

University of Economics, Prague
Faculty of Business Administration

Diploma Thesis

2012

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Faculty of Business Administration
Major: International Management



Title of Diploma Thesis:

**Application of Game Theory Principles in the
Oligopoly-characterized Industry**

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Declaration

I hereby declare that I am the sole author of the thesis entitled:
“Application of Game Theory Principles in the Oligopoly-characterized
Industry”

I duly marked out all quotations. The used literature and sources are stated
in the attached list of references.

In Prague on May 7, 2012

I would like to thank doc. Ing. Bronislava Hořejší CSc.
for introducing me into the economics of game theory and for all valuable comments
while writing this thesis.

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Abstract:

The goals of the diploma thesis are describing the strategic oligopoly environment of chosen industry of Czech telecommunications, together with introducing basic game theory principles with their possible real case application. It mentions historical shifts in Czech telecommunications sector which influence the actual industry conditions. The thesis briefly describes the individual players in the market and turns its attention towards the industry characterization through standard oligopoly models. Following, it introduces theoretical insight on possible market entry strategies into oligopoly industries. The application part focuses on game-theory in pricing strategies, market entry and entry deterring scenarios with examples. Final part summarizes the objectives in detail and provides final comments on the thesis.

Key words:

Game Theory, Oligopoly, Strategy, Market Entry

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Abbreviations

ARPU	-	Average Revenue per User
APMS	-	Association of Mobile Network Operators
ARCEP	-	Autorité de Régulation des Communications Électroniques des Postes
CC	-	The Conseil de la Concurrence
CDMA	-	Code Division Multiple Access
CTU	-	Czech Telecommunication Office
DD	-	Digital Dividend
ERF	-	European Regulatory Framework
EU	-	European Union
GATS	-	Global Agreement on Trade in Services
GDP	-	Gross Domestic Product
GSM	-	Global System for Mobile Communication
ISP	-	Internet Service Provider
ITU	-	International Telecommunication Union
LTE	-	Long Term Evolution
MC	-	Marginal Costs
MPSTP	-	Main Principles of State Telecommunication Policy
MR	-	Marginal Revenue
MTR	-	Mobile Termination Rates
MVNO	-	Mobile Virtual Network Operator
NMT	-	Next Mobile Telephony
NTP	-	National Telecommunication Policy
OECD	-	Organisation for Economic Cooperation and Development
RM	-	Relevant Market
UOHS	-	Office for the Protection of Competition
SMB	-	Small Medium Business
SMRA	-	Simultaneous Multiple Round Auction
telco	-	telecommunications
UMTS	-	Universal Mobile Telecommunications System
UOHS	-	Office for the Protection of Competition
WTO	-	World Trade Organisation
y-o-y	-	Year on year change

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1 Introduction

1.1 From Monopolies to Oligopolies with Strategic Behaviour

A government cannot reinstate or secure competitiveness. Government is a monopoly itself. If a government goes so far, that it requires individuals to have permissions to be economically active and all it can do is to issue orders, it will only lead to monopoly situation.

Isabel Paterson (1993)

A well developed, performing and nation/international wide competitive industry is recognized as of significant importance for any country. Many countries intended to undertake a shift from state monopoly structures towards oligopolies and further towards free market structures erected on economic competition principles. The monopoly structures had considerable economic power and therefore carried implications for national infrastructure and regulatory affairs. New model structures erected on more liberal principles of free supply and demand carry intrinsic ambition of continuous strategic development and prospective self-realisation. It is important to keep in mind that with more freedom comes more responsibility, where exactly the state monopoly market elements lack responsibility which is present in a market where private ownership and decision making dominate.¹ With the rise of freedom and responsibility the importance of strategic behaviour emerges, as an opposite to state managed, irresponsible and many times un-strategic behaviour of monopolies. Not forgetting about mutual interdependence, in an oligopoly a properly chosen balance between governance and regulatory affairs has to be maintained. This thesis elaborates on strategic behaviour in oligopolistic structures in a chosen industry using game theory approaches and their application.

Industry the thesis focuses on, are the Czech telecommunications. Telecommunications as presented by Sarkar, Cabusgi and Aulakh (1999) show behaviour of natural monopolies. Further research by Valletti shows that the telecommunications industry evolved into Natural Oligopoly structure.² In the observed oligopoly of Czech

¹ "With Freedom comes Responsibility," slogan is often used by liberal movement. First time used by (Roosevelt, 2012).

² Natural Oligopoly (other natural structure) – the industry is most efficient in its present state; other state would not be natural and therefore inefficient.

telecommunications industry the aim of the thesis is to implement chosen approaches of game theory as their origin lays in the economic theory of oligopolistic structures and competitive behaviour. In the final stage the paper compares different game theory models on the telecommunication market's size to characterize best measurement approach. With the dynamism in the industry a possible shift in the strategic aligning of the Czech telecommunications is proposed with its outlook in industry near future.

