General Management MBA

The Predictability Of Pharmaceutical Market Growth In Eastern Europe

Master Thesis zur Erlangung des akademischen Grades

Master of Business Administration (MBA)

an der Universität für Weiterbildung (Donau-Universität Krems)

und der Technischen Universität Wien, Continuing Education Center

eingereicht von

Claudio Reynaldo Lewandowski

BetreuerIn

Dipl.Ing. Dr. techn. Bernd Schossman, MBA

Wien, am 16.09.2011

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

BGR	Bulgaria
BLR	Belarus
CIS	Coomonwealth of Independent States
CZE	Czech Republic
EE	Eastern Europe
EM	Emerging Markets
EUU	European Union
FDA	Federal Drug Administration
GCF	Gross Capital Formation
GDP	Gross Domestic Product
GNP	Gross national product
Gr	Growth
HCE	Health Care Expenditure
HUN	Hungary
IMS	IMS Health Inc.
IT	International Trade
M&As	Mergers and Aquisitions
MDA	Moldava
MNE	Multinational Entreprise
ÖBIG	Österreichisches Bundesinstitut für Gesundheitswesen
OECD	Organization for Economic Co-operation and Development
OTC	Over-the-counter drug
Ph.	Pharmaceutical
POL	Poland
PPP	Purchasing Power Parity
PPRI	Pharmaceutical Pricing and Reimbursement Information
R&D	Rearch and development
ROM	Romania
RUS	Russian Federation
SVK	Slovak Republic

THCE	Total Health Care Expenditure
THCM	Total Health Care Market
UKR	Ukraine
UN	United Nations
VAT	Value Added Tax
WDI	World Develpment Indicator
WHO	World Health Organization
WTO	World Treaty Organization

EXECUTIVE SUMMARY

Exporting into emerging and developing markets is one of the main strategic pillars of pharmaceutical multinationals striving to increase their market shares.

Before conducting costly in-depth market analysis, these companies need to identify attractive markets that promise:

- Increasing income and growing health care expenditures per capita, and consequently an increasing number of patients that can afford imported pharmaceutical products, and
- A regulatory, monetary, and fiscal environment enabling profitable market transactions.

This research paper is focused on a group of prominent demographic, macro-economic and health care specific indicators used for preliminary market screening, and examines if these ratios have a proven predictive value for pharmaceutical sales growth in Eastern Europe – a mayor emerging market, with a population of three hundred million inhabitants, and impressive growths in terms of gross domestic product.

Besides current literature and scientific papers covering market entry strategies, selection methods, and emerging markets specifics, I used reports and databases from World Bank and OECD to choose the ratios and access empirical data.

A first examination lead me to the assumption that the indicators gross capital formation as percentage of GDP, public share of the total health care expenditures and the international trade as percentage of GDP – all depicted as growth rates - could correlate with pharmaceutical sales growth.

The general availability and quality of historical data influenced the decision to choose Czech Republic, Slovakia and Hungary as markets, and the period between 1990 and 2009 for my further research.

Comparing averages for each of the examined countries and periods with OECD values on empirical basis confirmed the assumptions and lead to the formulation of three hypotheses.

To test if the three indictors have predictive value for pharmaceutical sales growth, I used correlation calculations (with and without time lags), single variable regression analysis, and finally multiple linear regression examinations.

The calculations show that the ratios public share of total health care expenditure and international share of gross domestic product do not correlate with the growth in pharmaceutical sales in the examined period and markets. The indicator gross capital formation as percentage of gross domestic product does have an appreciable positive correlation, but should not be considered as sole predictor for pharmaceutical sales growth.

The examinations made clear that the variable pharmaceutical sales growth is embedded in a very complex environment. Not only health care systems are very unique in each economy, but the developing countries within the examined region are so as well. This leads to the conclusion that it makes sense to focus on demographic and macro-economic indicators during preliminary screening, leaving health care specific ratios to be examined during the second phase of market selection – the in-depth analysis.

In general, none of the examined indicators does cover the complete rage of parameters influencing the growth of a market. Still, they can be useful in conjunction with other ratios as GDP, total health care expenditure, total expenditure on pharmaceutical goods, etc. Being easy to obtain and elaborate, they can give valuable additional market insights without consuming resources. Especially when observing a longer period, the indicators can support the marketer to better understand the overall development of an emerging country and the present and future potential for market entry.

1. INTRODUCTION

In the effort to maintain and expand their market share, pharmaceutical multinationals are more and more focusing on the impressive growth rates of emerging markets. Eastern Europe, with a total of approximately three hundred million inhabitants, and gross domestic products growing at almost seven percent per year between 1990 and 2009, represent an attractive market to pharmaceutical multinationals.

The market potential, the risks, time and costs involved with the expantion are examined with preliminary and in-depth market selection methods, both of them based on demographic, economic and health care specific data. This data is used as source for a set of indicators that are more or less standardized and immanent in all market development reports.

This paper examines a group of prominent indicators used for preliminary pharmaceutical market screening, and tests three ratios that are assumed to be useful as compliments to predict market development.

Czech Republic, Slovakia, and Hungary, all depicting a successful transformation from former command to free economies with growing health care markets, have been selected as appropriate markets to test the assumptions.

1.1. BACKGROUND

The research conducted in this paper examines an industry known as complex, and markets in the middle of significant political, social and economical transformation processes. This chapter introduces the reader to the very specific environment, and describes the research topic.

1.1.1. THE PHARMACEUTICAL INDUSTRY

The most prominent features and characteristics of this industry are:

Capital intense high-tech industry under public preasure: The article "Big Pharma – The benefits of hypertention"[1] draws a picture of global pharmaceutical companies spending billions of dollars on development, registration, production and promotion of new drugs, earning critics for their profitability, and under significant preasure to deliver genuine new life-saving drugs to low prices not only to wealthy markets, but also to developing countries.

Concentration process: The established Big Pharma companies generate more than 50% of the returns in the industry, and create constant cash excess for further growth that can be achieved organically, or through M&As. Especially in the late 1980s and 1990s large horizontal mergers took place. Today it is more common to see pharmaceutical MNEs acquiring biotech companies. These concentrations are often explained with the quest for economies of scope and scale in R&D, Marketing, supply chain, and administration[2].

Global pharmaceutical industry: Michael E. Porter defines a global industry as *"…one in which the strategic positions of competitors in major geographic or national markets are fundamentally affected by their overall global positions"*[3]. The major pharmaceutical companies coordinate their strategies and operations worldwide:

[1] The Economist, Dec. 4th 2003, http://www.economist.com/node/2266340
[2] Danzon, Patricia M. (2006): Economics of the Pharmaceutical Industry, The National Bureau of Economic Research
[3] Porter, Michael E. (2004): Competitive Strategy, Free Press, N.Y.

- R&D departments and clinical trial organizations are being located close to the main markets.
- Production plants located in countries with low costs are centrally supplying all markets.
- Supply chain departments coordinate and optimize worldwide logistics.
- Marketing and sales activities are developed on a global level, and only adapted to regional needs when needed.

Strategic emphasis on R&D and sales & marketing: Only a strong product pipeline with blockbusters within patent protection period, and good relationship to global and local stakeholders guarantee success. This explains the enormous investments done in these areas. Approximately 15% of their sales are invested into R&D, and around 25% in marketing and sales[4].

Unusual roles affecting operations: The health care sector is strongly regulated to ensure patients safety and optimize the availability of drugs in the respective markets. The main roles are:

- Health organizations as the FDA in the USA regulating and supervising prescriptions, OTC drugs, vaccines, biopharmaceuticals among others (Market authorization and ceiling prices).
- Government and insurance companies (partially) funding drug expenditures (Reimbursment).
- The general practitioner prescribing the product.
- The patient finally consuming the products.

Technological improvement, the steady alignment of global demand and ongoing harmonization of regulations are fueling internationalization and economies of scale in the industry.

[4] Kesic, D. (2008): Strategic Analysis of the World Pharmaceutical Industry, Casy Study UDC 65.01:615, Faculty of Management Koper, Slovenia.

The global pharmaceutical industry consists of approximately 10.000 companies conducting research, tests, clinical trials, drug production, distribution, sales and marketing.

The IMS World Review 2010 estimates the global pharmaceutical market for 2009 at 806 Billion USD and forecasts 880 Billion USD for 2011. The average growth rate of 7% per year confirms the positive evolution of this industry.

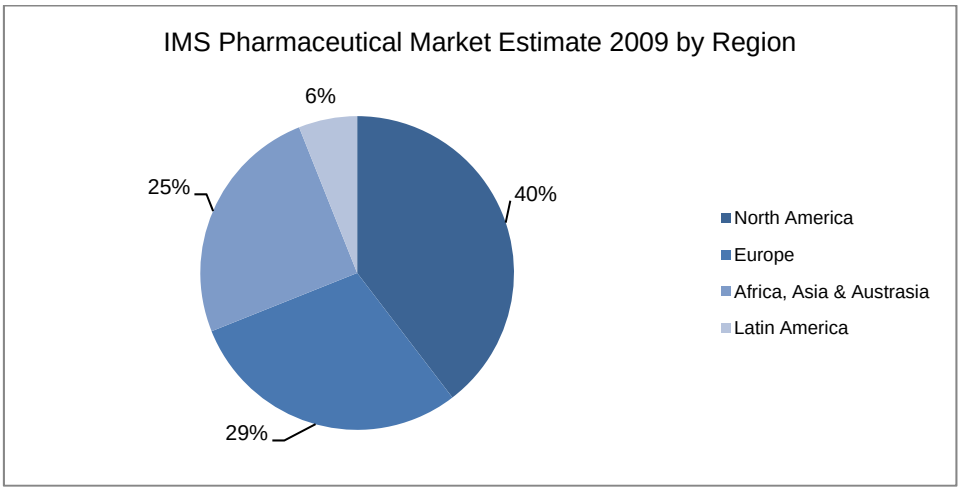


Figure 1: Pharmaceutical Market 2009

Source: IMS World Review Executive 2010

	2009		2008		2007		2006		2005	
Region	Sales*	%**	Sales*	%**	Sales*	%**	Sales*	%**	Sales*	%**
North America	319,5	5,06	304,1	1,84	298,6	4,52	285,7	9,42	261,1	
Europe	236,7	-4,01	246,6	13,22	217,8	16,91	186,3	6,82	174,4	
Africa, Asia & Austrasia	201,8	12,61	179,2	15,54	155,1	13,05	137,2	2,77	133,5	
Latin America	48,7	0,62	48,4	14,96	42,1	17,27	35,9	11,49	32,2	
Total World	806,7	3,65	778,3	9,07	713,6	10,62	645,1	7,30	601,2	

* Sales in Billion US$, ** % Growth rate

Table 1: Pharmaceutical Sales & Growth Rates

Source: IMS World Review Executive 2010

The Top-20 Countries in terms of pharmaceutical sales in 2009 are ranked below:

Rank	Country	2009		2008		2007	
(2009)		$ (Mill)	Growth (%)	$ (Mill)	Growth (%)	$ (Mill)	Growth (%)
1	United States	300.748	5	285.285	2	280.995	4
2	Japan	89.865	17	77.041	17	65.730	3
3	Germany	41.275	-2	41.932	12	37.278	16
4	France	40.575	-5	42.526	10	38.495	16
5	China	31.688	29	24.545	39	17.698	32
6	Italy	26.857	-1	27.169	12	24.234	15
7	Spain	22.818	1	22.620	16	19.563	19
8	United Kingdom	19.843	-11	22.234	-5	23.368	14
9	Canada	18.705	0	18.786	7	17.590	13
10	Brazil	17.403	4	16.749	22	13.708	25
11	Russian Fed.	11.442	-9	12.609	38	9.118	12
12	India	10.405	7	9.725	4	9.314	25
13	Mexico	10.399	-17	12.576	0	12.525	8
14	Turkey	10.276	-4	10.660	12	9.508	29
15	South Korea	9.472	-3	9.756	-5	10.287	14
16	Australia	9.423	0	9.388	11	8.443	23
17	Greece	7.537	4	7.254	18	6.124	28
18	Venezuela	6.626	31	5.050	33	3.793	33
19	Poland	6.601	-15	7.794	27	6.160	23
20	Belgium	6.208	-2	6.356	14	5.565	15

Table 2: The Top-20 Countries

Source: IMS World Review Executive 2010

The following table ranks the main pharmaceutical companies mesured on sales achieved in the global market in 2010.

Ranking	Company &HQ	Sales 2010 in bn USD	R&D Spends	Sales 2009 in bn USD	R&D Spends 2009	Top selling drugs 2010 & Sales
1	Pfizer (US)	58,5	9,41	45,4	7,8	Lipitor (10,7 bn) Enbrel (3,3 bn) Lyrica (3,1 bn)
2	Novartis (CH)	42	7,1	38,4	6,3	Diovan/co-Diovan (6,1 bn) Gleevec/Glivec (1,3 bn) Lucentis (1,5bn)
3	Sanofi-Aventis (FR)	40,3	5,14	46	6,5	Lantus (4,7 bn) Lovenox (3,7 bn) Taxotere (2,8 bn)
4	Merk (USA)	39,8	11	25,2		Singulair (5,0 bn) Remicade (2,7 bn) Januvia (2,4 bn)
5	Roche (CH)	39,1	8,6	37,56	8,5	Avastin (6,8 bn) MabThera/Rituxan (6,7 bn) Herceptin (5,7 bn)
6	GlaxoSmithKline (UK)	36,2	6,1	34,67	6,2	Seretide /Advair (7,9 bn) Pandemic Flu Vacc. (1,8 bn) Flixotide/Flovent (1,2 bn)
7	AstraZeneca (UK)	33,3	4,2	32,8	4,4	Crestor (5,7 bn) Nexium (5,0 bn) Seroquel(4,1 bn)
8	Johnson&Johnson (USA)	22,4	4,4	22,5	4,5	Remicade (4,6 bn) Procrit (1,9 bn) Risperdal (1,5 bn)
9	Eli Lilly (USA)	21,1	4,88	20,01	4,3	Zyprexa (5,0 bn) Cymbalta (3,5 bn) Alimta (2,2 bn)
10	Abbott (USA)	19,9	3,72	15,58		Humira (6,5 bn) Trilipix/TriCor (1,6 bn) Kaletra (1,3 bn)

Table 3: Top 10 Pharma Compnanies

Source: Offcial companie´s data. Anual reports 2010 (www.pharmexec.com)

Pharmaceutical companies can be grouped in:

- Originators: These companies focus on basic research, development and marketing and sales of original drugs.
- Generic producers: They focus on development and sales of generic drugs (Pharmaceutical products without patent protection).
- Specialists: They focus on basic research and development of biotechnology and pharmacogenomic products and technologies of new delivery systems.

The organizational form of representation abroad depends on the foreign market maturity and size. Representation offices in developing markets (around 100 countries in Africa, Middle East, CIS-countries, smaller markets in Central and Eastern Europe, Asia and Latinamerica) enabling transactions with governmental organizations, importing companies and distributors (Marketing, ordering, logistics, creditmanagement). The goods are sold in the country of origin and imported by the foreign market partner (Indirect export).

Once a market has established and / or reached a certain volume, the multinationals build a legal entity for sales, marketing, and administration, and import the goods them self (Direct export).

1.1.2. Rationale for Exporting into Uncertain Markets

Like any other stock company, pharmaceutical multinationals focus on activities that increase profitability, and thus improve the company´s shareholder value.

Saturated developed markets, the pressure on health systems to lower costs, the raise of genericas, and the risks and costs involved in R&D (From 10.000 substances in the research pipelines of biotech- and Big-Pharma-companies, only one will reach the approval for market. The costs per new drug from R&D till market approval are of 1 to 1.6 billion USD[5]), are the main push factors to opt for expantion into new markets. The main pull factors to export into emerging markets are: Fragmented or underdeveloped host market, potential nice, lack of competitors, favourable investment environment[6].

The essential condition a market has to fulfill is to grow with rates above average. The outlook of increasing pharmaceutical sales defines the market attractiveness for exporting multinationals.

The prospect of significant growth rates justifies the challenges companies exporting into uncertain markets take: Risks related to high foreign debts, unstable

[5] Seidenberger, M. (2011): Wachstumszelle, Industriemagazin, 05/2011
[6] Alexander, N. and Myers, H. (2000): The retail internationalization process, International Marketing Review, Vol. 17.

governments, unsteady exchange rates, entry restrictions imposed by governments, custom duties, corruption, technological piracy, high costs to adapt products and customer information, and the influence of economical integration between home and foreing market[7].

1.1.3. THE EASTERN EUROPEAN MARKET

The end of the former Soviet Union in 1990, and the Council for Mutual Economic Assistance COMECON in 1991 was the starting point for the transition to free market economies in Eastern Europe.

Czech Republic, Slovak Republic, Hungary and Poland (all with geographic borders to western countries) became members of the WTO (1995), the OECD (1995-1996), Schengen (2004), and the European Union (2004). Their healthcare systems and general regulatory framework are being aligned to international norms. Especially patent and data protection conventions, market authorization, pricing, reimbursement, and distribution norm harmonization boosted foreign direct invests and imports in the pharmaceutical industry. Foreign companies became investors in local manufacturing companies, and are today controlling most local players. Big Pharma has moved from indirect exporting to direct exports through own legal entities based in these countries. Romania, Bulgaria and Moldavia are following the above mentioned examples, but in terms of ratios they remain far below the Eastern European average. The remaining Eastern European countries, especially Belarius and Ukraine, have closer bonds to Russia, which seems to be the reason for their rather slow development compared with the other countries summarized by the UN statistics as “Eastern Europe”.

The average gross domestic product for these countries in 2009 was of 14.900 USD PPP per capita, not even half of the EU- and OECD-average of 32.845 and 33.668 respectively. The average yearly growth rate between 1990 and 2009 though is much

[7]Kotler, P., Lane Keller, K., and Bliemel, F. (2007): Marketing-Management: Strategien für wertschaffendes Handeln, Pearson Education.

higher: Eastern Europe with 6.8%, European Union with 4.3%, and OECD countries with 3.2% average growth per anno[8] ().

Despite the fact that population is ageing as in the rest of Europe, the number of almost 300 Million inhabitants, and the growth rates of their economies put them on the radar of multinationals of several industries as attractive, growing markets.

Most leading Eastern European pharmaceutical companies have been taken-over by Western multinationals as a result of globalization. These companies have lost the opportunity to grow by themselves and compete in Eastern and Western markets, especially in the area of genericas[9].

1.2. Defining the Research Topic

The monitoring of potential export markets requires significant resources and time, and there is probably no company that can afford to examine all developing markets simultaneously and in-depth. A system of reliable indicators that are proven to forecast the market development, and that are easy to access could be of immense value. These indicators could help to reduce the overall selection efforts, and enable companies to focus on the most attractive markets right after a preliminary screening.

