share as dependent variable) will be discussed. Then the results of the alternative model (with sales as dependent variable) with the comparison of two approaches follow.

All reported results are robust.

Basic model

Firstly, I start with the determining the number of lags for the advertisement solution. Secondly, I study the effect of promotion on market share, taking DTCA depending on the market share as instrumental variable.

As can be seen from the first column of Table2, market share lags from the first to the fourth are statistically insignificant. This confirms the suggestions given in the Chapter 3. Usually companies are unable to receive sales information up to date, that is why their advertisement solution depends on the more distanced lags. Thus, lags starting from the fifth should be included in first-stage equation.

In order to determine optimal number of lags, I apply goodness-of-fit measure, used by Kalyanaram (2009). It is equal to R^2 of regression. As indicated in the Table3, this measure equals to 0.064 for one lag, 0.096 for two lags, 0.123 for three lags, 0.214 for four lags, 0.408 for five lags, 0.481for six lags and 0.468 for seven lags. Hence, the six-period lag is the optimal advertisement decision lag for the company.

Results of 2SLS regression with optimal number of lags are presented in the Table4. It should be mentioned, that only fifth and ninth lags are statistically significant at 1% level, others are not. The magnitude of the fifth lag coefficient is -9.25, which means that one percentage point increase in market share[5] fifth lag decreases the DTCA efforts by 9.25%. Increase of market share ninth lag by 1% decreases the DTCA efforts by 10.275%. Magnitudes of the results are relatively high compared to those obtained by Kalyanaram (2009) His estimated magnitude was 0.11 and coefficients were positive. Such a difference could be explained by the fact that the companies in Ukraine are more sensitive to the market share changes. One should not overestimate the significance of magnitude of the lags' coefficients. The data I use to explain DTCA efforts differs from those used by other authors (they usually denominate DTCA in monetary terms). That's why I would pay more attention to the sign of the coefficients rather than to their magnitude. Model suggest practically relevant conclusion: firms can expand their advertisement campaign, when they are losing position on the market, and vice-versa, contract the campaign, when their market share increases.

The results of the analysis of promotion effect on market position of the company are similar to those obtained by Kalyaranam (2009). Promotion has positive and significant effect on market share, while price and competition – negative one.

As can be seen form the Column 2 of Table4, if company increases its DTCA efforts by 1%, its market share goes up by 0.0197%. The magnitude of this coefficient is relatively small to Kalyaranam's (2009) result. He estimated this coefficient to be equal to +0.21. This difference might be explained by various factors. The first reason can be peculiarity of the drug. DTCA may have such a

[5] Percentage increase of market share means increase of its decimal value by 1%

weak effect on this type of drug. Second factor is the type of advertisement. As mentioned Bala and Bhardwaj (2007), there are two types of advertisement: persuasive and informative. Perhaps, the company's usage of persuasive advertising is not sufficient to economically significant increase of market share.

The estimate of price coefficient is negative (-1.055) and significant at 1% level. Therefore, if price goes up by 1%, market share will go down by 1.055%. Since the product can be bought in the drugstore without prescription, the fact that magnitude is more than one appears to be reasonable.

The estimate of level of competition coefficient (number of competitors) is -0.6. As was postulated before, higher level of competition decreases market share of the company. The effect of this factor is more significant than in Kalyaranam's (2009), because drug can be bought without doctor's prescription.

Interesting and useful results were obtained for estimates of detailing effect. The coefficient of representatives visits to the doctors effect (detailing to doctors) is +0.0347. At the same time, estimate for the effect of detailing to pharmacists is +0.0495. This is because hepatoprotectors aer OTC drug and customers can go to drugstore without visiting their doctors. Magnitude of DTPA is ten times less than in Kalyaranam (2009) but still economically significant.

Alternative model

Since there was a question whether DTCA has a business-stealing effect (Kalyaranam, 2009; David and Markowitz, 2011) or market-expanding (Iizuka, 2004), I also investigate the effect of promotion on sales of the company.

The results are reported in the Table4. As can be seen in Column1, all sales lags are statistically insignificant; therefore, they appear to have no effect on advertisement decision.