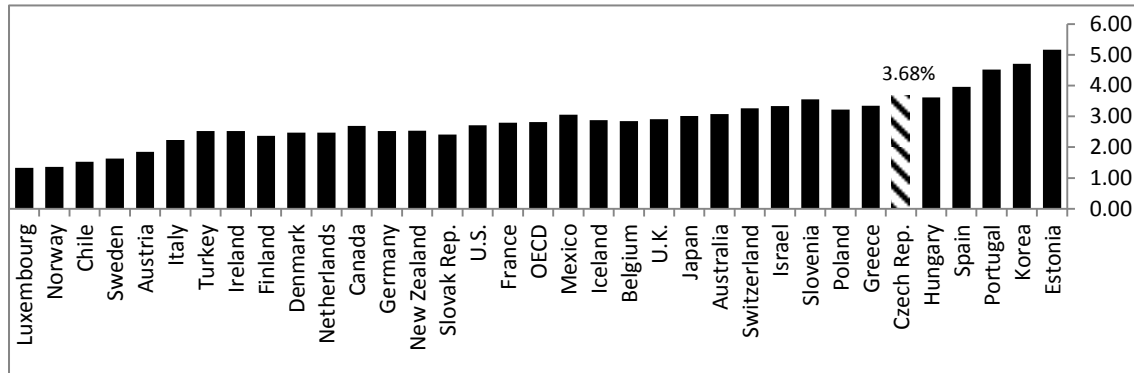
This paper is organized as follows. The introductory *Chapter 1* states the reasoning behind the motivation for writing the thesis and develops hypotheses. *Chapters 2* and *3* are dedicated to introduction the history of Czech telecommunication industry and actual market structure. *Chapter 4* proposes a description of theoretical foundations of a telecommunications oligopoly. *Chapter 5* focuses on practical aspects and tries to apply the theoretical approaches. Last *Chapter 6* comments on the objectives of the thesis and elaborates on the industry's close future.

1.2 Choosing the Topic

1.2.1 Telecommunications are Strategic

Telecommunications industry (telco) shows proof of being an attractive research subject, because of its size and importance for any national economy. Organisation for Economic Cooperation and Development (OECD) in its recent publication, *Communication Outlook 2011* postulates a constant annual growth rate of its cumulative telecommunication market of 3.9% since 2000 (OECD, 2011). The importance of telecommunication's size is illustrated by revenues comparison to annual national Gross Domestic Product (GDP). Czech industry stood in 2009 with a 3.68% share of the national GDP. This share belongs to the top five of all OECD members (see *Figure 1*) outperforming most of the mature markets. On the other hand the OECD statistics justifies the trend of diminishing share of telecommunications on national GDP. In case of Czech Republic the share fell from its maximum of 4.38% in 2003 to 3.68% share in 2009.

Figure 1 Telecommunication revenue as a percentage of GDP [as of 2009]

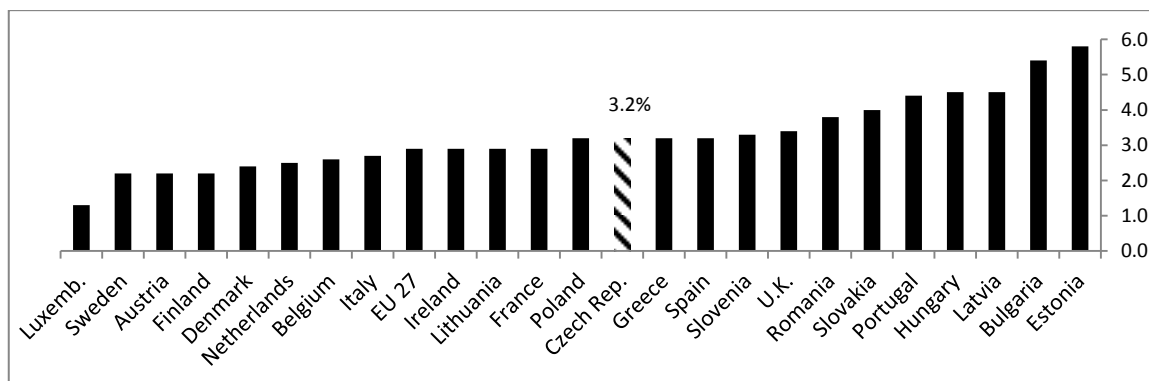


Source: (OECD, 2011)

An alternative view is provided by European Union (EU). The OECD argumentation is supported by its observations showing a similar trend to the previously mentioned one.³ In 2009 the Czech telecommunications accounted for 3.2% meanwhile in 2010 it was 3.0% share on national GDP, positioned approximately in the midpoint among observed countries (see *Figure 2*). Interesting observation is that the countries joining the EU in 2004 and 2007 show higher shares than older EU member countries. Because of non-existence of older statistical data, Eurostat reports a 1% fall of telco revenues in the period of 2006 - 2010.

Even with the downward trend identified, telecommunications industry must be still considered of important size and of high importance for any national economy. This claim supports the reason for choosing telecommunications industry as thesis subject.