Preliminary market examinations in the pharmaceutical industry are based on a group of indicators that seam to be more or less established. The question is if these ratios can be used as leading indicators for market growth in Eastern Europe. This represents the core question in my research, and led me to examine not only the most prominent ratios, but also additional performance indicators.

[8] Source: Worldbank WDI Database, own extracts.
[9] Kesic, D. (2008)

2. RESEARCH OBJECTIVES

The objective of this thesis is to appraise the value of established indicators to predict attractive pharmaceutical markets in Easter Europe. The value could then be the usage of these indicators by pharmaceutical companies to conduct preliminary screenings of today less developed countries in the East of Europe (Ukraine, Belarus, Bulgaria, Romania and Moldava). The companies could efficiently rank the countries and focus on the most promissing markets during in-depth analysis.

Before indicators can be examined and selected, the definition of such “attractive market” has to be framed.

Based on the reviewed literature, and my own understanding, a developing economy is concidered an attractive market when

a) There is evidence of sustainable GDP and healthcare expenditure growth,
b) The patients can therefore afford the imported pharmaceuticals, and
c) The regualtory, monetary, and fiscal environment enables market transactions without too high barriers.

Ad a) “There is evidence of sustainable GDP and healthcare expenditure growth”:

The market expantion into Eastern Europe represents an investment in a positive assumption about what this market will look like in the future. The investing company expects income, employment and political and social stability to reach similar standards as in the home market. Health care expenditures including pharmaceutical consumption is expected to grow in parallel, or with a certain lag.

The most suitable indicators to deliver evidence of such development are within demographics and macro-economics. These ratios will be examined in chapter 4.2.1. and 4.2.3.

Ad b) “The patients can therefore afford the imported pharmaceuticals”:

One of the main issues pharmaceutical companies face in developing countries is the difference in disposable income for drug consumption. As the levels of health care expenditure per capita in these markets are much lower than in western countries, imported drugs – especially originals – are not affordable.

Any evidence of a governmental participation on health care expenditures above average would indicate pharmaceutical consumptions higher than the general income level would suggest. Corresponding health care related indicators are examined in chapter 4.2.2.

Ad c) “The regualtory, monetary, and fiscal environment enables market transactions without too high barriers”:

From the perspective of a pharmaceutical multinational, the attractiveness of a market also depends on the degree of openness towards foreign companies and economic integration with western countries. A strong regulatory allignment for instance will attract more foreign companies, as they will find it feasible to succeed in the market.

An indicator providing evidence of the degree of integration with other economies is assumed to be found within the group of macro-economic ratios examined in chapter 4.2.3.

3. METHODOLOGY AND MATERIAL

I started to examine the papers topic reviewing current literature in the area of global marketing, which led me to the different market screening and ranking methods, and the broad range of entry strategies used across the worldwide economy.

The next research step involved screening reference books and papers more focused on emerging economies specific market evaluation methods.

To bring in pharmaceutical industry know-how into the research I reviewed special magazines, journals, technical books, and web sites of health care organizations,

governments, and pharmaceutical multinationals (e.g. Pharmaceutical Executive, PharmaLive, Harvard Business Review and Harvard Business School papers, MIT scientific papers, websites of WHO, OECD, UN, World Bank, and homepages of Big Pharma companies as Pfizer, Novartis, Roche, and others).

These sources led me to different electronic databases offering health care reports and indicators. I selected OECD and Worldbank as main sources for empirical data, as they publish a wide range of demographic, economic, and healthcare specific ratios in standardized and reliable form accessible without charges.

This secondary data represented the basis for the design approach leading to my assumptions and hypotheses formulated in chapter 4.3. and 4.4.

Once first calculations based on averages confirmed my assumptions, I calculated correlation coefficients with and without time lags for single markets, and indicators to test my hypotheses. Single variable linear regression calculations and graphs confirm the correlations. This examination was done in Microsoft Excel, as data volume did not justify a more sophisticated tool.

The final step of my hypothesis testings involves multi-variable linear regression analysis for each examined market, and for all markets in one analysis. These examinations where conducted with the software SPSS (former PASW – Predictive Analytics SoftWare) version 17.

4. RESULTS

4.1. RESEARCH OVERVIEW

This chapter starts with the examination of a broad group of indicators that have been identified as “common ratios” in the health care industry.

I will describe these ratios in chapter 4.2., explain where they are used, depict them with data for the Eastern European countries in the scope, and finally document my evaluation regarding usefulness for detailed analysis.

In chapter 4.3. I will introduce the rational that led me to the final scope of indicators, and underline the assumed value of each ratio as possible market growth predictor.

This final scope of research will lead to the hypotheses formulated in chapter 4.4.

Chapter 4.5. represents the introduction of the test data and explanation of each hypothesis testing step. Correlations, single variable regression analysis and finally multiple variable regression analysis will be documented accordingly.

4.2. Examination and Selection of Indicators

In general, the most important categories of market selection criterias are:

- Market-related characteristics (e.g. product fit, market size and potential),
- Cost-related aspects (e.g. transportations costs, for instance),
- Regulatory framework,
- Tariffs, duties, and
- Non-tariff trade barriers[10].

The health care sector covers these criterias with demographic, health care, and macro-economic indicators that can be used to predict the above defined “attractive market”. Based on the availability in quality and quantity of the corresponding empirical data, I will select three appropriate indicators, set hypotheses, and test them.

4.2.1. Demographic Indicators

The structure, size and distribution of a population, its life expectancy, birth- and death-rates are the main ratios broadly used to analyze what in other industries is called the customer base or traget market.

[10] Keegan, W.J. & Schlegelmilch, B.B. (2001): Global Marketing Management – A European Perspective, Harlow, Pearson Education Limited.

Population

The total number of inhabitants is broadly used in statistics. It counts all residents regardless of their legal status. The population growth rate is the first demographic ratio used in market research and health care related studies:

- UN Population Division: Yearly prospects of the worlds population,
- The OECD reports (e.g. Health at a glance) and database,
- The Worldbank development indicator database,
- The WHO World Health Report series, etc.

Between 1981 and 1990 the total population of Easter Europe increased from 297 to 311 million inhabitants. Since then however, the overall number has decreased to 294 million:

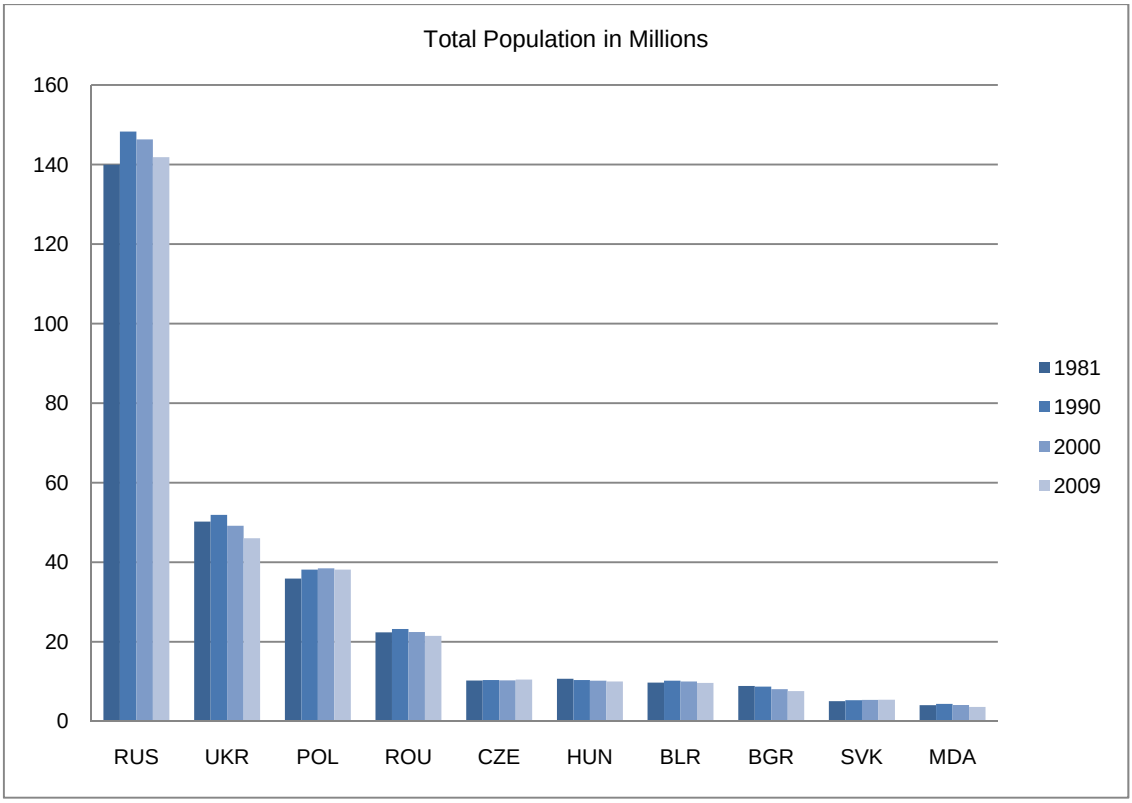


Figure 2: Population in Eastern Europe

Source: Worldbank Development Indicators, and own estimation.

This indicator is valuable for long term analysis, and more relevant when examining developing markets with significant population growth rates like China,

Brasil and India. For the purpose of this paper, the ratio clearly lags of dynamic as Eastern European population is not growing.

Population Age Structure

This ratio segregates the total number of inhabitants into three age-groups: 0-14, 15-65, and 65+, giving a useful insight about the development of the population pyramid.

It is included as indicator in:

- The OECD reports (Health at a glance) and database,
- The Worldbank development indicator database,
- The WHO World Health Report series,
- The PPRI-Project (2005-2007), where it can be found among the 21 pharmaceutical indicators (Set of Core PPRI Indicators) giving evidence for their relevance and limitations.

The graphic below shows the most common presentation form of this indicator. In this specific case it depicts the development of Eastern European age structure over the last 28 years.

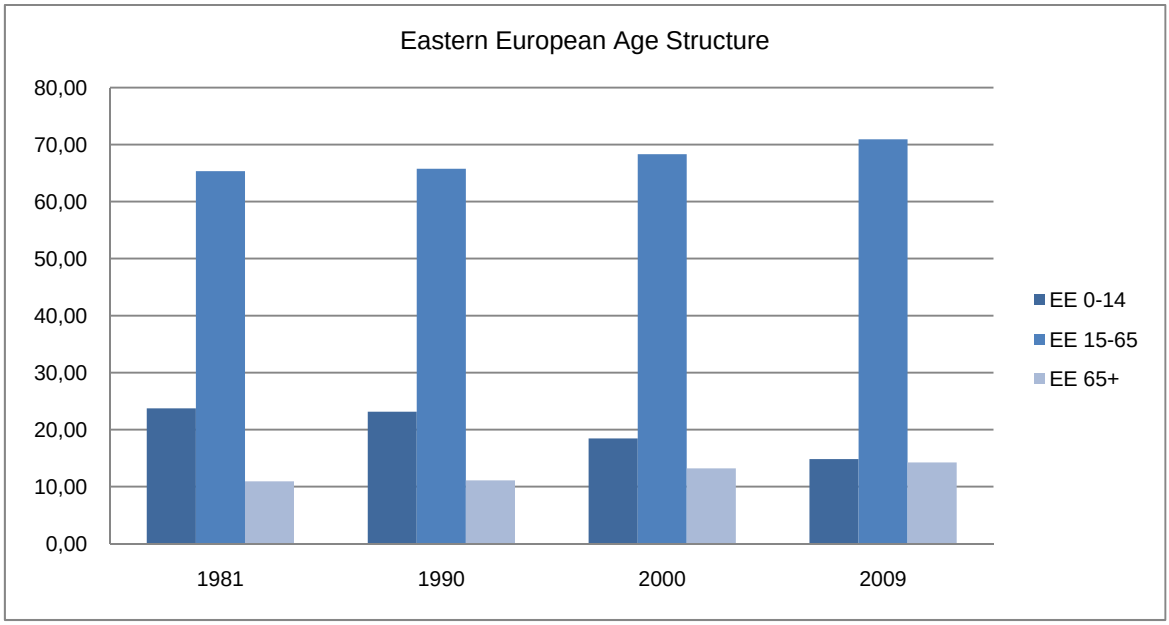


Figure 3: Age Structure in Eastern Europe

Source: Worldbank Development Indicators, and own estimation.

This indicator is of undenied importance, especially for long term analysis as it enables forecasts about the share of population that will be productive, or retired in the next decades. The Eastern European population for example is ageing. Decreasing fertility rates lead to a decrease in the population group 0-14 since 1990. The percentage of productive inhabitants will descrease as well, as this generation enters the labor market, according to OECD.

At the same time the group 65+ will continue to grow as life expectancy grows, fueling the market growth of corresponding pharmaceutical products (PPRI – Set of core pharmaceutical pricing and reimbursement information indicators, 2006).

Even expecting dramatic demographic changes in the next decades, with alarming impact on the economy of these countries, the indicator is not assumed to be sensitive enough to make market predictions on short and mid term. The trend is very similar to western countries. Under these circumstances, the more important variable would be the growth rate of available income.

Life Expectancy at Birth

The World Bank includes this ratio in its list of World Development Indicators and defines it as "... *the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life*." It is represented in

- The OECD reports (Health at a glance) and database,
- The Worldbank development indicator database,
- International databases and national cencus bureaus,
- The WHO World Health Report series, among others.

The life expectancy at birth in Eastern Europe in 2009 ranges between 68 in Russia and Moldava and 77 years in the Czech Republic. The average of 72,54 years is far

below OECD and EU mark of 79. Still, compared with values of 1980, total life expectancy has increased by 3,3 years. Only exceptions are Belarus and Ukranie, where the average life expectancy remained unchainged in the last 30 years.

Country /	Total Life Expectancy in years:				Growth rates in periods:			
Region	1980	1990	2000	2009	80-09	80-90	90-00	00-09
EUU	72,91	74,88	77,14	79,40	6,49	1,97	2,27	2,26
OECD	72,35	74,70	77,13	79,10	6,76	2,36	2,42	1,98
CZE	70,28	71,38	74,97	77,08	6,80	1,11	3,58	2,11
POL	70,10	70,89	73,75	75,70	5,60	0,79	2,86	1,95
SVK	70,41	70,93	73,05	74,91	4,50	0,52	2,12	1,86
HUN	69,06	69,32	71,25	73,90	4,84	0,25	1,93	2,66
BGR	71,16	71,64	71,66	73,41	2,25	0,48	0,02	1,75
ROM	69,09	69,74	71,16	73,31	4,22	0,65	1,42	2,15
EE Average	69,17	70,12	70,46	72,54	3,37	0,95	0,34	2,08
BLR	70,63	70,84	68,91	70,41	-0,22	0,20	-1,92	1,50
UKR	69,19	70,14	67,86	69,19	0,00	0,95	-2,27	1,33
RUS	67,03	68,90	65,34	68,86	1,82	1,87	-3,56	3,52
MDA	64,77	67,46	66,65	68,62	3,86	2,69	-0,80	1,97

Table 4: Life Expectancy in Eastern Europe

Source: Worldbank Development Indicators, and own estimation.

The data reflects the impact of the earlier transition waves from command systems to free economies in Czech Republic, Slovakia, Poland and Hungary, and the clear gap in health care system performance of EU countries and Eastern Europe.

The ratio indicates the output of health care activities. Its predictive value for pharmaceutical consumption is rather vague and long term oriented, and thus not suitable to identify attractive markets on short and mid term.

Infant Mortality Rate

This outcome indicator depicts the infants dying within the first year of live per one thousand live briths. It is represented in most health related surveys, reports and databases as:

- The OECD reports (Health at a glance) and database,
- The Worldbank development indicator database,
- The WHO World Health Report series, and others.

Eastern European countries have much higher infant mortality rates than developed countries. In 2007 for instance, only Czech Republic achieved rates as western countries (EU average: 3,5 per 1.000 live births; CZE 3,1; SVK 6,1; POL 6, HUN 5,9) (Source: OECD – Health at a Glance report 2009; Indicator code SP.DYN.IMRT.IN)

The infant mortality rate is a very sensitive indicator for the performance of health care systems. It gives evidence of qualitative before and after brith provisioning. Still, the available data reflects a very similar development in all Eastern European countries, regardless of all other market factors. Thus, it will not be concidered as leading indicator for pharmaceutical market growth.

Hospital beds and physician density

The appropriate density of physicians and hospital beds is one of the core targets of patient centered care. This indicator is used to compare and monitor service provisioning, and can be found in the main health care studies from OECD, WHO and others.

Health care systems with appropriate ratios could be concidered as “developed” and evidence of drug accessibility.

The low quality of available data, and the fact that both ratios do not show significant dynamic regarding pharmaceutical consumption, leads to the conclusion that they are not appropriate as leading indicator candidates for this paper.

4.2.2. Health Care Expenditure Specific Indicators

The second group of indicators to be examined is related to the funding of health care. These ratios either set health care expenditures in relation to demographic and economic ratios, or analyze specific components of health care expenditures.

These indicators have at least indirect influence on pharmaceutical product spendings. If the government officials decide to subsidese health-care, for example, then one can assume that drug expenditure will increase as patients will pay a smaller share and thus be able to access drugs easier. The public share of total health expenditures would modify the demand of all related products and services to a certain extend.

Health Care Expenditure

The healthcare expenditure per capita equates to the total spendings per inhabitant in the corresponding country. It includes the consumption of health goods and services, and investments in healthcare infrastructure, prevention programs and administration by both public and private sources.

This ratio shows significant variantion across countries, including developed economies. The reason for these differences can be market and social factors, financing models, and organizational forms in the respective healthcare systems.

In order to have comparable levels of spending, the total healthcare expenditures are converted into a common currency (Euro, or US Dollar) and adjusted to correct the different purchasing power of local currencies. The most reliable rate of conversion is the GDP PPP.

The total health care expenditure can be financed through the following methods:

- Government tax incomes
- Social health insurance
- Private health insurance
- Out of the pocket payments
- Donations

The National Bureau of Economic Research conducted a study proving that all five methods are intermateable with effective and efficient health care[11]. The figure "Health Care Expenditure" is the basis for cost control management measures as

Patient effective:

- Total coverage limits
- Exclusions
- Co-Payment models
- Co-Insurance
- Deductibles

Provider effective:

- Fee negotiations
- Drug price negotiations

This key figure is also used on a broad level to compare health care systems.