Estimate of DTCA coefficient is +0.06. It is higher than effect of this factor on the market share (+0.0197). However, magnitude of this effect is of the same order. It confirms the idea (Iizuka, 2004), that DTCA has market-expanding effect rather than brand-switching.

The effect of price has estimated coefficient of -1.514. It is higher in absolute value than the same coefficient in the basic model (-1.055). Results suggest that sales are more sensitive to price changes than market share.

Level of competition has the same sign and the same magnitude as for the basic model. This estimated coefficient is (-0.965), while in basic model it equals to (-0.6).

The main distinction between the models is in the difference between estimates of detailing effect. Estimate for detailing effect to doctors is (+0.13). It is slightly less than the effect of detailing to pharmacists (+0.15). In basic model these coefficients are equal to (+0.0347) and (+0.0495) respectively. Results suggest that detailing to pharmacists is more effective than detailing to doctors for both sales and market share increase. However, the magnitude of detailing effect for sales is of higher order compared to market share.

Chapter 6

CONCLUSIONS

This study is seeking the answer to three questions: what promotion effect has DTCA, brand-switching or market-expanding; what kind of promotion is more effective for the firms, DTCA or detailing; whether the firm makes its advertising decision endogenously or not. To answer these questions I used the 2SLS model provided by Kalyanaram (2009), using the dataon one of the leading firm within the market of hepatoprotectors in Ukraine from Morion database.

Comparing the results obtained of the basic and alternative model, DTCA is found to have market-expanding effect rather than brand-switching. However, the effect of DTCA is economically weak (+0.0197 for market share and +0.06 for sales) But nevertheless, the results are statistically and economically significant and should be taken into account by managers.

Detailing is found to have somewhat higher promotion effect than DTCA. Taking into account peculiarity of OTC drugs, the fact that detailing to pharmacists has higher effect (+0.0495 on market share and +0.15 on sales) than detailing to doctors (+0.0495 on market share and +0.15 on sales) appears to be reasonable. Thus, more attention to detailing to pharmacists should be paid by managers of the company

The results suggest that the company should use detailing rather than DTCA in order to increase its sales and market share.

The results confirm the hypothesis that the pharmaceutical firm makes its advertising solution endogenously, based on the information about previous

market shares. The company looks five month back to determine optimal advertising efforts for the next period. Also, the company increases its advertising efforts when market share goes down.

The empirical results of this study are encouraging and there is need for the future work to be done. For instance, one may study the effect of DTCA and detailing, given the data in monetary terms. Also, it is interesting to undertake the study of the effect of R&D.