Figure 2 Telecommunication expenditures as a percentage of GDP [as of 2009]



Source: (Eurostat Database, 2012)

³ Differences in methodology apply. OECD works with revenues/GDP ratio, Eurostat with expenditures/GDP ratio.

1.2.2 Deregulation and Internationalization of Telecoms

Any industry is under the influence of global shifts. As stated by Waverman and Sirel (1997) in pre-1980s the political and regulatory importance of telecommunications was not on governments' high priority list. In these times it was usual that state owned monopolies were used as cash cows for the state budget. The inefficiencies and rising prices plagued the markets and were of major problem because monopolization case simply failed to benefit customers as the remedies did turn out to have negligible practical impact for the end in the final stage. Inefficiencies and prices pressures together with the internationalization of telecommunications players started at end of the 80's and beginning of the 90's an inevitable strong horizontal and vertical deregulation processes. Countries were literally pushed into introducing changes in the telco industry. These processes started first in United States (early 1980s) in and United Kingdom (1981) followed by North (Denmark 1990) and West European countries (France 1988, Germany 1989) accompanied by Asian ones (Japan 1986). After that in the late 90's and beginning of the new millennia a good example of liberalization and deregulation practise transfer to East-European economies took place (CESifo Group, 2010).⁴

The internationalization of telecommunication operators was the reason behind deregulation. Not just telecommunications but many other industries were in the period of the 80's and 90's "riding on a horseback". Bill Clinton's rhetoric about, "each nation is like a big corporation competing in the global marketplace," claimed by Krugman (1994) as being dangerous, showed the necessity of having high ambitions for every individual, for businesses twice as much. As further researched by Sarkar, Cabusgi and Aulakh (1999) a set of environmental forces of privatization, liberalization and institutional changes together with firm-level strategic and scale related drivers led towards globalization of telecoms. Kramer believes that it was eminent that telecoms were undergoing a fundamental shift from an engineering-dominated sector to one that was commercially oriented with high resilience towards business cycle (1993).

However the competition does not arrive overnight. Even state monopolies have had the option of a pro-competitive behaviour or anti-competitive behaviour. Their strategy was based on the government intentions and management capabilities. Push after

⁴ The deregulation process might be in many countries not finished yet, possible liberalization as well as deregulation steps might continue.

deregulation was going against the cash cow paradox. Lower prices from deregulation and new competitors worsened the profit generation capabilities if the company could not adjust to these new conditions. According to Crandall and Winston (2003) antitrust laws deter price fixing i.e. in an oligopoly even more than they should deter monopoly behaviour.⁵ The German think-tank CESifo which continuously researches mostly OECD member countries still identifies minor weak points of state involvement in some telecommunication structures, proving that further deregulation and demonopolization opportunities might still lie further ahead. Situation in Czech telecommunications provide prospects of introducing additional competition into the market together with changes in the regulatory environment. More detailed concepts as opening new market and new market entrant will be considered later in *Chapter 4.4*.

1.2.3 Regulatory Presence for Maintaining the Game

Each government has to take into account several important decisions as: the technological standard, the timing and number of licences necessary for a network and procedures by which the licences are granted. With the deregulation and liberalization processes mentioned, the presence of governance bodies in charge for setting the rules of the game is important. In the Czech Republic this role is undertaken by Český telekomunikační úřad (Czech Telecommunication Office, CTU) and Úřad pro ochranu hospodářské soutěže (Office for the Protection of competition, UOHS). The official mission statement of CTU is;

“the Czech Telecommunication Office exercises state administration in the area of electronic communications and postal services, including market regulation and the determination of business conditions to substitute for the missing effects of economic competition and to provide conditions for appropriate functioning of economic competition and for the protection of users and other market actors until a fully competitive environment is achieved.”⁶

UOHS focuses on creation of conditions favouring and protecting competition, supervision, consultations and monitoring. In the process of liberalizing a market, competition and sectorial regulatory bodies are closely related and often interact. The market, meaning effective economic competition should be the sole determinant of the

⁵ Price fixing – see *Figure 11* and *Figure 11*

⁶ It might appear entertaining when a governmental body declares its intentions of substituting missing effects of economic competition...

market conditions. However Bovet and Gugler (2000) argument, that telecommunications as parts of public services are essential elements of today's economies and their determination exclusively by competition is hard to achieve and as a consequence active regulation is necessary.