The OECD for example uses this figure in its country profiles, databases, and in the Health Care at a Glance publication. Besides analyzing the shares of public and private health care expenditures, the OECD report also specifies the shares by function:

- In-patient (Curative-rehabilitative care in in-patient and day-care settings),
- Out-patient (Including home-care and ancillary services),
- Long-term care medical goods, and
- Collective services expenditures.

The shares by function report helps identifying the particular focus and topics that are addressed in each country.

The WHO includes it in its databases and in its World Health Report.

[11] Glied, Sherry A. (2008): Health Care Financing, Efficiency, and Equity, National Bureau of Economic Research.

The Worldbank depicts health care expenditures in its World Development Indicators catalogue, and offers data from 1995 on.

The European Commission, Directorate-General Health and Consumer Protection, and the Austrian Ministry of Health commissioned the Project PPRI – Pharmaceutical Pricing and Reimbursement Information between 2005 and 2007 to improve information and knowledge on the pharmaceutical systems in the European Union. The corner stone was the definition of 21 core indicators to compare pharmaceutical systems. Total Health Care Expenditures in € PPP is among these indicators, and is used as parameter to rank health care systems.

The graphic below shows the most common presentation form for absolute healthcare expenditure per capita. It includes the share of public and private spending.

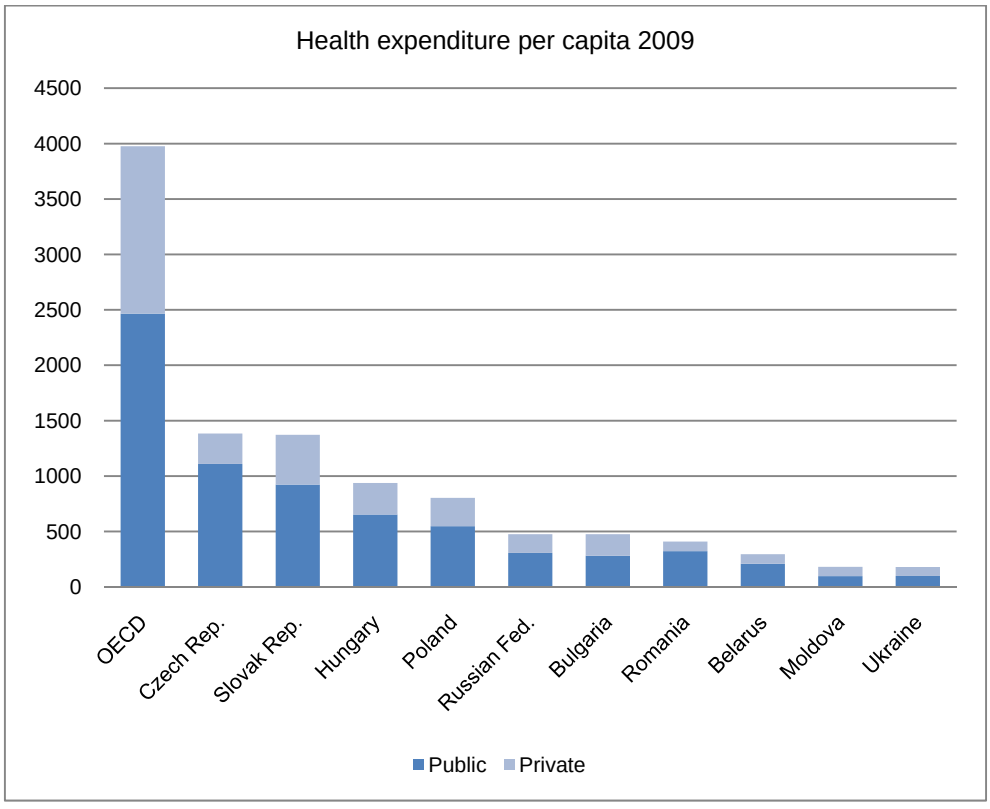


Figure 4: Health Expend. p.c. in Eastern Europe

Source: World Development Indicators – Worldbank, OECD Health at the glance, and own estimation.

The highest healthcare expenditure per capita is found in the USA. In Europe, Norway, Switzerland, Luxembourg and Austria exceed the European average by far. Eastern European countries are all below European and OECD average, but depict

much higher growth rates as their economies develop. Developed countries facing cost containment policies like Germany, show a growth between 1 and 2% per year, where as developing countries often grow in the two digit range[12]. The graphic below sets total healthcare expenditures in relation to the total life expectancy as used by OECD, PPRI among others.

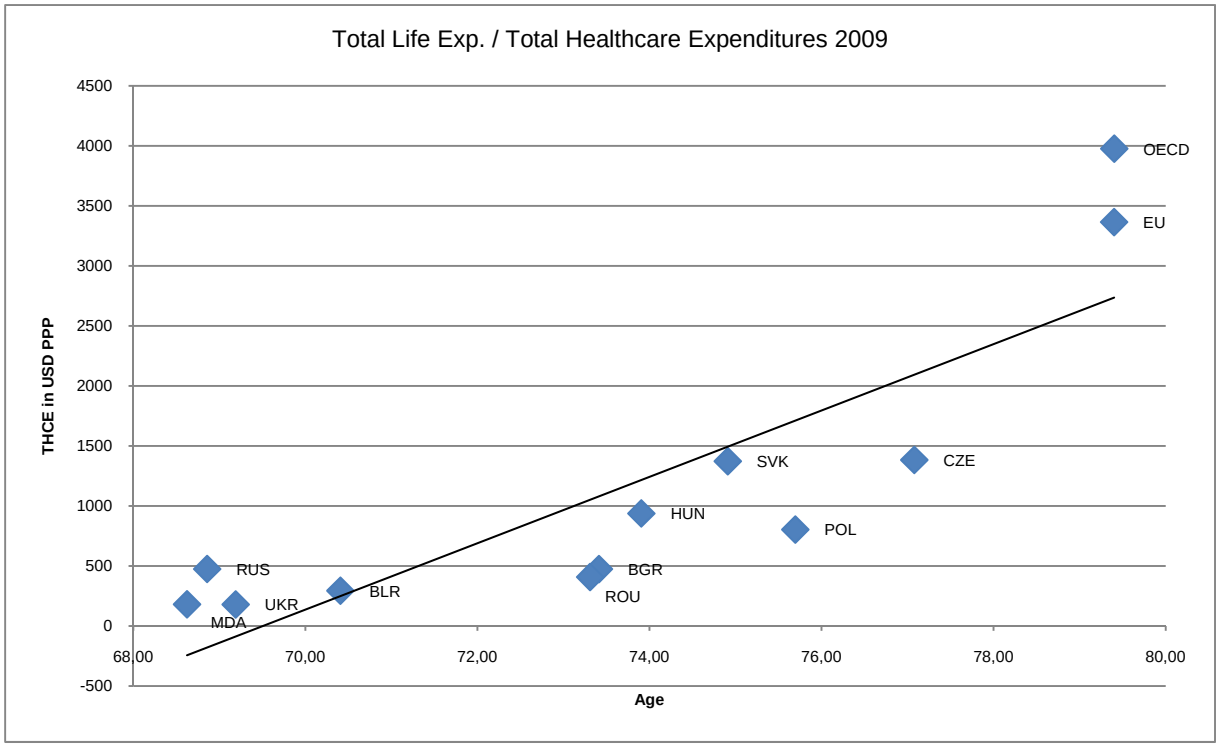


Figure 5: Life Exp./Health Exp. EE 2009

Source: World Development Indicators – Worldbank, OECD Health at the glance 2009

It suggests a strong relationship between life expectancy and overall investments in the health care system of a country. Still data for Czech Republic and Slovakia, Moldava and Ukraine, or even OECD and EU average makes clear, that the total expenditures in health care is not the only influencing factor in life expectancy (Example: Czech Rep. and Slovakia have very similar total health care expenditure per capita, but Czech life expectancy is significantly higher than Slovakias ratio). One of the reasons can be a different degree of investment efficiency.

The Eastern European average total healthcare expenditure per capita grew from 151 USD in 1995 to 651 USD in 2009. The Czech Republic and Slovakia show the highest values within these country group exceeding the mark of 1.300 USD per

[12]OECD Health at a Glance – Europe 2010, p. 103

capita and year in 2009. Moldava (181 USD) and Ukraine (180 USD) have spent the smallest absolut amount, but both with two digit growth rates on average between 1995 and 2009.

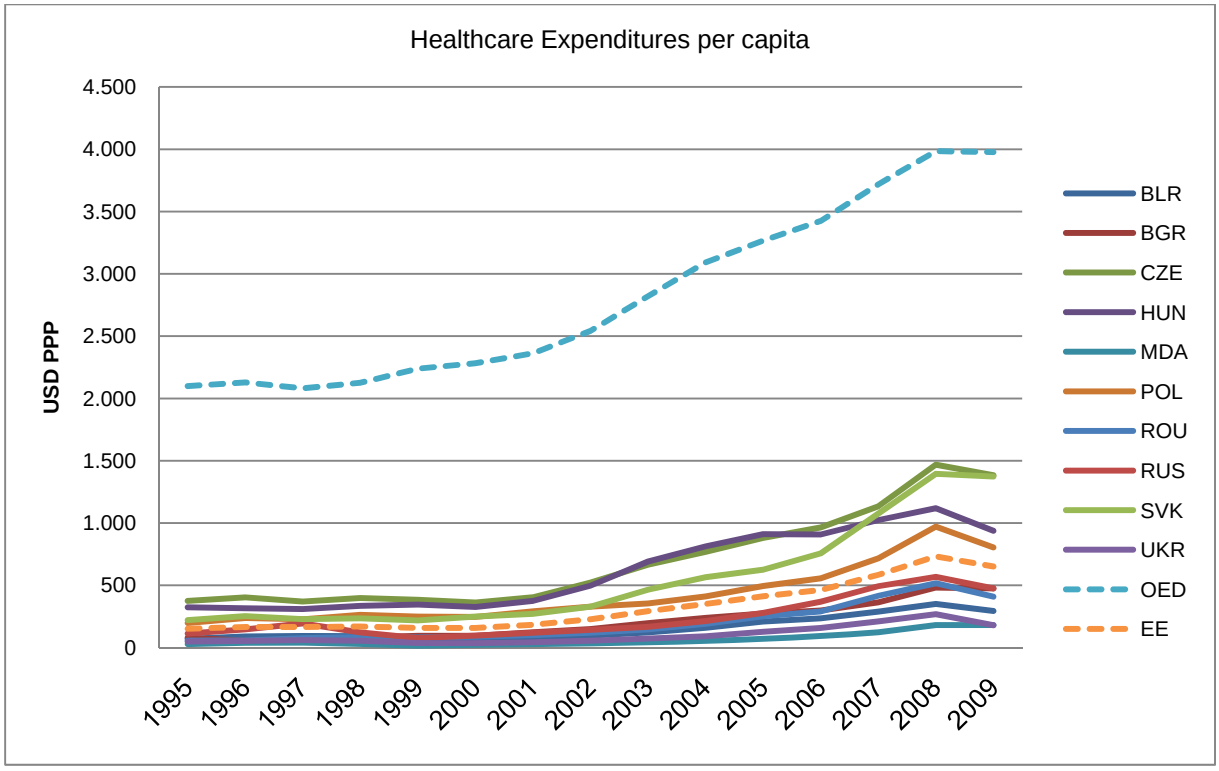


Figure 6: Health Exp. p.c. in EE 95-09

Source: Worldbank Development Indicators, and own estimation.

The economic gap between Western and Eastern European countries plays a significant role for the East with regard to their limited pharmaceutical budgets, as most of these products are imported from the West, and the prices are not influenced by local market or national economic power, but rather by the global strategies of western MNEs[13] .

Ranking the Eastern European Countries by their total health care expenditure (US$ PPP) for 2009 confirms the market development stages based on GDP per capita: Czech Republic, Slovakia, Hungary and Poland rank clearly above the Eastern European average ("EE"). The same ranking based on 1995 or 2000 data would not influence the grouping.

[13] Pharmaceutical Pricing and Reimbursement Report 2007

	1995	2000		2005		2009			1995-2009
Country	THCE	THCE	Growth %	THCE	Growth %	THCE	Growth %		Av. Annual Growth %
CZE	375	362	-3,51	880	143,27	1.384	57,29		10,5
SVK	220	249	12,86	626	151,55	1.373	119,33		15,0
HUN	323	326	0,89	910	178,89	938	3,05		8,8
POL	198	247	24,97	494	100,10	804	62,62		11,4
EE	151	159	4,72	412	159,91	651	58,04		11,7
RUS	113	96	-15,15	278	189,70	475	70,87		14,1
BGR	80	95	18,93	274	188,05	475	73,56		15,0
ROU	57	87	52,89	252	190,94	408	61,83		16,3
BLR	71	66	-6,00	210	215,47	295	40,57		12,2
MDA	28	22	-22,67	70	220,33	181	159,64		17,8
UKR	49	36	-27,29	127	256,77	180	41,62		12,4
OED	2.099	2.282	8,73	3.266	43,13	3.977	21,75		4,7
EUU	1.660	1.497	-9,81	2.631	75,68	3.365	27,92		5,6

Table 5: Total Health Care Exp. EE 95-09

Source: World Development Indicators – Worldbank

The list makes clear that both variables, total health care expenditure and its growth rate need to be considered when analyzing the development stage and estimating the market potential. Moldavia shows the strongest average growth rates per year over the period 1995-2009, but the absolute figure is still quite low.

The third variable to be introduced is the total population and its growth. Multiplying the health care expenditures per capita for a certain period with its corresponding number of inhabitants leads to the figure “Total Health Care Market” (“THCM”).

	1995	2000	2005	2009		1995-2009
Country	THCM	THCM	THCM	THCM		Growth %
RUS	16.762.410.455	14.046.234.363	39.815.025.593	67.413.604.768		302,2
POL	7.626.270.261	9.497.162.429	18.861.200.007	30.659.008.785		302,0
EE	4.690.813.728	4.825.562.674	12.238.237.984	19.161.464.734		308,5
CZE	3.871.893.217	3.714.955.285	9.004.344.924	14.514.462.058		274,9
HUN	3.341.140.197	3.332.525.063	9.181.370.092	9.400.780.685		181,4
ROU	1.286.557.933	1.946.348.766	5.458.691.743	8.771.853.421		581,8
UKR	2.517.860.007	1.747.715.328	5.972.796.384	8.261.574.854		228,1
SVK	1.182.406.212	1.340.732.431	3.371.550.912	7.437.438.687		529,0
BGR	670.863.589	765.566.134	2.117.659.957	3.601.771.934		436,9
BLR	720.480.007	664.679.315	2.048.802.248	2.846.862.508		295,1
MDA	122.026.336	89.177.998	261.913.298	651.842.464		434,2

Table 6: Total Health Care Market Abs. EE 95-09

Source: World Development Indicators – Worldbank

The size and growth rates of this figure suggest that they could be used to estimate the time it will take less developed countries to become attractive for pharmaceutical companies.

The comparison of total health care market values between 1995 and 2009 makes evident that the growth rates are not constant. Especially the growth rates between 2000 and 2005 in all economies are much higher than in the periods before and after. The attempt to project the health care market based on average growth rates would lead to significant inaccurarcy.

Such projection for the Czech market based on growth rates between 1995 and 2000 would lead to the assumption the market size would reach 3,4 bn USD instead of 14,5 bn.

The example points up the limitations of this indicator for market estimations / forecasts, and the nessecity to concider the broad economic framework the country is embedded in.

Health expenditure in relation to GDP

The ratio health care expenditure per capita ppp in percentage of gross domestic product is another established indicator for health care systems. It is independent of currency exchange oscillation, which is of importance when analyzing developing and emerging markets over a long period.

The indicator illustrates the relation between health care expenditures and the most important ratio used to depict the final consumption plus gross capital formation plus net exports – the GDP.

Countries with higher GDP tend to spend more on health topics, and the association seems to be stronger among European countries with low GDP per capita. Still GDP is not the only influencing factor, and so there is a broad variation, even for countries with similar levels of GDP per capita[14].

The WHO uses this ratio in its “World Health Report” to messure activities to build and re-build health services that are seen as first tangible signs that societies are returning to normality in after-war periods, or when developing to a more mature level[15]. The OECD report series “Health at a Glance” includes this indicator in the chapter dedicated to health expenditure and financing. The report makes clear that to make a more comprehensive analysis of a country´s spending on health, both health spending to GDP and health expenditure per capita should be considered, as relatively high health spending to GDP ratio could have relatively low per capita spending[16]. The main publicly accesible databases (e.g. WHO, OECD, Worldbank) include this key economic health care indicator. The slightly different presentation forms (Different currencies, or using GNP instead of GDP) do not alter the intended meaning.

[14] Das österreichische Gesundheitswesen im internationalen Vergleich 2009 – ÖBIG, http://www.oebig.at/

[15] WHO World Health Report 2008, Mediating the social contract for health, page 82.

[16] OECD Health at a Glance 2007, Health expenditure in relation to gross domestic product (GDP), page 88.

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MDA	8,47	9,70	8,90	7,27	5,63	6,14	6,66	7,47	7,68	7,73	8,38	9,74	10,01	10,65	11,94
HUN	7,30	6,98	6,73	7,06	7,20	7,03	7,15	7,54	8,32	8,00	8,33	8,10	7,46	7,22	7,29
CZE	7,00	6,71	6,66	6,63	6,56	6,55	6,69	7,08	7,44	7,18	7,24	6,96	6,76	7,11	7,64
SVK	6,06	6,44	5,78	5,66	5,75	6,57	6,93	7,20	7,52	7,21	7,04	7,34	7,74	8,00	8,50
EE av.	7,21	7,46	7,02	6,65	6,28	6,57	6,86	7,32	7,74	7,53	7,75	8,04	7,99	8,25	8,84
UKR	6,74	6,10	6,05	6,57	5,86	5,56	5,64	6,24	6,95	6,63	6,91	6,85	6,83	6,85	6,99
BLR	6,89	6,38	6,75	6,15	6,39	6,41	6,87	6,61	6,78	6,77	6,81	6,21	6,22	5,59	5,79
BGR	5,11	4,60	4,89	5,23	5,85	5,98	7,02	7,27	7,37	7,31	7,31	6,89	6,60	7,07	7,37
POL	5,48	5,88	5,61	5,91	5,73	5,52	5,86	6,34	6,24	6,20	6,21	6,20	6,43	7,01	7,13
RUS	5,34	5,53	7,07	6,59	5,77	5,40	5,65	5,96	5,57	5,16	5,19	5,28	5,38	4,82	5,44
ROM				4,59	5,13	5,21	5,38	5,66	5,33	5,46	5,50	5,10	5,24	5,44	5,44
EUU	8,70	8,76	8,57	8,55	8,62	8,59	8,77	9,00	9,30	9,35	9,41	9,38	9,32	9,58	10,31
OED	9,58	9,71	9,72	9,91	9,99	10,07	10,58	10,96	10,92	10,85	10,89	10,92	10,89	11,05	11,87

Table 7: Health Exp. % GDP EE 95-09

Source: World Development Indicators – Worldbank, and own calculation.