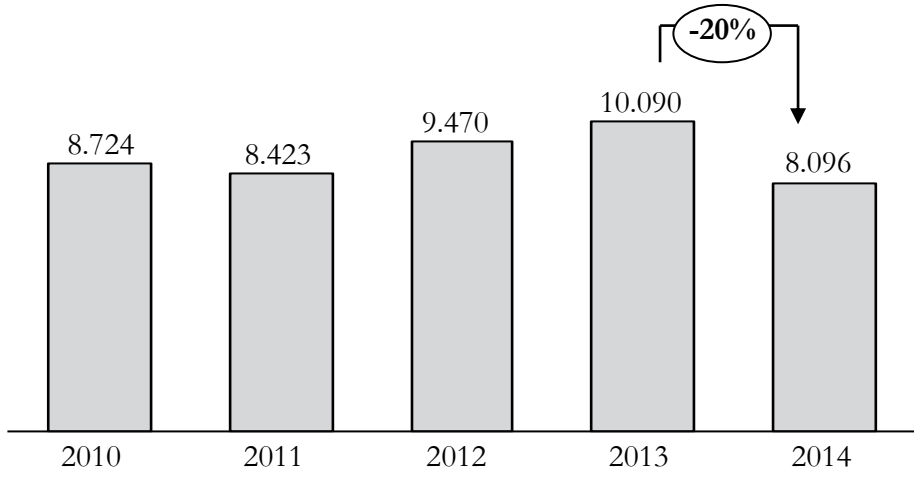

Figure1.Total market sales, million packs

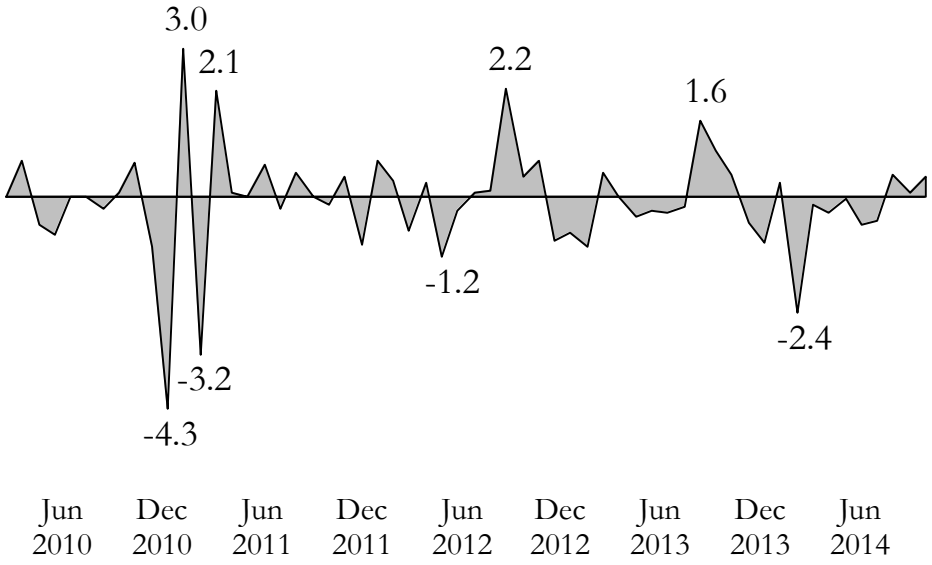

Figure2.Net changes of company's market share, %.

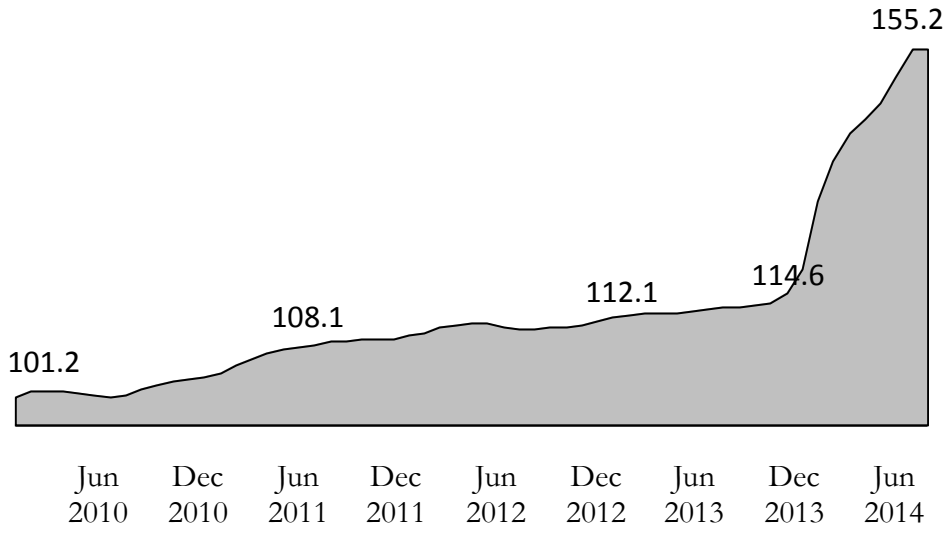

Figure3.CPI (2010=100)