Apart from the Czech authorities the European Union (EU) plays a vital role. European policy documents emphasise the role of technology and regulatory decisions as key determinants of diffusion and development of telecommunications services. With its European Regulatory Framework (ERF) for electronic communication it represents a harmonised set of rules regulating electronic communications and services. Whereas the European Parliament and the Council constituted the groundwork of ERF it is upon European Commission the review the functioning of the directives, implements new revision processes, conduct regulatory supervision and manage disputes. This complex regulatory body stands in focus point, setting the main framework for European telecommunications industries. Next, the guidelines and recommendations by International Telecommunication Union's (ITU) are of high importance. As it is the ultimate body for global allocation of radio spectrum, satellite orbits, technical standards and others close cooperation has to be maintained. World Trade Organization (WTO) guidelines under Global Agreement on Trade in Services (GATS) supervise trade and market opening commitments in telecommunication services. Czech telecommunications WTO commitments are subject of the GATS/SC/26 and GATS/SC/26/Suppl.2 Schedule of Specific Commitments document. Highlighting OECD, still there are other international and national bodies having eminent interest in best practise telecommunications services.⁷

1.2.4 Public Pressure on the Situation in Telco Industry

Public debate and journalist interest are in many cases the evidence of that there is something going on in a chosen industry. This assumption was used on Czech telecommunications as well. The most significant indication of public concern about the situation in telecommunications is a public from blog ongoing since 2009 Nechceme předražené volání (We don't want expensive calls). This blog started a public awareness campaign about the unsustainability and high price policy of telecommunication services in Czech Republic. The campaign was called Napiš ČTÚ (Write CTU) and its

⁷ Detailed and case concrete regulatory overview is provided in *Chapter 3.6*

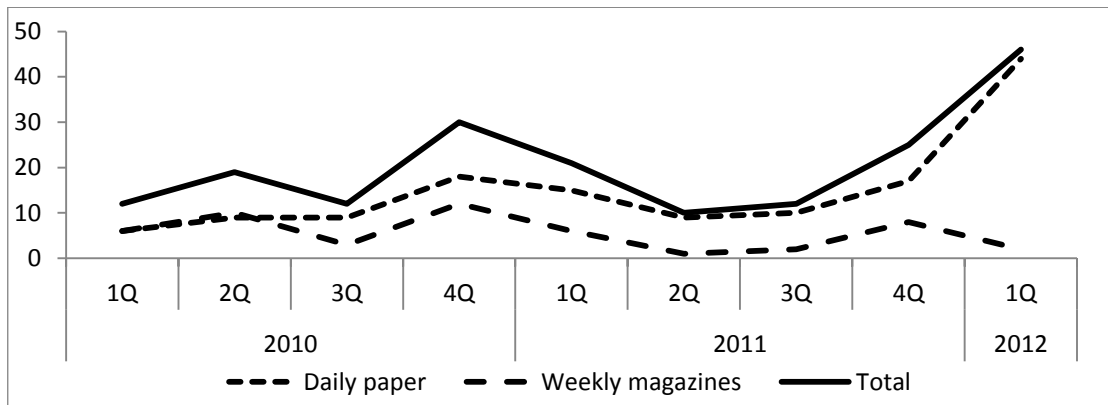
goal was to exercise pressure on the regulatory authority (and operators as well) because of unsatisfactory governance of price competition among operators. With approximately 150 suggestions arriving to CTU offices it was an interesting manifest of public concern (Peterka, 2011). CTU together with many experts and the general public expect the problem of high prices to be solved with a new mobile operator market entry as well as opening of wholesale mobile origination market services (opened as of April the 4th 2012).⁸ However, this process as it concerns a strategic industry takes some time. A more detailed analysis of the market entry strategy is provided in *Chapter 4.4* and *5.4* of the thesis.

The trend showing, how chosen daily papers and weekly business magazines reflect the key development of public discontent with the high prices together with the *media buzz* around the potential new operator in Czech Republic is provided *Figure 3*. First news about possible structural market regulatory changes appeared approximately in October 2010 when CTU announced the procedures, requirements and actions necessary for the new operator taking place in 2011. Through time it was clear that new entrant will not be allowed into the market during that year. The actual date for new market entrant was set 3Q 2012, unless new requirement alternations from Czech regulatory authorities appear. The experts are despite that sceptical because the new entrant requirements are too challenging and cost/benefit ratio analysis does not need to pay off for new as well as present market player (ihned.cz, 2012). Finalizing the reasoning, it is very likely that with continuous underdevelopment of services and regulatory unwillingness to introduce changes to the market, the public dissatisfaction will rise. Apart from public interest, businesses interested in entering Czech telecommunications in any way are beginning to create pressure on the regulator. It is as well in their interest that changes occur as they follow their company objectives in searching for any growth potential or position securing tactics.⁹

⁸ Please see <http://www.ctu.cz/aktuality/tiskove-zpravy.html?action=detail&ArticleId=9070> (Czech only)

⁹ Operators from West European are optimizing their operations in domestic markets because of new alternative market entrants in their relevant telecommunication markets. They see Central and Eastern European markets as yet not so highly competitive as their domestic ones.

Figure 3 How dailies and weeklies inform about Czech telecommunications? [hits]



Source: Draft by author, data from (ANOPRESS IT, 2012).¹⁰

1.3 Objectives of the Thesis

The thesis has 2 main objectives which have been chosen because of their importance and relevance to the industry development in 2012 and benefit which they can bring in understanding specific conditions of a telecommunications market influencing the strategic behaviour of industry competitors.