The data available in the Worldbank database does not seem to forecast the later corse of pharmaceutical sales (growth). The reason is assumed to be that both healthcare expenditures as % of GDP and pharmaceutical expenditure as % of total healthcare spending vary between the markets, and even within the same economy from year to year. This ratio will thus not be considered for this examination.

Public Share in Total Health Expenditure

The European countries finance health care with individualy mixed degrees of public and private means.

Public financing consists of general government revenues and social contributions (in countries with social insurance based funding).

Private financing encompass households out-of-pocket payments (direct or co-payments), 3rd party payments (private health insurance), health services provided by employers, and other direct provisioning by charities for example[17]. The indicator "Health Care Expenditure Funding (Public/Privat)" is broadly represented in

[17] OECD Health at a Glance, EU 2010, chapter 4.5. Financing of Health Care, page 82.

- The OECD reports (Health at a glance) and database,
- The Worldbank development indicator database,
- The WHO National Health Accounts , and
- The WHO World Health Report series,
- The PPRI-Project (2005-2007), where it is included among the 21 pharmaceutical indicators (Set of Core PPRI Indicators) giving evidence for their relevance and limitations.

The share of public funds used for pharmaceutical products is significantly lower than the share used for physician and hospital services. The European average was of 60% in 2008. The reasons are higher co-payments under public insurance schemes, or a lack of coverage for non-prescribed and even prescribed drugs. There are significant devations between the OECD members: Bulgaria 20%, Luxembourg, Greece and Germany 80%. Thus, the influence of public health care expenditures on pharmaceutical sales is relative. Still, the above mentioned institutions note that especially in developing countries, with low per capita GDPs, a strong participation of government leads to an overall higher spending on health care.

This note lead to the assumption that a high share of public spending on total health care could also indicate higher drug demand in these countries. Especially the Czech Republic, with long periods of 90%+ seems to confirm the expectations.

Even though the corresponding data is only available from 1995 on, the assumption is strong enough to choose the indicator for detailed examination.

Pharmaceutical Expenditure

The spending a country has dedicated to pharmaceutical products in the past is of course suitable to forecast the upcoming ratio.

The OECD pubishes “Pharmaceutical Expenditure” as a key figure when analyzing the healthcare expenditures of its members in its annual report “OECD – Health at a Glance”. The indicator covers spending on prescription medicines, self-medication (“OTC – Over The Counter”), and other non-durable medical goods, wholesale and

retail margins, and VAT. It excludes hospital consumptions, which would add another 15% to pharmaceutical spending[18].

The publication for 2010 indicates that pharmaceutical consumption has risen by almost 50% in the last ten years, mainly due to the introduction of new drugs and the ageing of populations. Pharmaceutical spending reached a peak in many member countries between 1999 and 2001. Policymakers have since then attempted to control these expenditures with price and volume controls directed at physicians and pharmacies, or increasing the share of private costs.

The OECD report serie “Health at a Glance” has adopted this ratio in the editions 2001 till 2009 reflecting pharmaceutical expenditures as percentage of total health care spending or in relation to the gross domestic product.

Other free accessible publications and databases do not include this data. Pharmaceutical multinationals obtain it from specialized market research institutes as IMS Health, but with restricted rights.

The pharmaceutical expenditure depicted in this paper has been extracted from OECD database. Its limitations have strong influence on the tests:

- Missing data from many OECD member countries,
- No data available for the years before 1995,
- From the countries dedicated to Eastern Europe, only Hungary, Czech Republic, and Slovakia have sufficient data. Some countries, like Poland, have not submitted this ratio at all.
- A significant part of the data is based on different methodologies, and depicts series breaks.

Even facing these constraints, “Pharmaceutical Expenditure” is the ratio that comes closest to pharmaceutical market sales, and is required as basic output in the hypotheses.

4.2.3. MACROECONOMIC INDICATORS

[18] Source: OECD Health at a Glance report 2010.

The third group of indicators covers macroeconomic aspects with influence on pharmaceutical industry transactions. I will examine the real GDP (taking inflation into account), the gross capital formation as percentage of GDP (indicating the general ability to invest in growth potential of an economy), and International Trade share of GDP (suggesting the degree of economic system alignment, stability and profitability identified by abroad business partners).

Gross Domestic Product

The gross domestic product equals to the value of all goods and services produced in an economy within a certain period. Depicted as per capita ratio, it reflects the standard of living in a country.

The gross domestic product per capita PPP in Czech Republic, Slovakia, Hungary and Poland is growing continuosly towards OECD- and European Union- average, and far above the Eastern European average. The Czech Republic for example reached a GDP of over 25.000 USD per inhabitant and year in 2009.

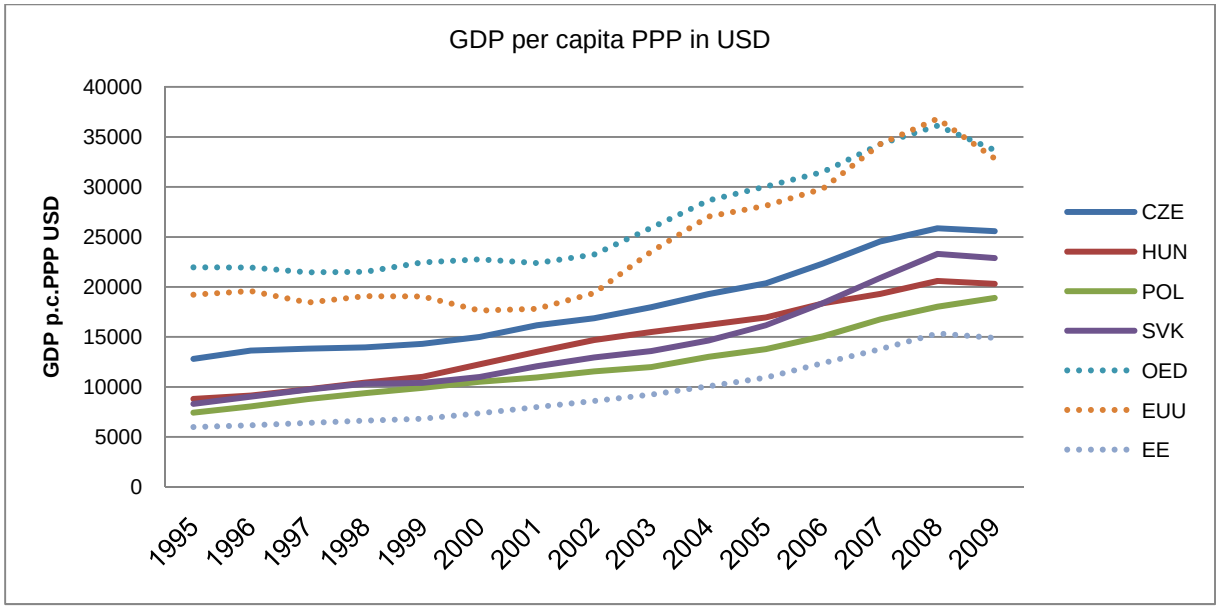


Figure 7: GDP p.c. Top 4 EE 95-09

Source: Worldbank Development Indicators, and own estimation.

Besides Russian Federation, the remaining Easter European economies show GDPs below 15.000 USD per year. Belarus reached the 5.000 USD mark in 2009, and Moldavias GDP for 2009 is even below 3.000 USD.

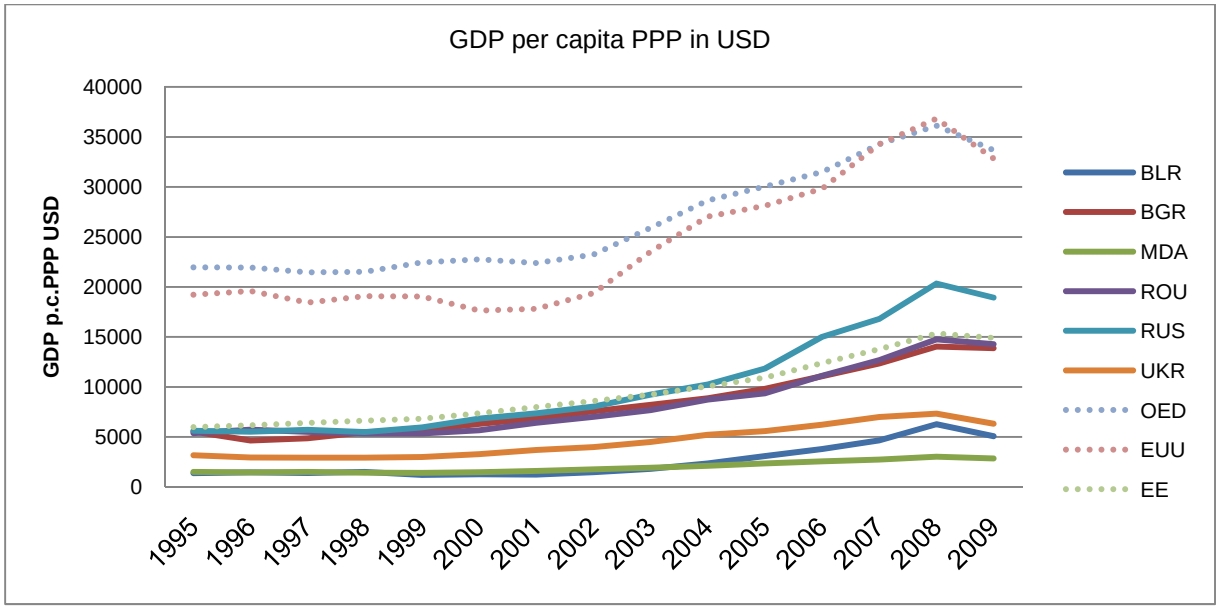


Figure 8: GDP p.c. Rem. EE 95-09

Source: Worldbank Development Indicators, and own estimation.

The usage of this ratio can lead to wrong assumptions, as statistical data does not include the grey economy, which plays a significant role in these economies. In 1998-99 Bulgaria´s shadow economy reached estimated 34% of GDP, and Slovakia´s 11%[19].

Still, the influence and importance of the gross domestic product is undeniable. As it is the most prominently used ratio in market screenings, a detailed examination in the context of this work would not ad new value to the topic. Thus, it will be used as reference for other indicators only.

Gross Capital Formation

The Gross capital formation consists of spending on additions to fixed assets and the net changes in the inventory level.

[19] Schneider F. and Enste D. (2002): Hiding in the Shadows. A publication for the International Monetary Fund

Fixed Assets include improvements in land, plant, machinery, and equipment purchases. Further it includes construction of roads, railways, schools, offices, hospitals, and commercial and industrial buildings. Inventories include stocks of goods held by firms for production and sales, and work in progress[20].

This ratio is represented in the Worldbank collection of World Development Indicators. The OECD publications use a similar ratio that has not been chosen, as these publications do not offer sufficient sets of data.

Gross Capital Formation – GCF is often put in relation to GDP. A high percentage of GCF is assumed to identify a developing enconomy with sufficient wealth to grow, and with confident market players willing to re-invest in future oportunities or demand.

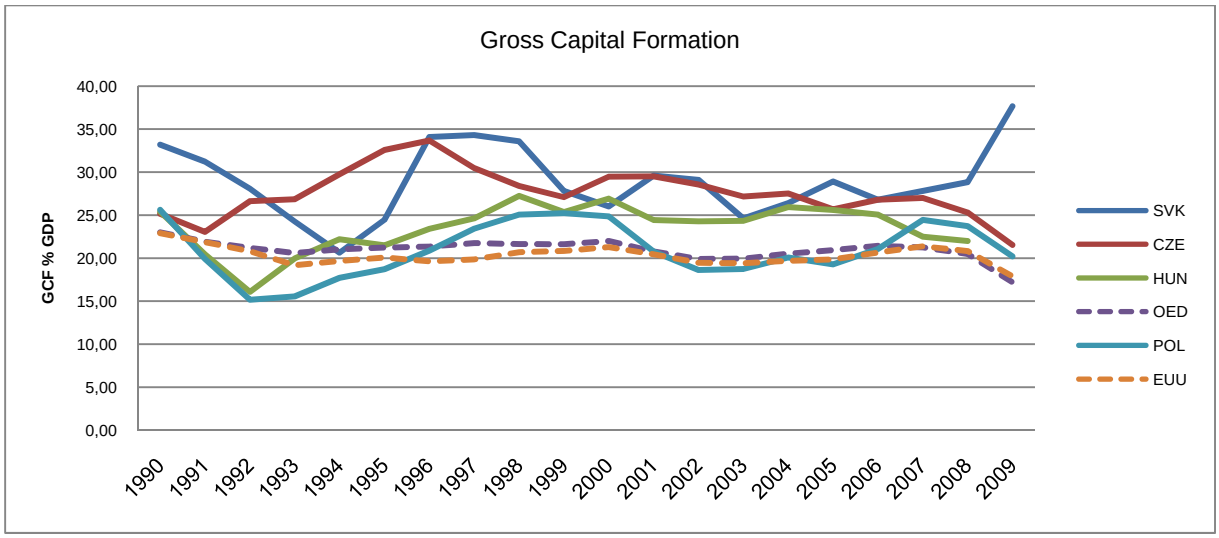


Figure 9: GCF%GDP EE 90-09

Source: World Development Indicators – Worldbank, and own calculation

In the European Union and OECD countries, the average GCF is of 20% of GDP, growing at a rate of 1.5% per year. Slovakia and the Czech Republic in contrast have ratios higher than 25% in average, and growth rates between 4 and 7.5% per year. With these countries performing better than EU an OECD average in terms of pharmaceutical sales growth, Gross Capital Formation is expected to be a reliable leading indicator for the health care sector since it also is a good proxy for the

[20] World Bank National Accounts, and OECD National Accounts

buildup of health care infrastructure, like hospitals and other treatment centers, and will thus be taken into the final selection for hypotheses and testing.

International Trade as Share of GDP

The international trade as percentage of GDP is defined as sum of import and exports, put in relation to the gross domestic product. The ratio is used to compare the degree of economic integration between countries.

Countries with large internal markets, a high degree of self-sufficiency, or penalized by high transport costs due to geographical isolation will feature lower values of international trade than smaller countries that are surrounded by econonies with open trade regimes. Thus, comparing countries should only be conducted for economies with similar characteristics[21].

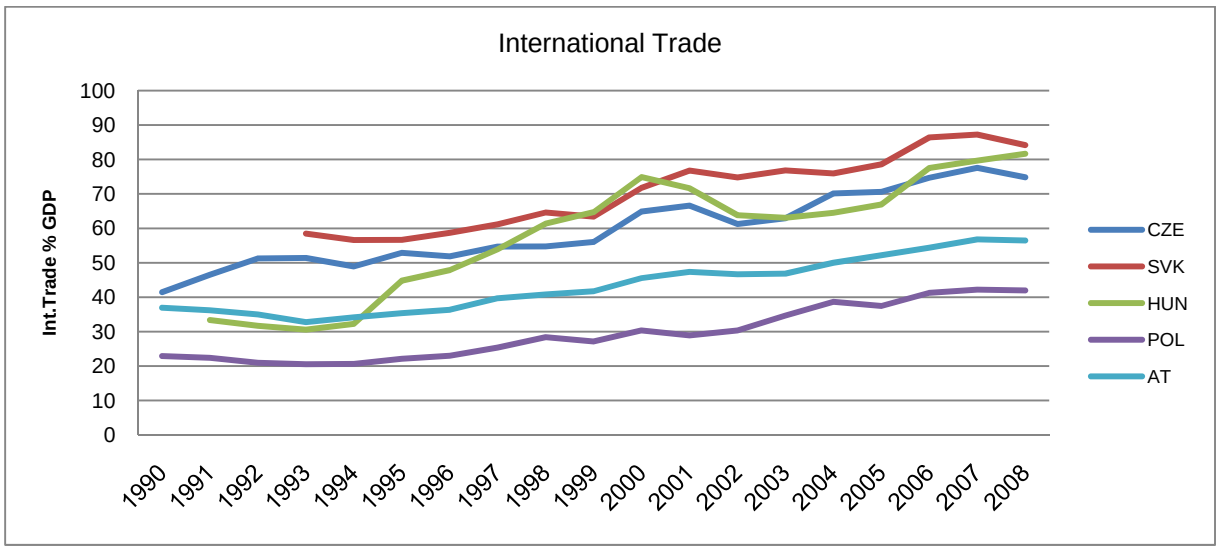


Figure 10: Int.Trade%GDP Top 4 EE 90-08

Source: OECD Factbook 2010: Economic, Environmental and Social Statistics

The ratio does not have a direct cause or an effect realtionship to the economic wealth of a market, but it is an important attribute of such, especially for multinational enterprises with operations spread all over the planet, looking for new markets with low entry barriers and transaction costs.

[21] OECD Health Factbook 2010.

It has to be considered, that a high percentage of international trade implies the risk of dependency from the corresponding international markets.

My assumption is that Eastern European countries with high ratios in international trade suggest a strong alignment with western economies that attract companies from different industries. The strong integration could lead to faster development and wealth, finally leading to more disposable income for high price drug imports.

4.3. Final Scope for Research

The availability and quality of respective data sets have strong impact on the final scope of markets, periods, and indicators to be used as basis for the hypotheses.

The main sources affecting the final scope are the OECD statistic database and country reports, and the Worldbank WDI database (World Development Indicators). These sources offer a significant number of ratios based on broadly agreed standard definitions, and only show data from officially recognized international sources.

The World Data Bank database “WDI” offers data from over 200 countries including all Eastern European economies. Most economic and demographic indicators used in this paper have been downloaded from this source.

The OECD statistics focuses on fewer economies (OECD member countries only – from Eastern Europe, only Czech Republic, Slovakia, Poland and Hungary are represented), but offers detailed country reports and indicators that are not covered anywhere else (e.g. Pharmaceutical consumption and international trade share of GDP). Being the supplier of key data, makes OECD the leading source for this research work, and influences the number of potential Eastern European markets to be considered. As there is no pharmaceutical sales data available for Poland, only Czech Republic, Slovakia and Hungary remain in scope as test markets.

The availability of data for these markets is limited for the years before 1995. This might have its roots in the common historical events after the end of the former Soviet Union. The countries joined the OECD in 1995 and 1996, which is assumed to be the trigger for statistical alignment.