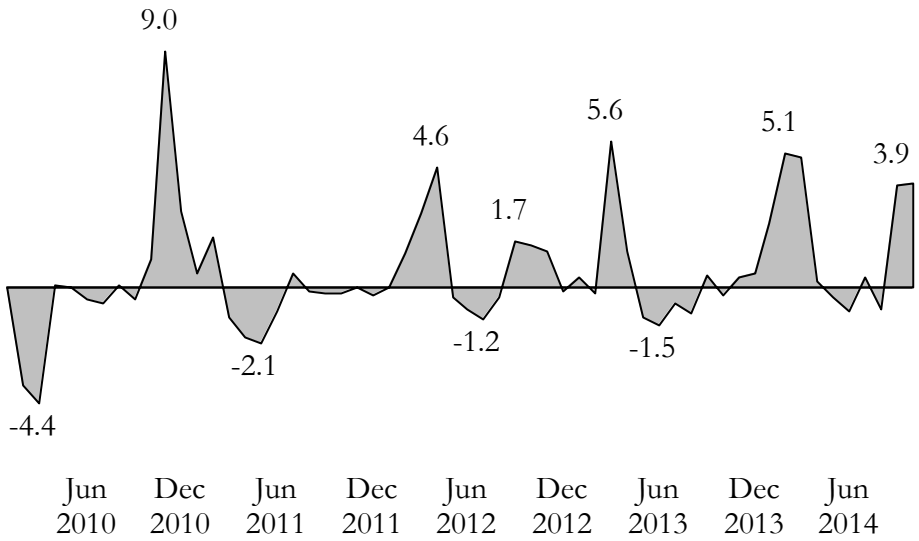

Figure4.Net changes of drug's real price, UAH.

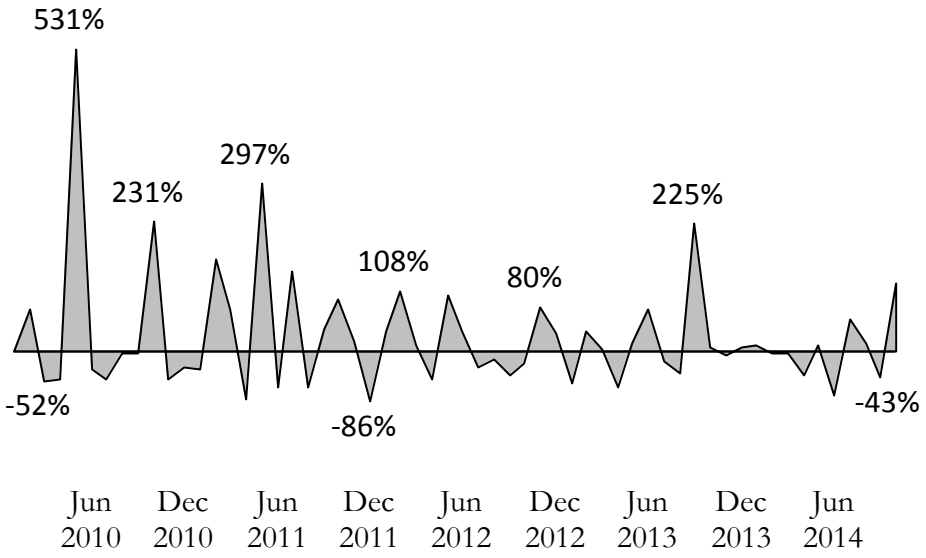

Figure5.Percentage changes in the number of representatives' visits to doctors.