1.3.1 First Objective

Czech telecommunication industry is facing significant headwinds (as illustrated mainly in *Introduction* and *Market structure part*). Introducing the industry's historical prospects and actual conditions it's assumed of an oligopoly market. With the introduction of theory of oligopoly and continuous methodology the first objective is;

To outline a theoretical framework for a telecommunications industry under three member oligopoly. Proposing most important market typical circumstances under which the market is working in its most common form together with outlying the foundation of three most commonly used oligopoly equilibrium models.

¹⁰ The research was conducted on the time period of 27 months, from January 2010 to March 2012. Reason for not choosing a longer period is technical restraint of maximum 3 year search query in the ANOPRESS IT database. Research was undertaken by using a combination of key words: "oligopoly AND telekomunikace", "český telekomunikační úřad AND oligopoly" and "český telekomunikační úřad AND trh". In the category *Daily paper* were 8 newspapers. Category *Weekly magazines* consisted of 23 titles.

1.3.2 Second Objective

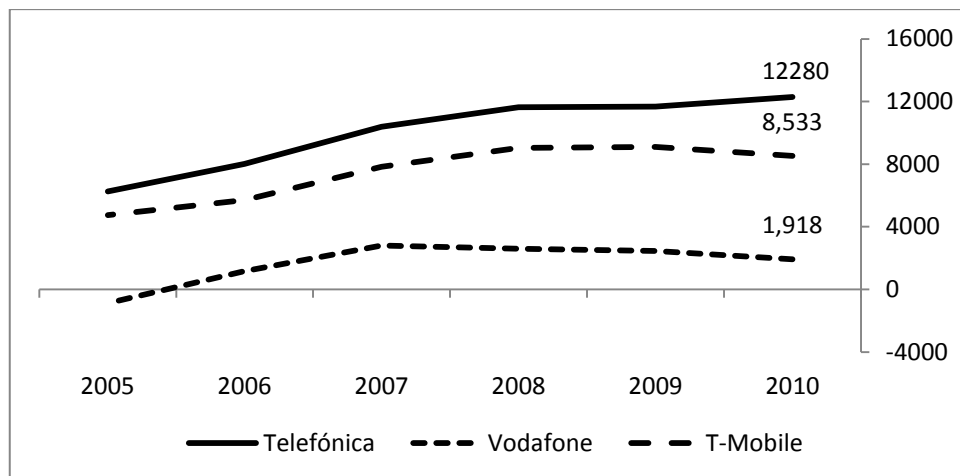
This objective continues in the findings of the first objective. With the actual structural changes in the telco industry, it stands in front of a complicated situation multiplied by public pressure on prices, introducing regulatory changes in the industry and the entry of a new market player.

With theoretical foundations provided in the first objective the second objective tries to illustrate behaviour and strategy patterns among industry members using various approaches, mainly game theoretic ones. The illustration should provide the reader with possible understanding of present industry conditions with a possible short-term outlook.

2 History of Czech Telecommunications Industry

For understanding key issues in an industry it is important to know its history and development. Czech telecommunications industry consists of three present players; Telefónica, T-Mobile and Vodafone forming a market structure of an oligopoly industry. This chapter provides an historical overview through Czech telecommunications. It is divided into three logical parts focusing on fixed telephony, mobile telephony and privatization of state monopoly Český Telekom. The chapter focuses separately on mobile and fixed voice services as they create the industry's dominant and historical core feature (see Figure 4).¹¹

Figure 4 Profit development in Czech telecommunications [CZK mil.]



Source: Author, Annual Reports, (Magnusweb Database, 2012)

2.1 Fixed Telephony

Few years after the end of II World War Czechoslovakia underwent major political and structural changes which influenced its development for many decades. During the few days of February 1948 the communist movement seized power and linked the country's fate with Soviet Block. The soviet state planned economy model was chosen as exemplary one to be readapted in Czechoslovak conditions. On the 1st of May 1952 with Governmental Resolution 13/1952 Ministerstvo spojů a pověřenectva spojů was established as the central authority responsible for the administration of telecommunications, post and telegraph network. Full centralization was achieved during 1960 when the Ministerstvo spojů a pověřenectva spojů was merged with

¹¹ Division into fixed and mobile services is very usual. Data services (internet, VOIP and others) then belong under fixed and mobile as corresponding data subcategories.

Ministerstvo dopravy (Ministry of Transportation). Yet this merger of ministries was not a successful gamble and in 1963 they split again under the guidance of Centrální Správa Spojů. With a Law no. 110/1964 the state monopoly on post and telecommunication services under state owned Československé spoje was officially founded.

Since the 1960's changes in ministry names and of the governance levels were regularly occurring. First signals of structural faults in the telecommunications industry are emerging at the end of the 1980's. This corresponds with the global trends presented in *Chapter 1.2.2* followed by deregulation and liberalization tendencies, as well as with structural political turbulences occurring in the Eastern Block. In 1989 was founded the Správa pošt a telekomunikací Praha, státní podnik. This company, again, responsible for strategic sectors, was later of strategic market creation importance. On the 1st of January 1993 with the dissolving of Czechoslovakia into two separate countries Czech and Slovak Republic, two new companies had been created from dividing the one state monopoly. In Czech Republic for telecommunications was responsible SPT Telekom meanwhile Česká Pošta s.p. took over postal services.¹² In 1994 was SPT Telekom transformed into SPT Telekom a. with 100% ownership held by Czech National Fund (Fond národního majetku) falling under the government.