The examination of potential leading indicators conducted in chapter 4.2., and the above drawed conclusions regarding markets and periods, lead to the following final scope for the further in-depth research:

Markets in scope:

- Czech Republic,
- Slovakia, and
- Hungary

Periods in scope:

- 1990 – 1995 with restrictions, and
- 1995 – 2008/9

Indicators in scope:

- Gross Capital Formation as Share of GDP

The examined GDP- , health care- and pharmaceutical sales- data gives clear empirical evidence that a steady growing economy with increasing wealth will have growing health care and pharmaceutical expenditures.

Gross Capital Formation above average is assumed to indicate a growing economy, with market players willing to invest in opportunities they believe in. The concequence of a high GCF%GDP is expected to be then a high degree of general economic activity involving the development of services and infrastructure (including health care facilities as hospitals for example), which should lead to low unemployment ratios, and higher incomes.

A more developed health care system and higher GDP per capita is assumed to lead to higher accessiblity and affordablity of pharmaceutical products. Thus this ratio seems to be very promising as leading indicator for attractive pharmaceutical markets.

A simple count of matching data sets reveals that in 60% of the examined years the pharmaceutical growth rates for Slovakia, Czech Republic and Hungary

where higher than OECD average. At the same time, in almost every year the gross capital formation as percentage of GDP was higher than OECD average.

Comparing averages for each of the examined countries for the period 1990 – 2009 with OECD values on empirical basis, seems to confirm the assumption (even though both measures do not have real statistical relevance):

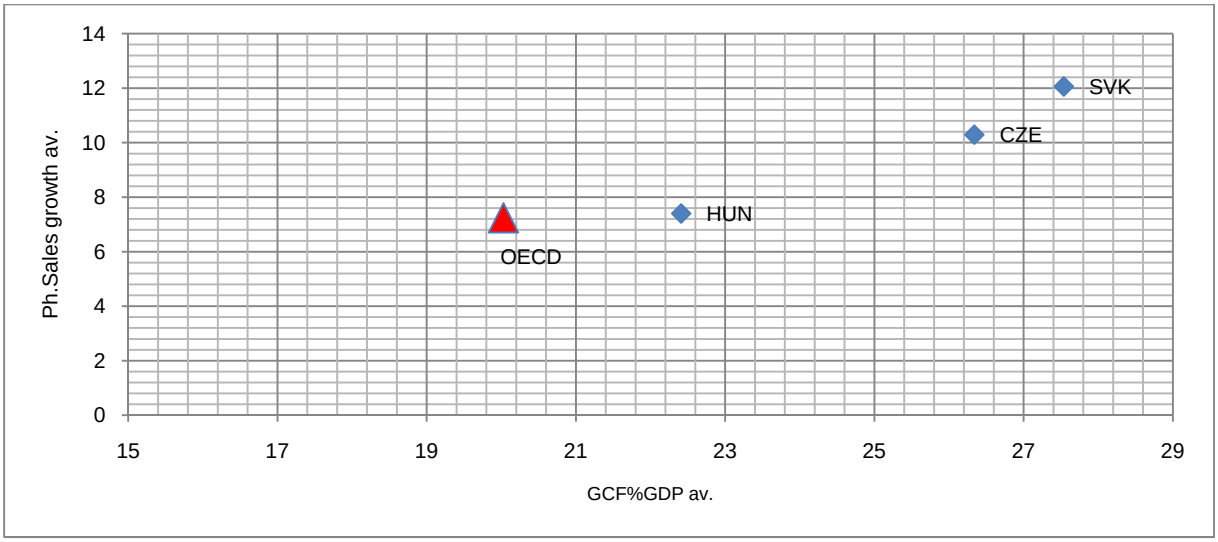


Figure 11: GCF%GDP & Ph.Sales Gr. Av.

Public Share on Total Health Care Spending

A strong participation of governments in total health care expenditures is considered as essencial for a developing market with temporarily low GDP per capita, because it enables a higher drug consumption level (short term effect), and leads to a healthy, growing population (long term effect).

The very high average ratio of publicly funded health care and the corresponding positive development of drug sales in the three markets in scope during the last 20 years seem to indicate the predictive value of this figure.

In this case the data sets reflect that in every single year between 1995 and 2009, the ratio Public Share of Total health Care Expenditures for all three test markets has been significantly higher than OECD average.

Comparing averages for each of the examined countries for the period 1995 – 2009 with OECD values on empirical basis, seems to confirm the assumption (even though both measures do not have real statistical relevance):

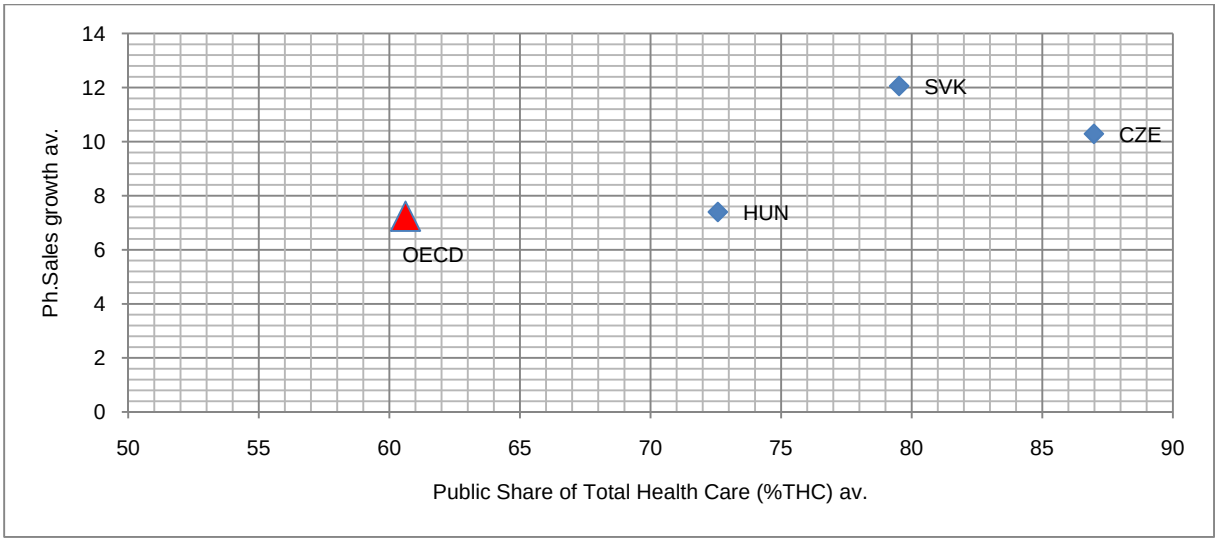


Figure 12: Public%HCE & Ph.Sales Gr. Av.

International Trade as Share of GDP

A market with favorable growth rates in GDP and drug expenditure could still be considered unappropriate to enter due to high barriers as fiscal policies protecting local industry, unsufficient protection of intellectual property rights (Patents), adverse health care related regulations, etc.

The international trade share on GDP seems to be an adequate ratio to predict growing markets for export entry as it summarizes the general degree of economic integration and regulatory alignment of a market. The test markets have average ratios of International Trade % GDP between 58 and 70%, which is significantly higher than the OECD average of 47% in the last 20 years, and higher growth ratios in Pharmaceutical Sales as the OECD average of 7.24%. Thus, the educated guess is that this ratio could deliver important information to a multinational during preliminary market screenings.

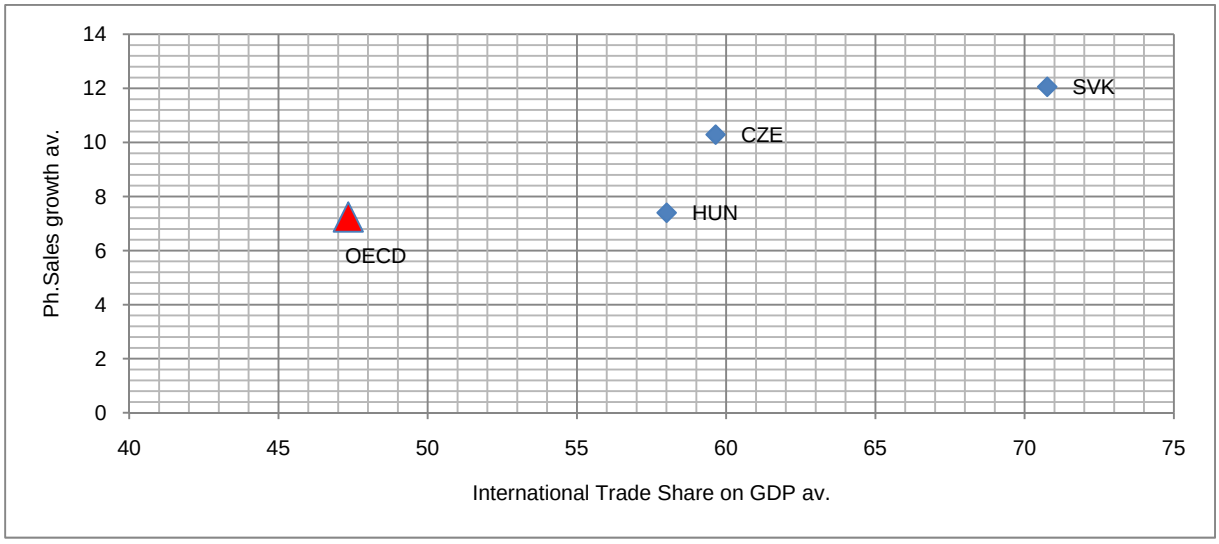


Figure 13: Int.Trade%GDP & Ph.Sales Gr. Av.

4.4. HYPOTHESES

The final scope of research described in chapter 4.3., especially the rationale and assumptions related to the three chosen indicators form the basis for the hypothesis formulation.

Gross Capital Formation

If pharmaceutical sales growth in developing economies is related to the level of investment in fixed assets, then a gross capital formation as percentage of GDP higher than OECD average (close to 20%) will correlate to pharmaceutical sales growing at higher rates than OECD average.

Share of Public Funding on Health Care Expenditure

If pharmaceutical sales growth in developing economies is related to the share of public expenditure on total health care expenditure, then government participation in health care costs above OECD average will correlate with future growth in pharmaceutical sales above OECD average.

International Trade as Share of GDP

If pharmaceutical sales growth in developing economies is related to the growth in international trade, then a share of international trade on GDP above OECD average will correlate with future growth in pharmaceutical sales above OECD average.

4.5. HYPOTHESES TESTING

4.5.1. DATA

Pharmaceutical sales:

Source: OECD Statistical Database

Dataset: Pharmaceutical Market

Variable: Pharmaceutical Sales

Unit: Million US$, purchase power parity

Country	Slovak Republic		Czech Republic		Hungary		OECD av.
Year	Sales	Growth	Sales	Growth	Sales	Growth	Growth
1990			1.030,9				
1991			875,0	-15,12			5,06
1992			1.111,9	27,07	1.173,2		11,72
1993			1.473,7	32,54	1.323,4	12,81	8,03
1994			2.029,9	37,74	1.483,4	12,09	8,52
1995	479,3		2.295,5	13,08	1.520,4	2,49	7,39
1996	703,4	46,76	2.341,3	2,00	1.606,3	5,65	9,58
1997	867,3	23,30	2.349,8	0,36	1.744,8	8,62	6,33
1998	913,0	5,27	2.391,1	1,76	1.893,1	8,50	6,65
1999	900,8	-1,34	2.575,2	7,70	2.053,7	8,48	8,47
2000	962,1	6,81	2.700,2	4,85	2.124,6	3,45	10,47
2001	1.058,1	9,98	3.109,7	15,17	2.482,1	16,83	11,19
2002	1.354,5	28,01	3.354,4	7,87	2.852,5	14,92	8,66
2003	1.371,2	1,23	3.718,9	10,87	3.024,6	6,03	5,48
2004	1.168,1	-14,81	3.989,6	7,28	3.039,3	0,49	4,17
2005	1.305,6	11,77	4.532,6	13,61	3.542,1	16,54	6,53
2006	1.492,3	14,30	4.199,2	-7,36	3.985,2	12,51	6,27
2007	1.762,4	18,10	4.819,5	14,77	3.171,1	-20,43	5,74
2008	1.974,3	12,02	5.316,0	10,30	3.349,0	5,61	7,24
2009	2.148,0	8,80	5.899,6	10,98	3.723,8	11,19	-0,19
Av	1.230,69	12,16	3.005,7	10,29	2.449,59	7,40	7,24

Table 8: OECD Ph. Sales 90-09

(Source: OECD statistical database and own calculations)

Gross Capital Formation as share of GDP:

Source: World Bank and OECD national accounts data

Catalog: World Development Indicators

Dataset: Economic Policy and Extrenal Debt

Indicator: Gross Capital Formation (% of GDP)

Code: NE.GDI.TOTL.ZS

Country	Slovak Republic		Czech Rep.		Hungary		OECD av.	
Year	GCF%GDP	growth	GCF%GDP	growth	GCF%GDP	growth	GCF%GDP	growth
1990	33,20		25,15		25,39	-4,20	23,00	3,45
1991	31,22		23,04	-28,91	20,45	-21,10	21,92	-1,32
1992	28,08		26,63	8,28	16,08	-20,40	21,19	0,34
1993	24,26		26,85	2,89	19,95	32,30	20,60	-0,52
1994	20,64	-10,32	29,75	18,54	22,19	19,80	21,02	5,41
1995	24,46	27,92	32,57	20,87	21,49	8,20	21,23	3,80
1996	34,09	39,19	33,69	11,63	23,41	11,60	21,34	4,81
1997	34,30	8,33	30,47	-8,40	24,61	12,20	21,74	5,93
1998	33,58	1,24	28,39	-2,09	27,24	20,00	21,63	2,99
1999	27,82	-16,25	27,09	-3,53	25,35	6,50	21,61	4,09
2000	26,00	-3,42	29,47	10,62	26,93	4,40	21,99	5,85
2001	29,59	16,32	29,51	6,79	24,44	-5,20	20,78	-3,35
2002	29,10	1,32	28,56	4,48	24,28	-1,10	19,91	-1,61
2003	24,62	-8,95	27,17	-1,65	24,34	3,00	19,94	2,45
2004	26,41	15,79	27,51	9,81	25,93	10,00	20,53	5,69
2005	28,91	16,31	25,68	-0,84	25,60	-3,70	20,93	3,84
2006	26,79	5,55	26,79	9,64	25,05	-0,20	21,42	4,13
2007	27,82	10,43	27,00	9,36	22,50	1,90	21,25	1,81
2008	28,84	8,24	25,31	-2,74	22,00	2,30	20,49	-3,81
2009	37,67	10,45	21,53	-18,48			17,20	-16,42
Av.	27,54	7,63	26,34	2,44	22,41	4,02	20,03	1,38
Av.95-00	26,98	8,80	27,33	4,34	20,92	2,43	21,49	1,86
Av.00-05	30,04	9,50	30,28	4,85	24,84	10,48	21,59	4,58
Av.05-09	30,01	10,20	25,26	-0,61	23,79	0,08	20,26	-2,09

Table 9: OECD GCF%GDP 90-09

(Source: Worldbank WDI database and own calculations)

Growth rates and averages included in the above table are based in own calculations.

Public Share of Total Health Care Expenditure:

Source: World Bank and WHO national health account database

Catalog: World Development Indicators

Dataset: Health

Indicator: Health Expenditure, Public (% of total health expenditure)

Code: SH.XPD.PUBL

Unit: Percentage rate

The availability of this ratio starts from 1995 on.

Country	Czech Republic		Slovak Republic		Hungary		OECD members	
Year	P%HCE	Growth	P%HCE	Growth	P%HCE	Growth	P%HCE	Growth
1995	90,89		88,52		83,96		63,32	
1996	90,67	-0,24	88,68	0,18	81,60	-2,81	62,69	-0,99
1997	90,29	-0,42	91,68	3,38	81,28	-0,39	61,16	-2,44
1998	90,43	0,16	91,59	-0,10	74,78	-8,00	60,00	-1,90
1999	90,48	0,06	89,64	-2,12	72,37	-3,22	59,76	-0,40
2000	90,32	-0,18	84,98	-5,20	70,74	-2,26	59,12	-1,07
2001	89,77	-0,61	84,69	-0,34	68,98	-2,49	58,97	-0,26
2002	90,47	0,79	85,27	0,68	70,21	1,79	58,73	-0,41
2003	85,89	-5,07	74,78	-12,30	69,93	-0,40	59,45	1,22
2004	85,86	-0,04	73,76	-1,36	69,24	-0,99	60,10	1,10
2005	83,73	-2,47	72,08	-2,28	69,67	0,62	60,11	0,01
2006	83,71	-0,03	66,86	-7,24	69,71	0,06	60,45	0,57
2007	81,90	-2,16	65,92	-1,40	67,66	-2,94	61,00	0,91
2008	80,07	-2,24	67,07	1,74	68,92	1,86	62,05	1,72
2009	80,21	0,18	67,27	0,30	69,65	1,05	62,37	0,52
Av.	86,98	-0,88	79,52	-1,86	72,58	-1,29	60,62	-0,10

Table 10: WDI Public%HCE 95-09

(Source: Worldbank WDI database and own calculations)

Growth rates depicted in the above table are based on own calculations.

International Share of Total Health Care Expenditure:

Source: OECD Factbook 2010 – Economic, Environmental and Social Statistics

Catalog: World Development Indicators

Dataset: Globalisation - Trade

Indicator: Share of international trade in GDP

Country	Slovak Republic		Czech Republic		Hungary		OECD av.*	
Year	IT%GDP	Growth	IT%GDP	Growth	IT%GDP	Growth	IT%GDP	Growth
1990			41,50				37,44	
1991			46,50	12,05	33,40		36,98	-1,23
1992			51,30	10,32	31,70	-5,09	36,57	-1,12
1993	58,50		51,40	0,19	30,60	-3,47	37,58	2,77
1994	56,60	-3,25	48,90	-4,86	32,30	5,56	38,76	3,14
1995	56,70	0,18	52,90	8,18	44,80	38,70	42,06	8,52
1996	58,70	3,53	51,80	-2,08	47,90	6,92	42,54	1,14
1997	61,20	4,26	54,70	5,60	53,90	12,53	45,56	7,09
1998	64,60	5,56	54,80	0,18	61,30	13,73	47,19	3,59
1999	63,40	-1,86	56,00	2,19	64,70	5,55	47,49	0,63
2000	71,70	13,09	64,90	15,89	74,90	15,77	53,38	12,41
2001	76,80	7,11	66,60	2,62	71,60	-4,41	52,96	-0,78
2002	74,80	-2,60	61,30	-7,96	63,80	-10,89	50,45	-4,75
2003	76,80	2,67	62,90	2,61	63,10	-1,10	49,50	-1,87
2004	75,90	-1,17	70,10	11,45	64,50	2,22	52,09	5,23
2005	78,60	3,56	70,60	0,71	66,90	3,72	53,96	3,58
2006	86,40	9,92	74,70	5,81	77,50	15,84	57,38	6,34
2007	87,20	0,93	77,60	3,88	79,70	2,84	58,61	2,14
2008	84,20	-3,44	74,80	-3,61	81,70	2,51	58,99	0,65

Table 11: OECD Int.Trade%GDP 90-08

(Source: OECD Factbook 2010 and own calculations)

*For the calculation of OECD average international trade only countries with similar size and geographical parameters have been taken into account.