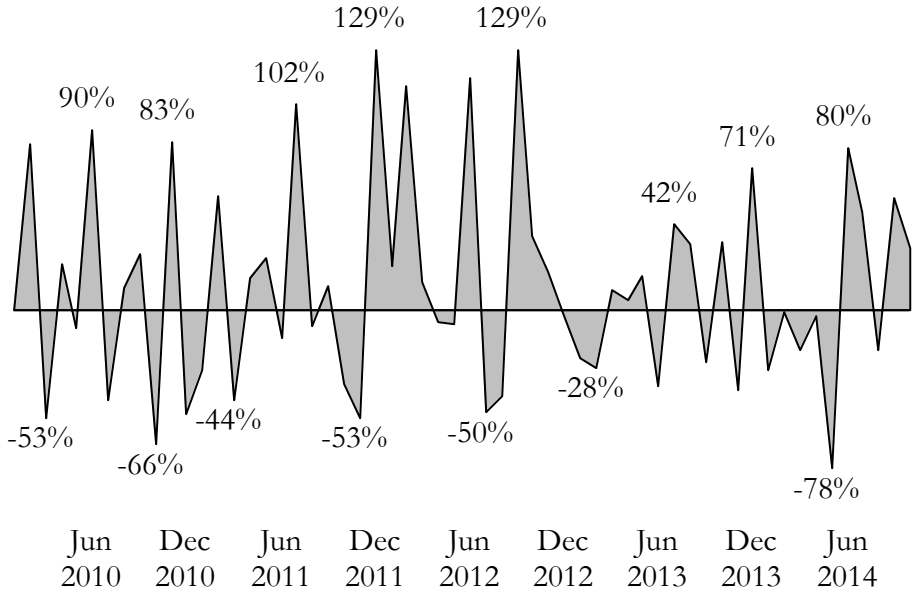

Figure6.Percentage changes in the number of representatives' visits to pharmacists.

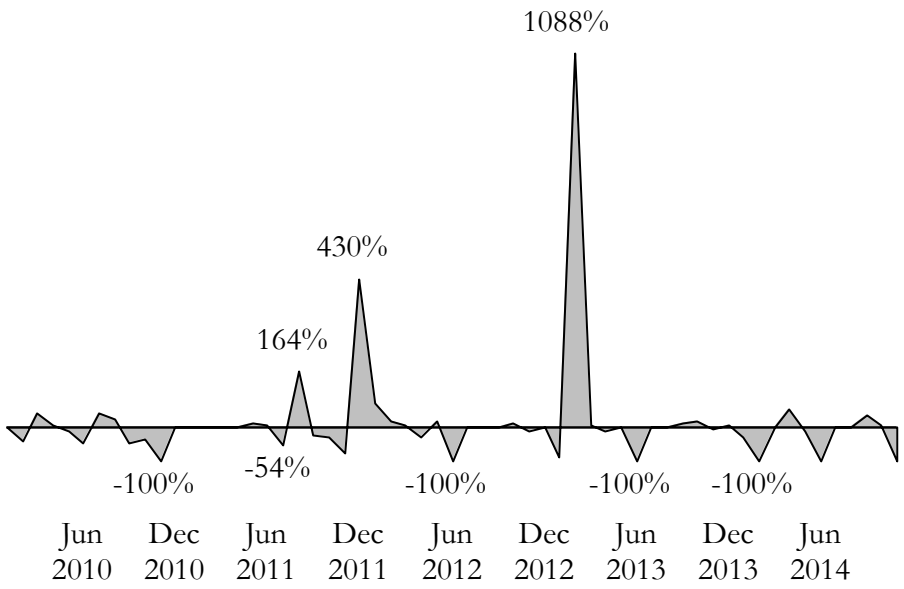

Figure7.Percentage changes in gross rating point (GRP).

Figure8.The number of competitors within the market of hepatoprotectors.

Table1.Data description

Variable	**Description**	**Source**
lnMS	natural logarithm of market share (given in decimal values)	Morion database
lnDTCA	natural logarithm of gross rating point	Morion database
lnRP	natural logarithm of real price of the drug (adjusted by CPI index)	Morion database, State Statistics Service of Ukraine
lnN	natural logarithm of number of competitors	Morion database
lnDd	natural logarithm of number of detailing representatives visits to doctors	Morion database
lnPd	natural logarithm of number of detailing representatives visits to doctors	Morion database
lnSunit	natural logarithm of company's sales (given in number of packs being sold)	Morion database
lnMS1-lnMS12	natural logarithms of market share lags from the 1^{st} to 12^{th}.	Morion database
lnSunit1-lnSunit12	natural logarithms of market share lags from the 1^{st} to 12^{th}.	Morion database

Table2.First-stage results with 12 lags for the model with market share as a dependent variable