On the 10th of August 1994 the Czech government proposed a strategic plan for its telecommunications policy in next five years. Document was called Hlavní zásady státní telekomunikační politiky (Main Principles of the State Telecommunication Policy, MPSTP). Ten objectives of this document should have provided an exemplary method of introducing liberal values into a former strictly monopolized industry.

Main Principles of State Telecommunication Policy (MPSTP)

1. Till 2000 the supply of telephone stations should be doubled and network quality should be improved. Rise in supply shall be reached equally, cheaply and with the highest possible involvement of Czech industry.

¹² With separate but mirrored governance structures similar demonopolization and liberalization processes occurred in both new countries.

Main Principles of State Telecommunication Policy (MPSTP)

2. *Objective 1* should be achieved with securing SPT Telekom's monopoly market position in the international, nationwide and local call markets.¹³
3. *Objective 2* should be valid till 2000.
4. The entry of strategic investor into SPT Telekom should be facilitated.
5. Ministry of Economy was responsible for the *Objective 3* processing. The new investor should have opted for 27% stake in the company and competences this share.
6. State's ownership will not fall under 51% share. The government will consider another round of privatization.
7. State regulatory framework to be established till June 30th of 1995. Regulation of tariff policy, market entry, customer-provider and frequency spectrum rules to be put into practice.
8. The entry of new players should be allowed in some local networks as they were intended to co-develop the network with SPT Telekom.
9. The interconnection fees between the new market entrants and SPK Telekom are to be decided by them. If they cannot come to a conclusion Ministry of Finance decides.
10. Two licences for GSM mobile network should be offered.

Even with proclaiming liberalization intentions by the government, the new telecommunication strategy was erected on mixed and contradictory rules still guaranteeing a single monopoly nationwide market participant SPT Telekom. Local network entrants could not compete with the state monopoly. The monopoly was used as a cash cow to mitigate the faults in state budget (Markoš, et al., 2002).

In 1999 Czech government valorised the MPSTP and introduced a new strategy - Národní telekomunikační politika (National Telecommunication Policy, NTP) as of 14th April 1999. The scepticism about the 1994 strategy as rather being a restructuring

¹³ Exemptions applied.

than liberalization process was eminent, yet the authorities declared it as successful in many ways. Practical implementation of new NTP was enforced by new telecommunication Law no. 151/2000. The goal of the NTP was obligatory high importance of telecommunications playing a vital role in Czech economic growth. Its aim was to meet the needs of private and business customer base with quality tailored services corresponding with the EU's requirements. NTP consisted of many counterbalancing acts, on one hand it presented deregulatory measures in government's involvement on the other hand it introduced the role of established regulatory authority CTU (Peterka, 2011). The patronage over SPT Telekom's monopoly was ended in 2001 whereas only with telephone number transferability and distant calls operator selection procedures coming into action in 2003 it is possible to talk about most significant liberalization steps (Peltrám, 1999).

2.2 Mobile Telephony

First subject with its business focus on mobile network coverage was Eurotel Praha founded by Správa pošt a telekomunikací (51% stake) and Atlantic West (49% stake) on 16th November 1990. The company's strategic goal was to develop mobile and data communication networks. Meeting this objective the company was backed by the government's generosity and received a guarantee of monopoly position in network operations matters (similar with Fixed Telephony). Its analogous Next Mobile Technology (NMT) network was launched on September the 12th 1991 facing problems as the need of customer education and extremely high prices of mobile telephones.¹⁴