Growth rates depicted in the above table are based on own calculations.

Comments on the data used for hypothesis testing:

The delta between median and average values is not significant enough to justify cutting peaks, or eliminating data via percentiles. The only measure taken is to convert the yearly accumulative values into average of T0 and T-1.

In the years between 1990 and 2009 many significant historical events marked the development of all three test markets. Especially the years between 1990 and 1996, in which the complete economy transformed from former command systems to free markets with private companies, have an important impact on the ratios used to verify the hypotheses. Even representing rather rare events with enormous magnitude, they are part of a potential scenario for Eastern European countries yet to develop as free markets. The 2008/09 financial crisis impact on data sets is visible, but does not have a mayor impact on the calculations to vary the predictability value of the indicators. Thus, I will keep the data sets for these years in the calculations.

4.5.2. Correlations and Single Linear Regressions

The single linear regression will be calculated to assess the relationship between pharmaceutical sales growth (the dependent variable), and each single predictor variable.

The correlation coefficient will be calculated with and without lags to get a value of the strength of the corresponding linear relationship.

This part of the analysis will include the regression equation and a scatter plot depicting the regression line to visualize the data, and the correlation type.

4.5.2.1. Gross Capital Formation as Share of GDP

The data has been normalized using the average of actual and last year value respectively. Calculations are based on both GCF%GDP and Ph.Sales as growth rates.

Ratio	GCF%GDP					GCF%GDP gr					Ph.Sales gr			
Market	SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD
1990	33,20	25,15	25,39	23,00										
1991	32,71	24,62	24,15	22,73		-5,98	-8,38	-19,44	-4,68			-15,12		5,06
1992	30,93	24,47	20,59	22,01		-7,00	-2,40	-19,93	-4,35			-4,57		6,73
1993	27,91	25,79	18,14	21,22		-9,92	5,89	-9,53	-3,54			17,89	12,81	9,21
1994	24,31	27,52	19,54	20,85		-13,05	7,01	9,51	-1,71			32,47	12,63	9,24
1995	22,50	29,73	21,46	20,97		-6,23	7,98	10,84	0,58			30,28	9,87	8,20
1996	25,91	32,15	22,14	21,21		15,37	8,30	3,46	1,14		46,76	16,48	5,68	8,22
1997	31,73	32,60	23,23	21,41		24,47	1,69	4,97	0,98		40,89	4,36	5,60	8,22
1998	34,07	30,76	24,97	21,61		9,63	-5,62	7,48	0,94		24,66	1,12	7,85	7,22
1999	32,32	28,59	26,11	21,65		-5,19	-6,94	4,89	0,19		8,13	2,89	8,53	7,02
2000	28,80	28,01	26,22	21,71		-10,74	-1,80	0,75	0,27		2,35	5,50	7,23	8,52
2001	27,35	28,88	25,91	21,59		-4,10	3,27	-0,94	-0,52		5,56	8,14	8,05	10,15
2002	28,57	29,26	25,02	20,86		4,86	1,46	-3,23	-3,36		13,69	10,76	13,01	10,38
2003	28,11	28,45	24,33	20,14		-1,23	-2,78	-2,57	-3,43		16,81	10,44	13,18	8,50
2004	26,19	27,61	24,72	20,08		-6,30	-2,92	1,60	-0,24		3,92	9,22	6,87	5,95
2005	26,59	26,97	25,45	20,48		2,15	-2,26	3,01	2,01		-4,15	9,76	5,89	5,09
2006	27,76	26,41	25,54	20,96		4,72	-1,94	0,45	2,32		5,76	6,79	11,52	5,88
2007	27,58	26,56	24,55	21,26		-0,34	0,70	-3,93	1,46		14,62	3,42	5,28	6,20
2008	27,82	26,53	23,01	21,10		1,00	-0,09	-6,18	-0,72		15,63	8,12	-5,68	6,25
2009	30,79	24,79	22,12	19,86		10,45	-6,66	-4,23	-6,00		12,74	11,59	0,50	5,01
Av.	28,76	27,74	23,63	21,24		0,14	-0,29	-1,21	-0,98		14,81	8,92	7,58	7,42
Median	28,01	27,56	24,44	21,21		-1,23	-1,80	0,45	-0,24		13,21	8,14	7,85	7,22

Table 12: GCF%GDP Norm.

Correlations

Ratio	GCF%GDP					GCF%GDP gr			
Market	Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years		Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years
SVK	0.41	-0.33	-0.74	-0.48		0.72	0.55	-0.28	-0.65
CZE	0.18	-0.40	-0.66	-0.71		0.64	0.50	-0.05	-0.43
HUN	0.02	-0.14	-0.13	0.03		0.34	-0.01	-0.27	-0.18
OECD	0,31	030	0.59	0.54		0.10	-0.16	-0.10	-0.07
Av.	0.23	-0.14	-0.23	-0.15		0.45	0.22	-0.18	-0.33

Table 13: GCF%GDP & Ph.Sales gr. Corr.

Single Variable Linear Regression Analysis

Market	GCF%GDP – Ph.Sales gr.	GCF%GDP gr. – Ph.Sales gr.
SVK	Y = 1.2663x – 21.693 R^2 = 0.0477	y = 1.2107x + 10.941 R^2 = 0.6326
CZE	y = 1.2654x – 26.354 R^2 = 0.0758	y = 1.6209x + 9.3927 R^2 = 0.5782
HUN	y = -0.1812x + 11.868 R^2 = 0.0076	y = 0.194x + 7.3905 R^2 = 0.0499

Table 14: GCF%GDP & Ph.Sales gr. SLRA

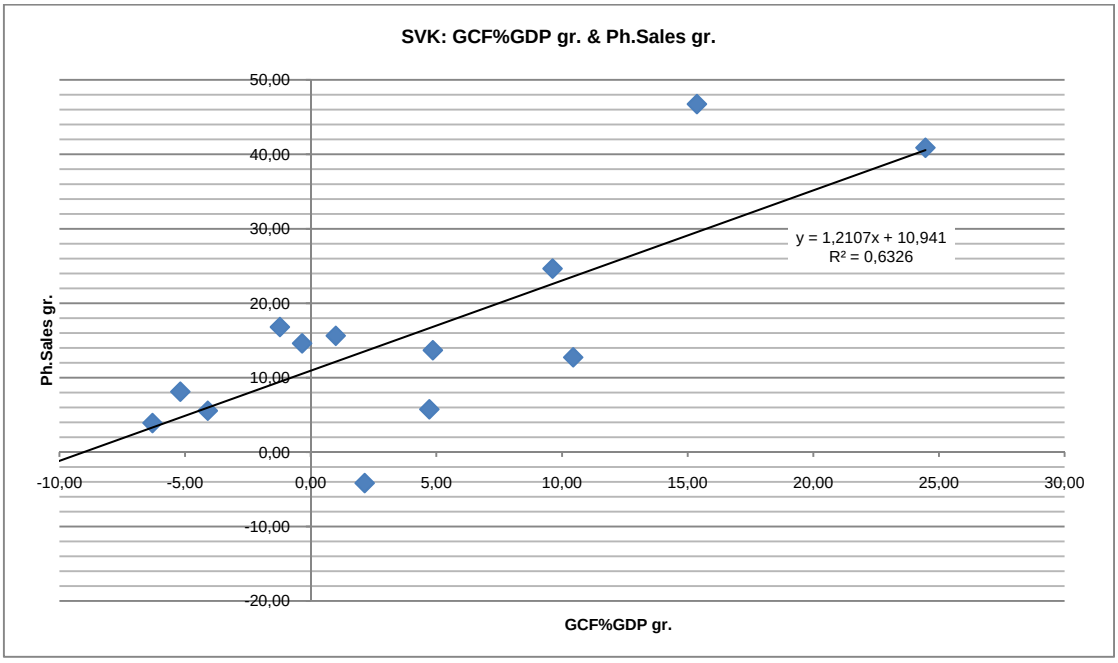


Figure 14: GCF%GDPgr&Ph.Sales gr. Slovakia

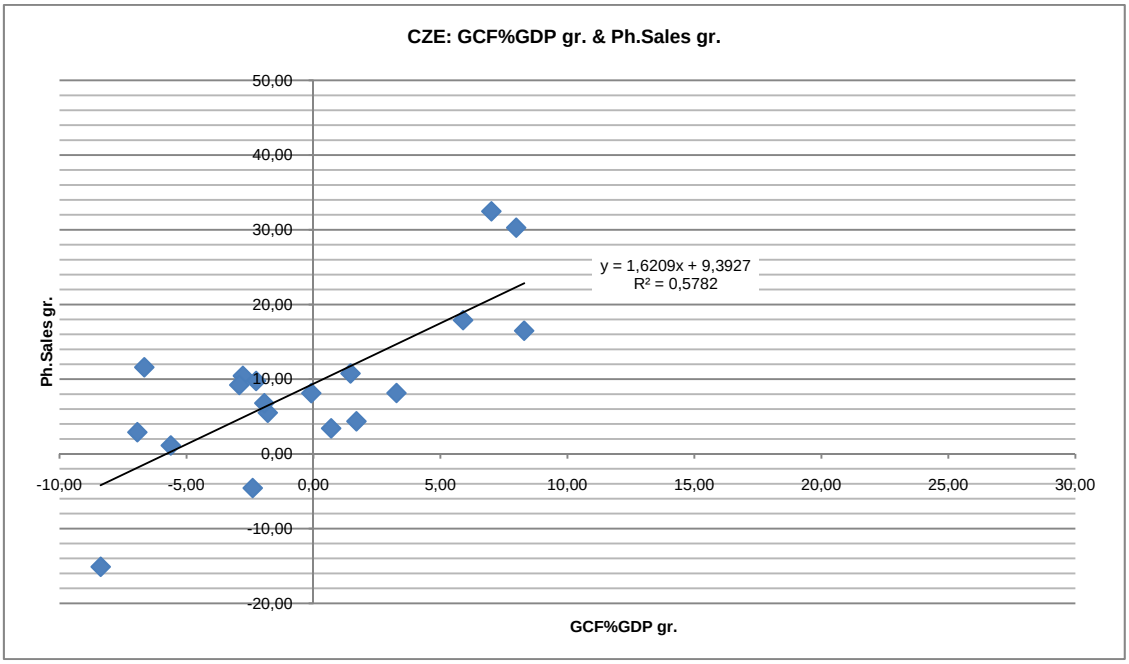


Figure 15:GCF%GDPgr&Ph.Sales gr. Czech Rep.

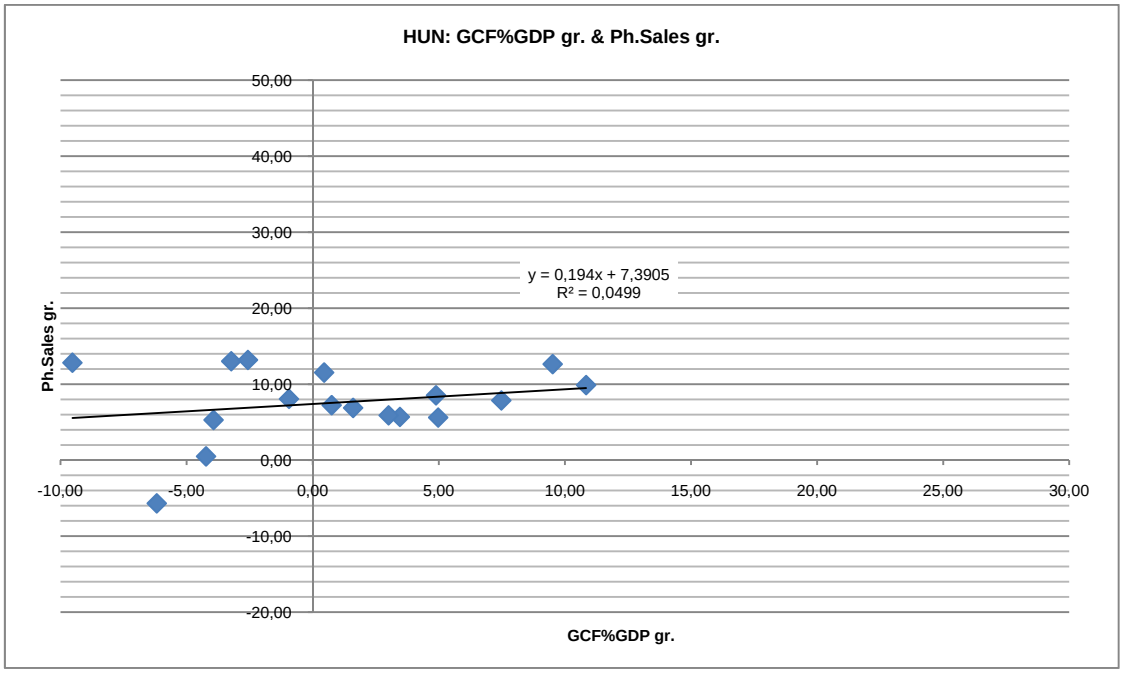


Figure 16: GCF%GDPgr&Ph.Sales gr. Hungary

4.5.2.2. Public Share of Total Health Care Expenditures

Data has been normalized using the average of actual and last value respectively. Calculations are based on both public share of total health care expenditure (P%HCE) and pharmaceutical sales growth (Ph.Sales gr.).

Ratio	P%HCE					P%HCE gr					Ph.Sales gr			
Country	SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD
1990														
1991												-15,12		5,06
1992												-4,57		6,73
1993												17,89	12,81	9,21
1994												32,47	12,63	9,24
1995	88,52	90,89	83,96	63,32								30,28	9,87	8,20
1996	88,60	90,78	82,78	63,01		0,18	-0,24	-2,81	-0,99		46,76	16,48	5,68	8,22
1997	90,18	90,48	81,44	61,93		1,78	-0,33	-1,60	-1,72		40,89	4,36	5,60	8,22
1998	91,63	90,36	78,03	60,58		1,64	-0,13	-4,20	-2,17		24,66	1,12	7,85	7,22
1999	90,61	90,46	73,58	59,88		-1,11	0,11	-5,61	-1,15		8,13	2,89	8,53	7,02
2000	87,31	90,40	71,56	59,44		-3,66	-0,06	-2,74	-0,73		2,35	5,50	7,23	8,52
2001	84,84	90,04	69,86	59,05		-2,77	-0,40	-2,37	-0,66		5,56	8,14	8,05	10,15
2002	84,98	90,12	69,59	58,85		0,17	0,09	-0,35	-0,33		13,69	10,76	13,01	10,38
2003	80,02	88,18	70,07	59,09		-5,81	-2,14	0,69	0,41		16,81	10,44	13,18	8,50
2004	74,27	85,87	69,58	59,77		-6,83	-2,55	-0,69	1,16		3,92	9,22	6,87	5,95
2005	72,92	84,79	69,45	60,10		-1,82	-1,25	-0,18	0,56		-4,15	9,76	5,89	5,09
2006	69,47	83,72	69,69	60,28		-4,76	-1,25	0,34	0,29		5,76	6,79	11,52	5,88
2007	66,39	82,81	68,68	60,72		-4,32	-1,09	-1,44	0,74		14,62	3,42	5,28	6,20
2008	66,50	80,99	68,29	61,52		0,17	-2,20	-0,54	1,32		15,63	8,12	-5,68	6,25
2009	67,17	80,14	69,28	62,21		1,02	-1,03	1,46	1,12		12,74	11,59	0,50	5,01
Av.	80,23	87,33	73,06	60,65		-1,87	-0,89	-1,43	-0,16		14,81	8,92	7,58	7,42
Median	84,84	90,04	69,86	60,28		-1,47	-0,71	-1,07	-0,02		13,21	8,14	7,85	7,22

Table 15: Public%HCE Norm.

Correlations:

Ratio	P%HCE					P%HCE gr			
Market	Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years		Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years
SVK	0.43	0.30	0.07	-0.19		0.58	0.52	0.09	-0.50
CZE	0.14	-0.09	-0.26	-0.21		-0.23	-0.41	-0.08	0.39
HUN	0.14	0.07	0.13	0.27		-0.10	-0.08	-0.40	-0.54
OECD	-0.27	-0.12	0.06	0.23		-0.53	-0.61	-0.66	-0.75
Av.	0.11	0.04	0.00	0.03		-0.07	-0.15	-0.26	-0.35

Table 16: P%HCEgr&Ph.Sales gr. Corr.