	2SLS
	one-stage
VARIABLES	lnDTCA
lnMS1	-1.770
	(5.373)
lnMS2	5.888
	(4.821)
lnMS3	2.978
	(4.40)
lnMS4	-2.960
	(4.466)
lnMS5	-10.01**
	(4.655)
lnMS6	-4.140
	(4.503)
lnMS7	8.836
	(5.577)
lnMS8	-0.0077
	(4.341)
lnMS9	-12.86**
	(4.851)
lnMS10	-7.529
	(4.413)
lnMS11	5.156
	(4.335)
lnMS12	4.801
	(4.113)
lnDTCA	
lnRP	-2.890
	(7.155)
lnN	-1.486
	(5.566)
lnDd	-1.131
	(0.841)
lnPd	-0.0551
	(0.945)
Constant	0.696
	(41.52)
Observations	46
R-squared	0.528

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table3.Goodness-of-fit measures of number of lags

VARIABLES	(1) 1lag	(2) 2lags	(3) 3lags	(4) 4lags	(5) 5lags	(6) 6lags	(7) 7lags
lnMS5	-4.560*	-2.739	-3.126	-5.348	-8.556***	-9.056***	-9.731***
	(2.275)	(2.859)	(3.280)	(3.361)	(3.116)	(3.117)	(2.910)
lnMS6		-3.573	-3.187	-1.505	-3.605	-4.429	-5.045
		(2.474)	(2.361)	(3.675)	(3.509)	(3.875)	(3.828)
lnMS7			-1.394	1.590	6.317	5.587	7.209
			(2.790)	(3.230)	(4.157)	(4.227)	(5.114)
lnMS8				-6.240*	-1.781	-1.287	-0.606
				(3.172)	(2.750)	(3.330)	(3.170)
lnMS9					-11.11***	-10.31***	-12.79***
					(3.043)	(3.246)	(4.204)
lnMS10						-2.993	-4.872
						(2.753)	(3.726)
lnMS11							3.821
							(3.280)
Constant	-5.542	-9.466	-12.63*	-21.12***	-37.24***	-45.67***	-44.68***
	(5.201)	(5.937)	(6.548)	(7.452)	(7.316)	(4.457)	(5.254)
Observations	53	52	51	50	49	48	47
R-squared	0.064	0.096	0.123	0.214	0.408	0.481	0.468

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table4. Estimation results for the model with market share as a dependent variable

	2SLS	
	one-stage	two-stage
VARIABLES	lnDTCA	lnMS
lnMS5	-9.250***	
	(3.117)	
lnMS6	-4.506	
	(3.875)	
lnMS7	6.217	
	(4.227)	
lnMS8	-1.225	
	(3.330)	
lnMS9	-10.275***	
	(3.246)	
lnMS10	-3.296	
	(2.753)	
lnDTCA		0.0197**
		(0.00997)
lnRP	-3.694	-1.055***
	(4.697)	(0.0959)
lnN	-0.292	-0.600***
	(5.062)	(0.159)
lnDd	-0.326	0.0347**
	(0.589)	(0.0151)
lnPd	0.330	0.0495**
	(0.593)	(0.0202)
Constant	-29.90	3.161***
	(38.0)	(0.826)
Observations	48	48
R-squared	0.507	0.733

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table5. Estimation results for the model with sales as a dependent variable

	2SLS	
	one-stage	two-stage
VARIABLES	lnDTCA	lnSunit
lnSunit1	30.84	
	(48.23)	
lnSunit2	24.21	
	(56.89)	
lnSunit3	-58.76	
	(67.05)	
lnSunit4	-35.39	
	(52.39)	
lnSunit5	-31.80	
	(65.34)	
lnSunit6	-36.68	
	(63.17)	
lnSunit7	27.98	
	(67.45)	
lnSunit8	-13.69	
	(49.72)	
lnSunit9	-77.25	
	(56.86)	
lnSunit10	-46.78	
	(41.81)	
lnSunit11	-0.804	
	(51.34)	
lnSunit12	22.06	
	(34.24)	
lnDTCA		0.0599***
		(0.0172)
lnRP	- 6.046	-1.514***
	(7.836)	(0.348)
lnN	-12.80*	-0.965***
	(7.186)	(0.340)
lnDd	-1.192	0.130**
	(0.888)	(0.0511)
lnPd	- 0.151	0.150***
	(0.868)	(0.0422)
Constant	548.1	18.30***
	(176.1)	(2.399)
Observations	46	46
R-squared	0.483	0.607

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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