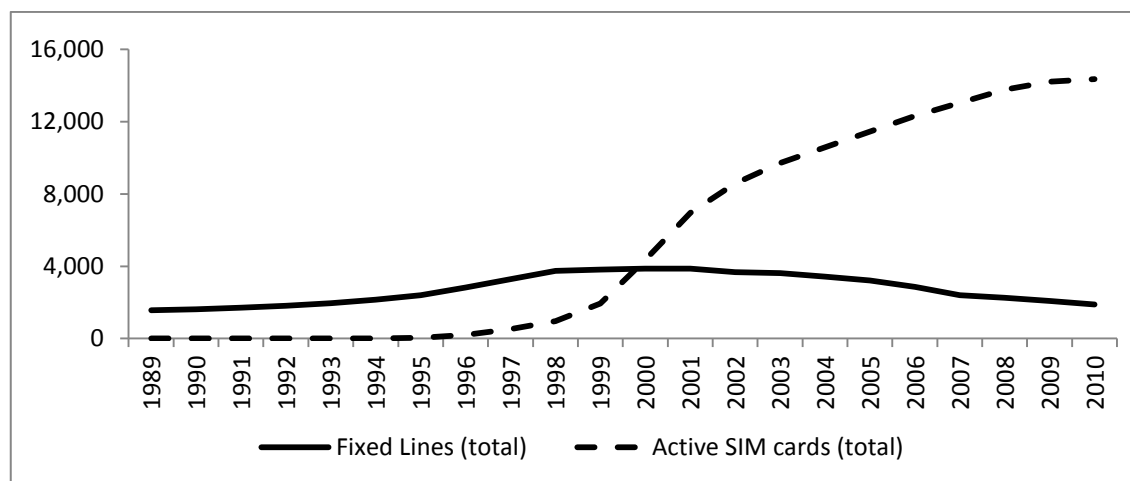
Significant shift in mobile telephony occurred in 1996. Corresponding with 1994 MTSTP, GSM licences were to be granted. (Not) surprisingly one was awarded to, logically in that time already former monopolist Eurotel, launching the new network on the 1st July 1996. Second license was awarded to České Radiokomunikace in a partnership with foreign consortium Cmobil B.V. (Deutsche Telekom holding). The company started its GSM mobile telecommunications network called Paegas on the 1st September 1996. This duopoly environment provided outlooks for a fall in prices and more rapid spread of mobile telecommunication services. Illustrated by Markoš (2002) Eurotel's yearly Average Revenue per User (ARPU) fell in 1996 CZK 4000 to CZK

¹⁴ NMT technology is often referred to as 2 Generation (2G) technology

2500 on 1999.¹⁵ Paegas experienced an ARPU fall in the same period from CZK 2500 of CZK 1000. With expectations the most vibrant development was to be expected with the entry of 3rd operator.

In March 2000 Český Mobil launched its Oskar GSM network further pushing on price competition, but already experiencing first problems with market saturation and that the most attractive customers were already split among former duopoly members – Eurotel and Paegas. In its first year in business Oskar performed with CZK 400 ARPU with pushing Eurotel towards CZK 1500 and Paegas to CZK 1100 ARPU. State agreed to three member oligopoly in telecommunications, but there was always room for improvement. However, tougher price competition than in a monopoly or duopoly market was eminent for some time horizon. Mobile telephony underwent a boom period with fixed telephony significantly lacking behind Mobile because of customer attractiveness, modern technology and remaining state monopoly of SPT Telekom (see *Figure 5*). Further market development is characterized by Paegas’s rebranding to T-Mobile in 2002 and of Oskar’s transformation to Vodafone in 2004.

Figure 5 Mobile and Fixed network usage [in thousands]



Source (Czech Statistical Office, 2012)

2.3 Incumbent Český Telekom going Private

Fulfilling *Objective 5* of MPSTP (entry of a new investor into SPT Telekom), during 1995 consortium TelSource acquired a 27% 5 year stake in the company. As TelSource expressed no continuous interest of taking over the company accompanied by its final retreat from all investor positions later on in 2003, the search for new strategic investor

¹⁵ ARPU/month – Average Revenue per User is a standard financial measure tool in telecommunications.

began.¹⁶ During 4Q 1999 Czech government declared intentions of SPT Telekom's privatization as it was nearing the end of its state guaranteed monopoly market position (*Objective 2 MPTSP*). The process of introducing a new strategic investor into SPT Telekom was set to motion, however it was a complicated and long one. Conforming to this process at the beginning of 2000 SPT Telekom changed its name to Český Telekom (Czech Telecom) to more clearly express the nature of its operations.

With a similar development as in *Figure 5*, all operators were facing during the first years of new millennia headwinds from the need of significant investments into new 3rd generation UMTS networks as the market conditions demanded faster and more reliable mobile services. Simultaneously with liberalization processes of telephone number transferability and distant calls operator selection procedures (Law no. 151/2000), the attractiveness of SPT Telekom and whole Czech market was facing a fall in attractiveness in the eyes of foreign investors. The government's priority was to create a compact operator to be offered to potential investors. For this reason the remaining stake of 47% in Eurotel was bought back from Atlantic West. After paying out the investor with USD 1.05 bil. the government succeeded to gain 100% control over the company. Consequently it was merged with Czech Telecom forming an incumbent operator focusing on fixed, mobile voice and data services (Anderson, 2004). During 2004/2005 the process of Czech Telecom going private still continued. From former five parties interested, only three remained with Spanish Telefónica S.A. taking over the initiative. With Government Resolution 407/2005 Telefónica was announced as the winning party of the long privatization process lasting from 1999 for almost five years. With this the privatization process of Czech Telecom was fully completed.

With no government ownership stakes in any of the subjects a three participant oligopoly environment is identified since 2005. Yet the reader should not forget that all three players have been present on the market since 1999, one of them was the described Czech Telecom undergoing privatization. Next chapter is focusing on the description of the thesis most recent 2010-2011 Czech market conditions.