Single Variable Linear Regression Analysis:

Market	Publ.%THCE – Ph.Sales gr.	Publ.%THCE gr. – Ph.Sales gr.
SVK	y = 0.6014x – 33.086 R^2 = 0.1705	y = 2.7087x + 19.865 R^2 = 0.292
CZE	y = 0.2585x – 13.321 R^2 = 0.0206	y = -1.061x + 6.8106 R^2 = 0.0546
HUN	y = 0.1164x – 1.6099 R^2 = 0.0185	y = -0.2401x + 6.3349 R^2 = 0.0093

Table 17: P%HCEgr&Ph.Sales gr. SLRA

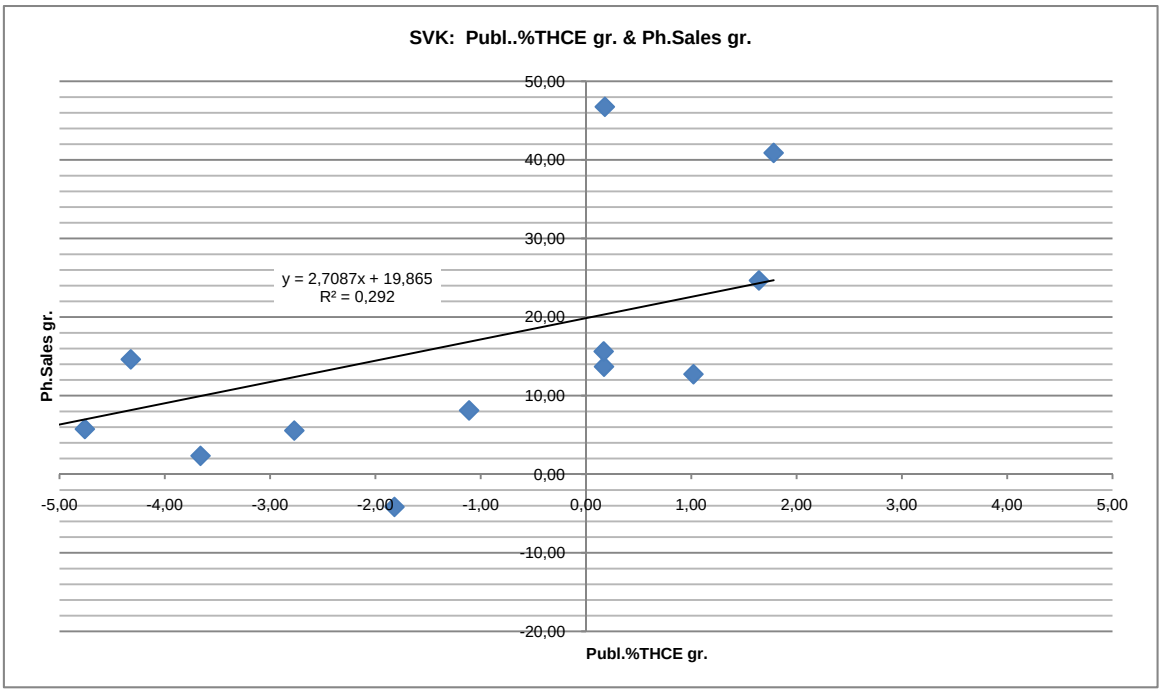


Figure 17: P%HCEgr. & Ph.Sales gr. Slovakia

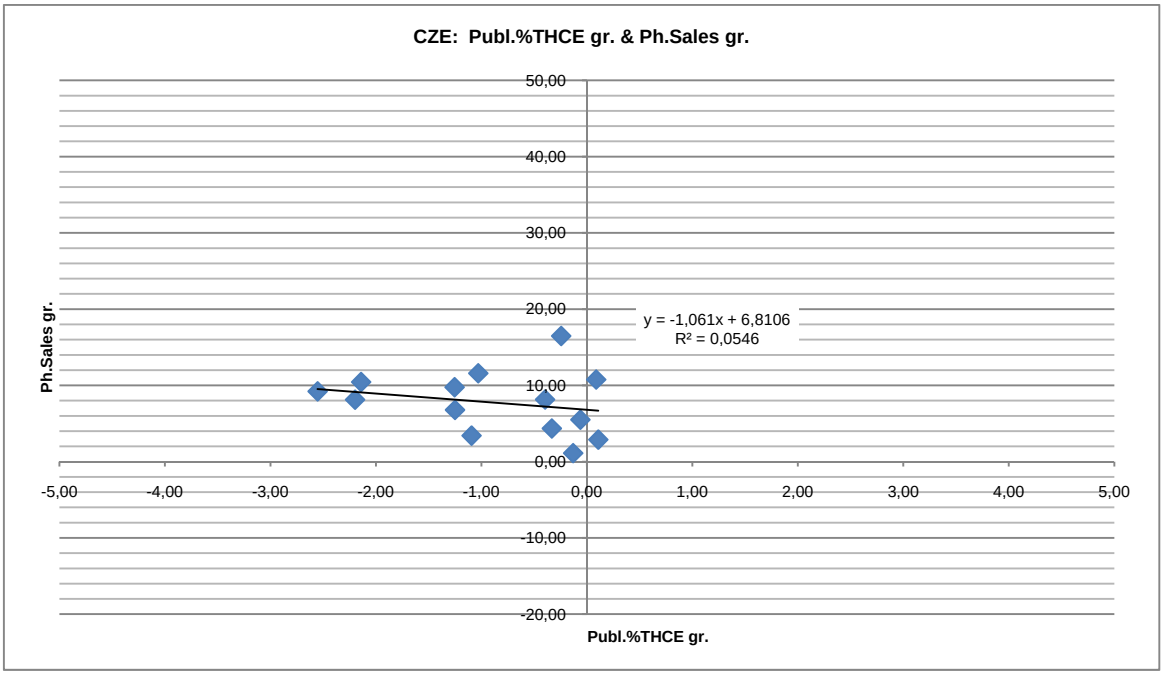


Figure 18: P%HCEgr. & Ph.Sales gr. Czech Rep.

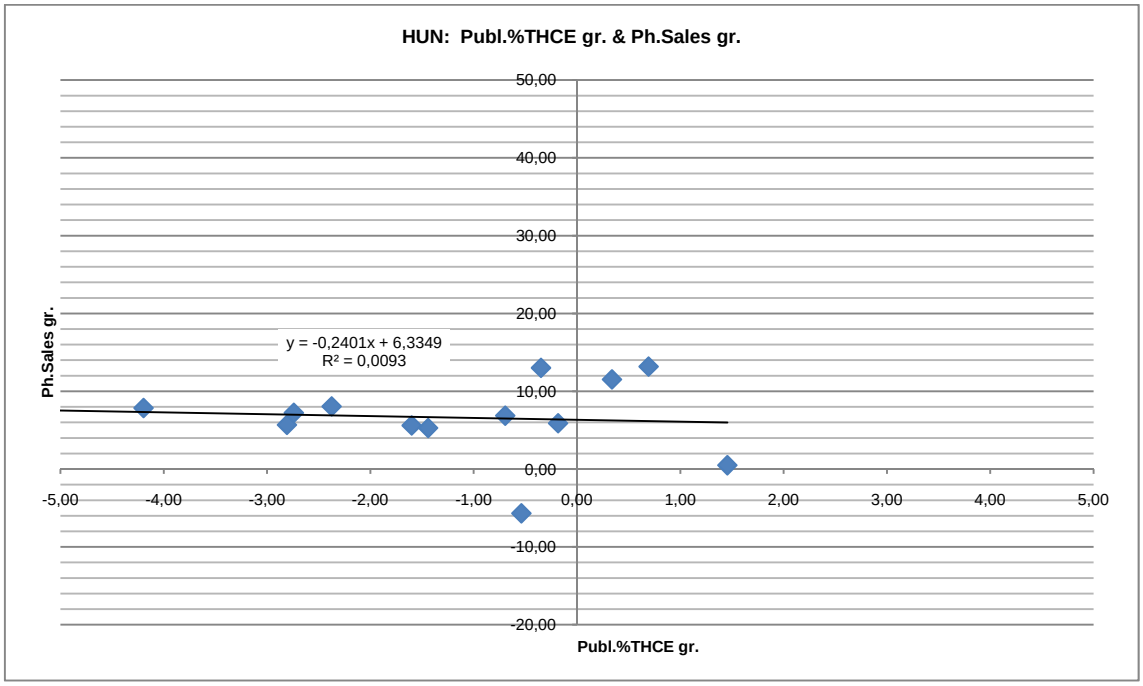


Figure 19: P%HCEgr. & Ph.Sales gr. Hungary

4.5.2.3. International Trade as Share of GDP

Data has been normalized using the average of actual and last value respectively. Calculations are based on both international share of GDP and pharmaceutical sales as growth rates.

Ratio	Int.Share%GDP					Int.Share%GDP gr					Ph.Sales gr			
Country	SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD		SVK	CZE	HUN	OECD
1990		41,46		37,44										
1991		43,99	33,35	37,21			12,22		-1,23			-15,12		5,06
1992		48,90	32,52	36,78			11,21	-5,00	-1,18			-4,57		6,73
1993	58,47	51,35	31,14	37,07			5,25	-4,22	0,82			17,89	12,81	9,21
1994	57,53	50,18	31,43	38,17		-3,19	-2,26	1,00	2,95			32,47	12,63	9,24
1995	56,63	50,92	38,53	40,41		-1,55	1,63	22,15	5,83			30,28	9,87	8,20
1996	57,69	52,38	46,34	42,30		1,87	3,05	22,89	4,83		46,76	16,48	5,68	8,22
1997	59,95	53,27	50,91	44,05		3,91	1,74	9,76	4,12		40,89	4,36	5,60	8,22
1998	62,89	54,73	57,64	46,37		4,88	2,81	13,18	5,34		24,66	1,12	7,85	7,22
1999	64,01	55,40	63,01	47,34		1,88	1,24	9,59	2,11		8,13	2,89	8,53	7,02
2000	67,58	60,46	69,79	50,43		5,66	9,05	10,62	6,52		2,35	5,50	7,23	8,52
2001	74,26	65,74	73,26	53,17		10,07	9,22	5,71	5,81		5,56	8,14	8,05	10,15
2002	75,77	63,93	67,72	51,70		2,20	-2,68	-7,64	-2,76		13,69	10,76	13,01	10,38
2003	75,79	62,09	63,44	49,98		0,07	-2,65	-6,04	-3,31		16,81	10,44	13,18	8,50
2004	76,38	66,52	63,80	50,80		0,80	7,07	0,57	1,68		3,92	9,22	6,87	5,95
2005	77,27	70,37	65,72	53,02		1,18	6,08	3,01	4,40		-4,15	9,76	5,89	5,09
2006	82,50	72,66	72,21	55,67		6,71	3,25	9,76	4,96		5,76	6,79	11,52	5,88
2007	86,82	76,14	78,59	57,99		5,45	4,81	9,31	4,24		14,62	3,42	5,28	6,20
2008	85,70	76,19	80,67	58,80		-1,28	0,14	2,64	1,39		15,63	8,12	-5,68	6,25
2009	84,16	74,82	81,66	58,99		-3,54	-3,55	2,49	0,65		12,74	11,59	0,50	5,01
Av.	70,79	59,58	57,99	47,39		2,20	3,56	5,54	2,48		14,81	8,92	7,58	7,42
Median	74,26	57,93	63,44	48,66		1,88	3,05	4,36	2,95		13,21	8,14	7,85	7,22

Table 18: IT%GDP Norm.

Correlations:

Ratio	Int.Share%GDP					Int.Share%GDP gr			
Market	Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years		Lag 0 years	Lag 1 year	Lag 2 years	Lag 3 years
SVK	-0.59	-0.51	-0.49	-0.46		-0.12	-0.16	-0.39	-0.57
CZE	-0.02	-0.17	-0.14	-0.43		-0.58	-0.20	0.38	0.64
HUN	-0.47	-0.45	-0.34	-0.21		-0.26	-0.39	-0.19	0.11
OECD	-0.19	-0.28	-0.46	-0.60		-0.02	0.19	0.21	0.12
Av.	-0.32	-0.35	-0.36	-0.43		-0.25	-0.14	0.00	0.08

Table 19: IT%GDP gr. & Ph.Sales gr Corr.

Single Variable Linear Regression Analysis:

Market	Int.Trade%GDP – Ph.Sales gr.	Int.Trade%GDP gr. – Ph.Sales gr.
SVK	y = -0.8403x + 76.679 R² = 0.3261	y = -0.3412x + 15.782 R² = 0.0071
CZE	y = -0.0001x + 8.9319 R² = 2E-08	y = -1.266x + 13.428 R² = 0.3115
HUN	y = -0.1607x + 17.372 R² = 0.2844	y = -0.1119x + 8.2667 R² = 0.0395

Table 20: IT%GDPgr. & Ph.Sales gr. SLRA

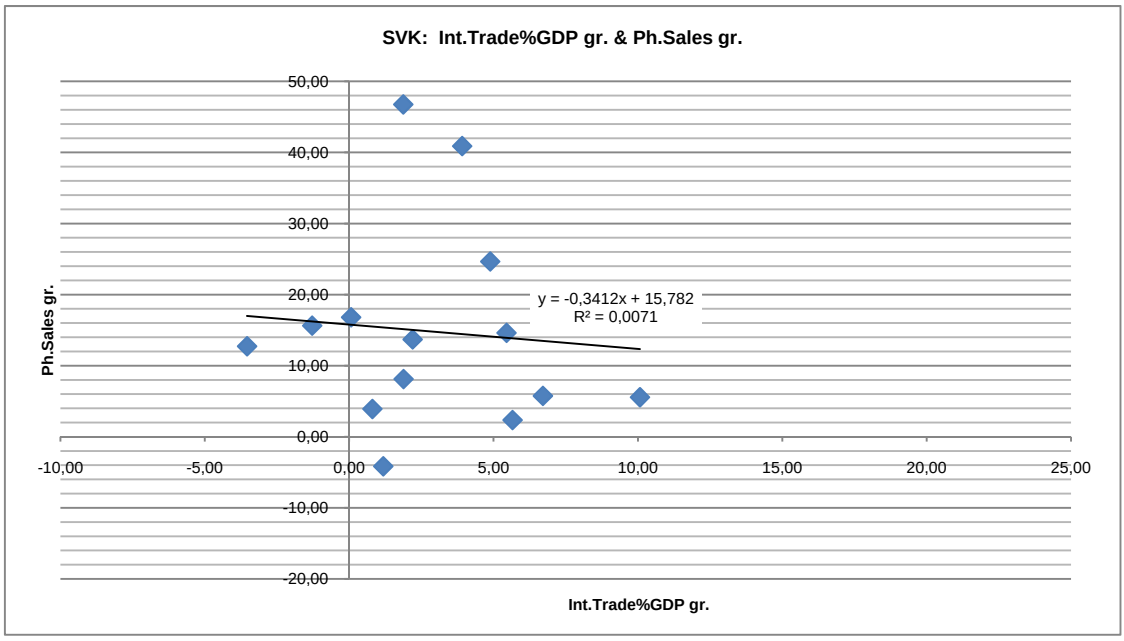


Figure 20: IT%GDPgr. & Ph.Sales gr. Slovakia

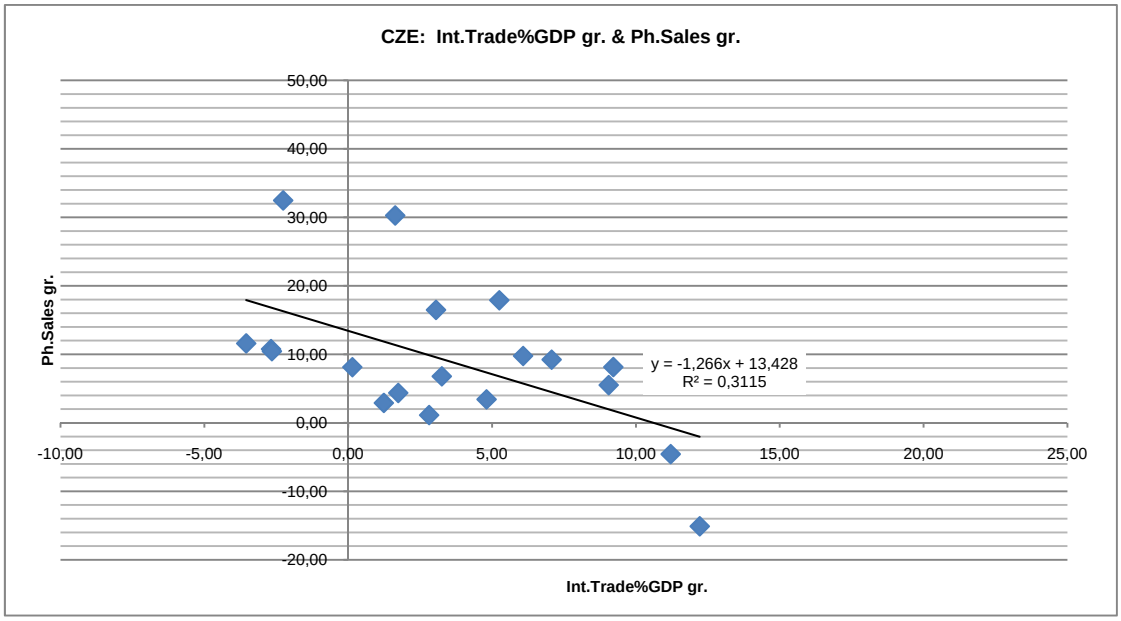


Figure 21: IT%GDPgr. & Ph.Sales gr. Czech Rep.

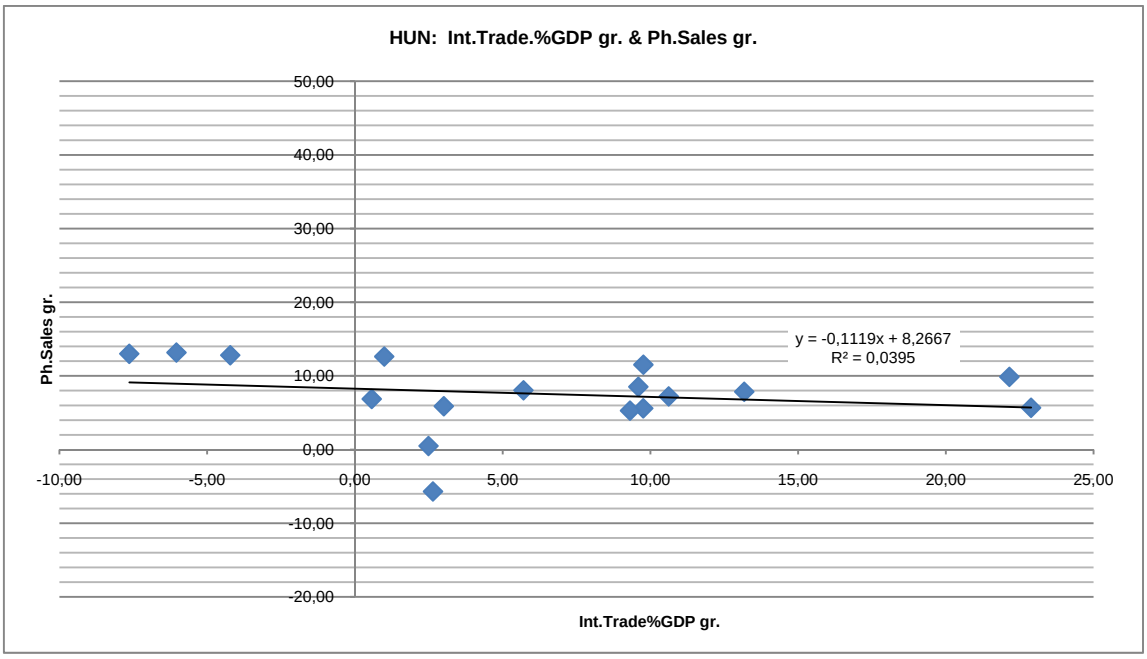


Figure 22: IT%GDPgr. & Ph.Sales gr. Hungary

4.5.3. MULTIPLE LINEAR REGRESSION ANALYSIS

The multiple linear regression model will include multiple explanatory variables (the three chosen indicators GCF%GDP growth, P%HCE growth, and Int.Trade%GDP growth), and the dependent variable (Pharmaceutical Sales growth). The model will first examine single markets, and in addtion the data of all markets at once[22].

This analysis will investigate if the level variations in pharmaceutical sales growth can be explained with the three explanatory variables in the regression model.

The main questions in the focus of this examination are:

- Are the assumptions of multiple linear regression analysis met?
- How significant is the quota of sales growth variation that can be explained with the model?
- How important are the single explanatory variables?

Adjusted R^2: This value reveals the percentage of variations on the depended variable that can be explained with the model.

Durbin-Watson: Statistical test that will be used to detect the precense of autocorrelation in the residuals from the linear regression analysis.

ANOVA: (Analysis of Variance). The ANOVA table indicates the overall fit of the model to the data.

Colinearity: Having explanatory variables with high degree of correlation among them need to be avoided. Multicollinearity would produce estimates of regression coefficients not fitting the expected values. One of the variables would need to be excluded from the model in such case.

This examination is based on the same data sets depicted in chapter 4.5.2.

[22] SPSS analyses sources: Janssen, J. & Laatz, W. (2009): Multivariate Analysemethoden – Eine anwendungsorientierte Einführung, Springer Verlag, Berlin.

Slovakia

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,752[a]	,565	,435	10,49706	1,635

a. Predictors: (Constant), gdp_sk, hp_sk, gcf_sk; b. Dependent Variable: sales_sk

ANOVA[b]

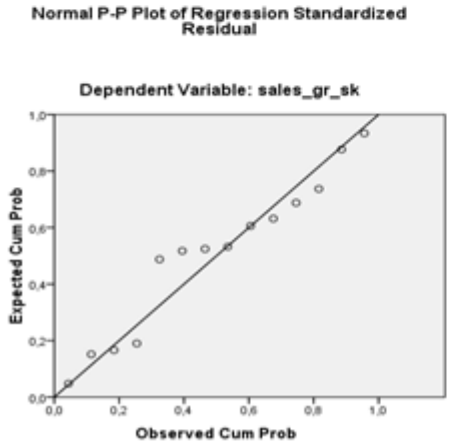
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1431,377	3	477,126	4,330	,034[a]
	Residual	1101,882	10	110,188		
	Total	2533,259	13			

a. Predictors: (Constant), gdp_sk, hp_sk, gcf_sk; b. Dependent Variable: sales_sk

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9,370	4,870		1,924	,083		
	gcf_sk	,817	,314	,688	2,600	,026	,622	1,609
	hp_sk	,622	1,294	,127	,481	,641	,623	1,606
	gdp_sk	,789	,850	,199	,928	,375	,942	1,061

a. Dependent Variable: sales_sk



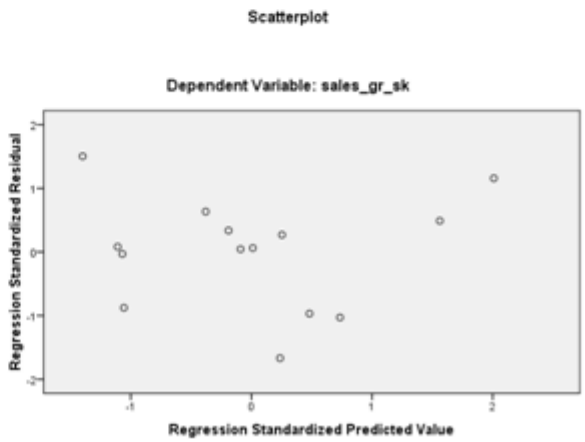


Figure 23: Multiple Linear Regression Analysis Slovakia

Czech Republic

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,491[a]	,241	,013	3,85092	1,398

a. Predictors: (Constant), gdp_cz, hp_cz, gcf_cz; b. Dependent Variable: sales_cz

ANOVA[b]

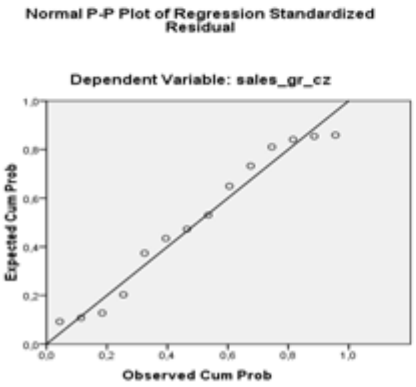
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47,077	3	15,692	1,058	,409[a]
	Residual	148,296	10	14,830		
	Total	195,373	13			

a. Predictors: (Constant), gdp_cz, hp_cz, gcf_cz; b. Dependent Variable: sales_cz

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	7,059	1,926		3,665	,004		
gcf_cz	,259	,285	,312	,909	,385	,643	1,554
hp_cz	-1,748	1,195	-,406	-1,463	,174	,984	1,016
gdp_cz	-,321	,319	-,344	-1,008	,337	,651	1,536

a. Dependent Variable: sales_cz



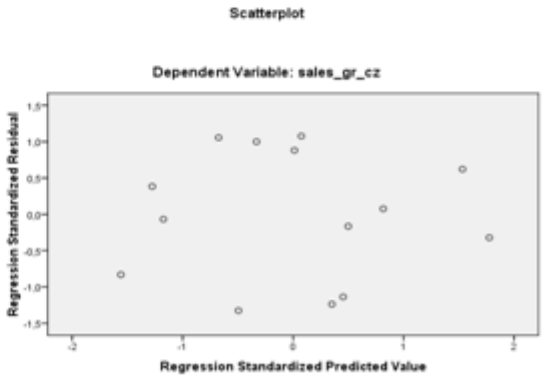


Figure 24: Multiple Linear Regression Analysis Czech Rep.

Hungary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,445[a]	,198	-,042	6,43594	1,863

a. Predictors: (Constant), gdp_hu, gcf_hu, hp_hu; b. Dependent Variable: sales_hu

ANOVA[b]

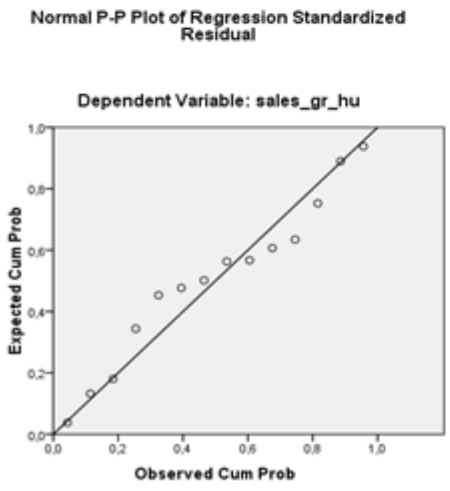
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	102,326	3	34,109	,823	,510[a]
	Residual	414,214	10	41,421		
	Total	516,539	13			

a. Predictors: (Constant), gdp_hu, gcf_hu, hp_hu; b. Dependent Variable: sales_hu

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	8,643	2,401		3,600	,005		
	gcf_hu	,602	,457	,421	1,316	,217	,782	1,278
	hp_hu	,093	1,176	,029	,079	,938	,603	1,658
	gdp_hu	-,309	,289	-,385	-1,068	,311	,617	1,621

a. Dependent Variable: sales_hu



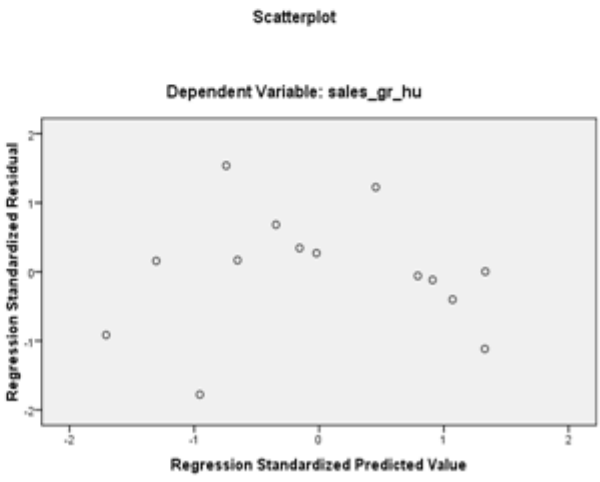


Figure 25: Multiple Linear Regression Analysis Hungary

Multiple Linear Regression Analysis for SVK, CZE and HUN data in sum

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,659[a]	,435	,390	7,36491	1,373

a. Predictors: (Constant), gdp, gcf, hp; b. Dependent Variable: sales

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1584,888	3	528,296	9,740	,000[a]
	Residual	2061,193	38	54,242		
	Total	3646,081	41			

a. Predictors: (Constant), gdp, gcf, hp; b. Dependent Variable: sales

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	10,088	1,518		6,647	,000		
gcf	,763	,155	,639	4,914	,000	,881	1,135
hp	,150	,625	,033	,240	,812	,806	1,241
gdp	-,317	,220	-,189	-1,440	,158	,865	1,156

a. Dependent Variable: sales

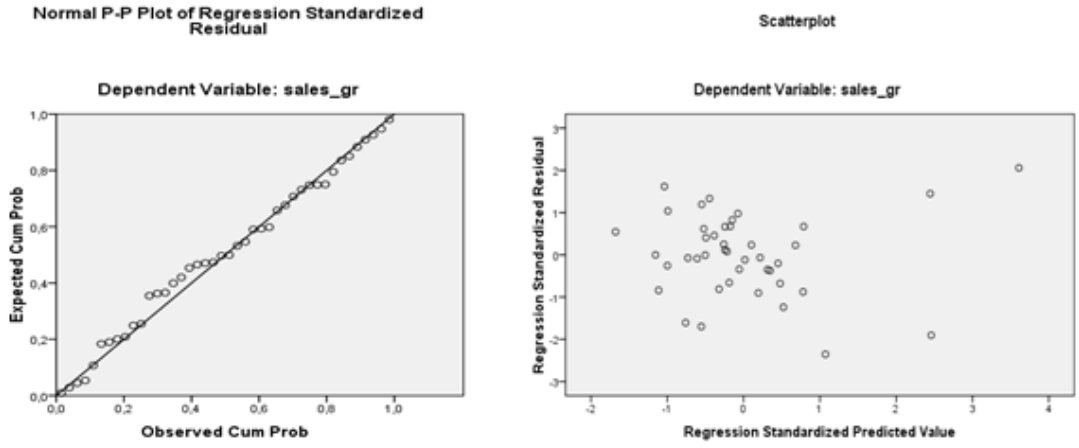


Figure 26: Multiple Linear Regression Analysis SVK, CZE, and HUN

5. OBSERVATIONS / CONCLUSIONS

5.1. CORRELATIONS AND SINGLE LINEAR REGRESSIONS

Gross Capital Formation as Share of GDP

There is a positive correlation for all markets in the calculation without lag (L0), and even for two markets in the version with 1 year lag (L1). For L2 and L3 all correlations are negative.

The correlation is made visible in the data plots. The correlation coefficient R^2, reflecting how strong the correlation is, are 0.6326 for SVK, 0.5782 for CZE, and 0.0499 for HUN. All R^2s confirm a positive correlation (If predictor variable increases, dependent variable tends to do so in the same direction).

Public Share of Total Health Care Expenditures

Two of three markets have negative correlations with rather small values. Only SVK has a positive correlation in L0 and L1. The correlation coefficients confirm a much smaller correlation as in the case of the first predictor variable GCF%GDP. The Correlations are: SVK: 0.58, CZE: -0.23, HUN: -0.10. The coefficients are 0.292 for SVK, 0.0546 for CZE, and 0.0093 for HUN. The plotted data confirms one positive and two negative regression lines. The variable is not useful as stand alone predictor for the hypothesis two.

International Trade as Share of GDP

All three market data sets have negative correlations in L0 and L1. In L2 two of three are negative as well. The correlation coefficients are 0.0071 for SVK, 0.3115 for CZE and 0.0395 for HUN, and all regression lines confirm a small negative correlation (As the share of international trade growth increases, the pharmaceutical sales growth decreases). The predictor variable has no statistical relevant influence on the dependent variable.

5.2. Multiple Variable Regression Analysis

Slovakia

Adjusted R^2: 0.435. This means, that about 43% of the variances on the dependend variable can be explained with the model.

Durbin-Watson: 1.635. This ratio being smaller than 2 proves that the predictor variables – at least for the examined set of data - do not have a strong correlation.

ANOVA: The analysis of variance for Slovakia has a significance of 0.034. A significance smaller than 5% confirms that at least one of the examined predictor variables has significant influence on the dependend variable.

Coefficients: This part of the analysis reveals that the predictor variable with significant influence is the GCF%GDP. Concidering the very small number of available data, the value is of importance.

Collinearity: VIF being smaller than 3.2 and tolerance being less than 1 confirms that correlation between the predictors is not given.

Normal P-P Plot: Most points are close to the projected line. But there are visible exceptions, disturbtions, deviations.

Homogenität: The scatterplot does not depict any pattern. The points are spread in a homogenous way.

Result: The regression analysis conducted with focus on Slovakian data and all three predictor variables show that only GCF%GDP does have an influence on the dependend variable Sales growth.

Czech Republic and Hugary

Even having all statistical prerequisites fulfilled for both data sets, the multiple regression analysis makes clear that the three predictor variables do not have a relevant influence on the depended variable:

CZE: Adj. R^2: 0.013; ANOVA sig.: 0.409 (No significant influence)

HUN: Adj. R^2: -0.042; ANOVA sig.: 0.510 (No significant influence)

Regression Model for the sum of data (Slovakia, Czech Republic, and Hungary)

The final analysis does not filter by country, and thus uses much more data.

Adjusted R^2: 0.390. This means, that about 39% of the variances on the dependend variable can be explained with the model.

Durbin-Watson: 1.373. This ratio being smaller than 2 proves that the predictor variables – at least for the examined set of data - do not have a strong correlation.

ANOVA: The analysis of variance has a significance of 0.000, which confirms the effect of the higher number of data sets, and a strong significance of at least one predictor variable for the dependend variable.

Coefficients: This part of the analysis reveals that the predictor variable with significant influence is the GCF%GDP.

Collinearity: VIF being smaller than 3.2 and tolerance being less than 1 confirms that correlation between the predictors.

Normal P-P Plot: Most points are clearly closer to the projected line, which again confirms the regression model.

Homogenität: The scatterplot does not depict any pattern. The points are spread in a homogenous way.

Result: The regression analysis conducted without focus on a certain country confirms that only GCF%GDP has an influence on Sales growth.

5.3. CONCLUSIONS

Gross Capital Formation as Share of GDP

A market experiencing economic improvements (measured on the GDP) is undoubtedly the basic sign marketers are looking for. Increasing rates of spending on additions to fixed assets is an additional pointer that reflects investor´s confidence in the future growth of the respective market. Its information value could be compared with the value of indicators as the PMI – Purchasing Managers Index.

The tests conducted in this paper prove a certain positive correlation between GCF%GDP and pharmaceutical sales growth within the same period, but also with one year lag. The examination also shows that gross capital formation is by far not the sole predictor variable influencing sales growth. In my opinion though, the test results are strong enough to consider adding this ratio to the indicators used in preliminary pharmaceutical market screening. The correlation in the analized markets is significant enough to award predictive value to the indicator.

Public Share of Total Health Care Expenditures

In general, government´s health care funding shares are higher in services and infrastructure and distinguished lower in pharmaceutical expenditures. As the correlation and regression analysis confirms, the influence of P%THCE on pharmaceutical sales growths is hence smaller than expected.

Pharmaceutical expenditures, especially spending on originals are strictly monitored and regulated through the so called positive drug lists (Listing of pharmaceuticals that are (partially) reimbursed), ceiling price regulations, and market authorizations. The impact of this general trend could be raising public shares on health care expenditures, and decreasing pharmaceutical sales figures.

The public share of total health care expenditures dedicated to drugs vary among countries. In Czech Republic for instance, the pharmaceutical spending is significantly higher than in OECD average. In Hungary on the other hand, regulations have been imposed to reduce overprescription much earlier than in Czech Republic, and with much better results (Economist Intelligence Unit, Country report). This

circumstance makes it difficult to take general assumptions that should apply for all Eastern European countries.

Even without prove of correlation in the selected markets and periods, the ratio can be used in addition to other indicators to correct expected sales, as public spending increase patients access to drugs. A more accurate forecast can only be expected during in-depth screening, when marketers focus on the product portfolio level and examine the health care expenditure tools mentioned above.

International Trade as Share of GDP

A significant share of international trade on GDP does not necessarily correlate with a broad income distribution and corresponding drug consumption per capita. Imports and exports could be concentrated in few industries and even companies influencing GDP and the examined ratio, but not pharmaceutical sales.

A high share of international trade must not reflect openness towards western economies. Belarus and Ukraine for instance, have ratios far above OECD average, but most of the trade is achieved through commerce with the Russian Federation, not with Western economies. Market entry for Western pharmaceutical companies could still be hindered by adverse regulations and even a general social and cultural aversion.

The degree of integration within a region can differ from industry to industry. Slovakia and the Czech Republic for example, are producing and assembling automobiles for Western European multinationals. This significant industrial business is based on broad governamental support manifested in corresponding regulations. Thus, the ratio is high. But government in these countries might not put the same emphasis on enabling pharmaceutical multinationals to enter the market.

On the other hand, the circumstances could be the oposit. The country could restrict most imports, but bear up pharmaceutical imports. In this case a low ratio of international trade as % of GDP could lead to wrong assumptions as well.

The share of international trade as % of gross domestic product can be useful during preliminary market screening. Before evaluating the ratio though, the marketer

should find out which countries are involved in the respective trades, and in addition which industries or even companies are involved.

Final Conclusions

The evaluation of single demographic, economic, or health care specific indicators regarding their usefulness to forecast the pharmaceutical market life cycle in developing and emerging markets is not easy. The application of these ratios to analyse such markets has to be conducted with unsufficient statistical data, and under consideration of the tipical dispositon to frequently change economic and regulatory environment that can be observed in such countries. Most indicators do not address the specific nature of emerging markets, and its usage to predict attractiveness could lead to wrong assumpitons.

My research leads me to the conclucion that for preliminary screening of developing pharmaceutical markets, demographic and macro-economic indicators are more suitable than health care specific ratios. The attempt to predict pharmaceutical sales growth based on the latter group of indicators fails due to the fact that health care systems are far from being uniform. The political stability, governments, regulations, economic background, and even cultural specifics have strong influence on the health care market. The suggestion is to exclude this indicator group from preliminary screening, and to analize the health care system and the corresponding group of indicators within the in-debth market screening.

In general, the indicators examined in detail do not cover the complete rage of variables that influence the growth of a market. Still, they can be useful in conjunction with other ratios as GDP, total health care expenditure, total expenditure on pharmaceutical goods, etc. Being easy to obtain and elaborate, they can give valuable additional market insights without consuming resources. Especially when observing a longer series of time, the indicators can support the marketer to better understand the overall development of an emerging country and the present and future potential for market entry.

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