¹⁶ More on TelSource's decision: <http://www.earchiv.cz/b00/b0831002.php3>

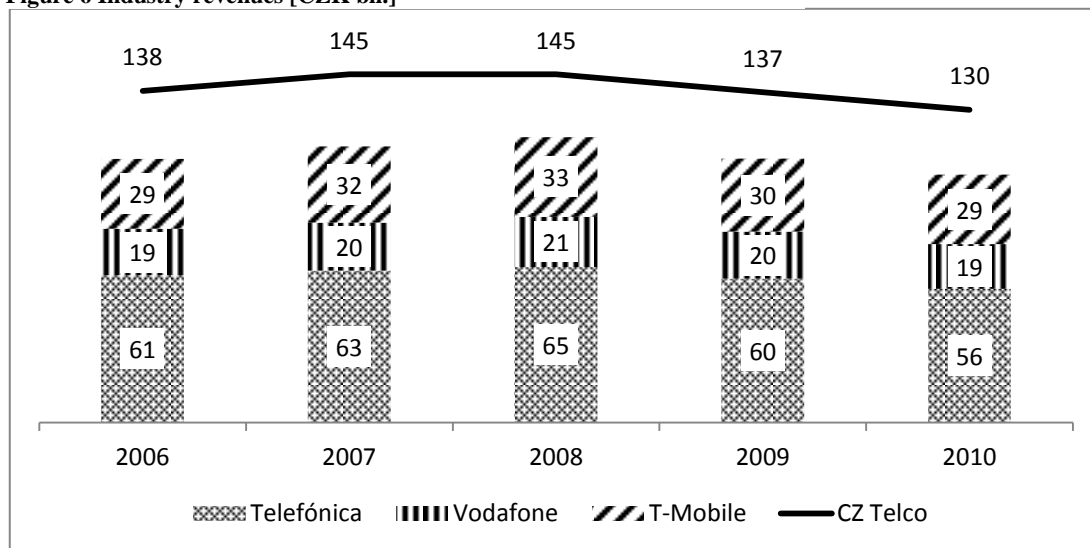
3 Market Structure

After the insight into history of Czech telecommunications industry the following chapter focuses on describing the most update market situation as a whole (as of spring 2012), describes the market players and provides overview of the regulatory and legal framework valid in the industry. The market is dominated by three main players introduced in the previous chapter (Telefónica, T-Mobile and Vodafone) taking approximately 80% share of the industry sales. Telefónica thanks to its historical monopoly heritage still holds the largest share (44%) thanks to the wider service spectrum offering than the competitors.

3.1 Fixed Telephony

The growth expectations in telecommunications for Czech Republic might be biased. The overall revenues in the Czech telecommunication industry accounted approximately CZK 126.5 bil. for 2010 with annual 4.8% fall (see *Figure 6*). The industry accounts for 3.68% of Czech GDP, one of the biggest figures in the OECD comparison (see *Chapter 1.2.1*). Yet the downward trend is likely to continue in the years to come.

Figure 6 Industry revenues [CZK bil.]



Source: Company ARs, author's calculation

Fixed telephony trend has been declining since 2000/01. This was caused by the fixed-to-mobile substitution trend. Fixed network penetration was 38%, down from 80% penetration at the beginning of the century. This is reflected in industry revenues, which accounted for CZK 45.9 bn. with annual fall around 3% in 2010. Although further decline is to be expected, the downward move, which was mainly due to decline in

voice services, is slowing down as market finds some support points, aided by the development in fixed data access services (Český telekomunikační úřad, 2011).

Fixed broadband connection revenues partially substitute the outage from voice services. Number of connections more than doubled from 2006, reaching 2.8 mil. in 2010. Telefónica holds a leader position on this market taking 36% share with its DSL based technology – taking advantage of existing fixed line network (Český telekomunikační úřad, 2011). The only biggest competitor is UPC with fibre technology, aggressively attacking not only households but Small Medium Businesses (SMB). Wireless broadband technologies in the Czech market are a phenomenon.¹⁷ They grew vividly in the past due to the very low quality of internet service quality provided by Telefónica via fixed lines. This also promoted the exodus of Telefónica customers and the result is second largest number of Internet Service Providers (ISP) in whole EU - 1800 providers (Český telekomunikační úřad, 2011). The market is therefore as a consequence still fragmented between small local operators, but there have been some consolidation moves both within operators themselves and in the form of horizontal acquisitions by the major players. Both Telefónica and T-Mobile declared intentions of horizontal integration.

In 2009, T-Mobile acquired share in České Radiokomunikace. By this move it entered the fixed broadband DSL market where it currently claims second position. It reported 100 000 customers at the end of 4Q2011 creating with this step dynamism in the segment (T-Mobile, 2012). Telefónica answered by continuous deployment of advanced Digital Subscriber Line xDSL technology with intention to retain customers with most favourable ARPU.¹⁸ The market trend forecast by the Czech regulator, however, routes towards the falling shares in xDSL technologies with fibre and mobile gaining on momentum in the period of 3/4Q 2012.

3.2 Mobile Telephony

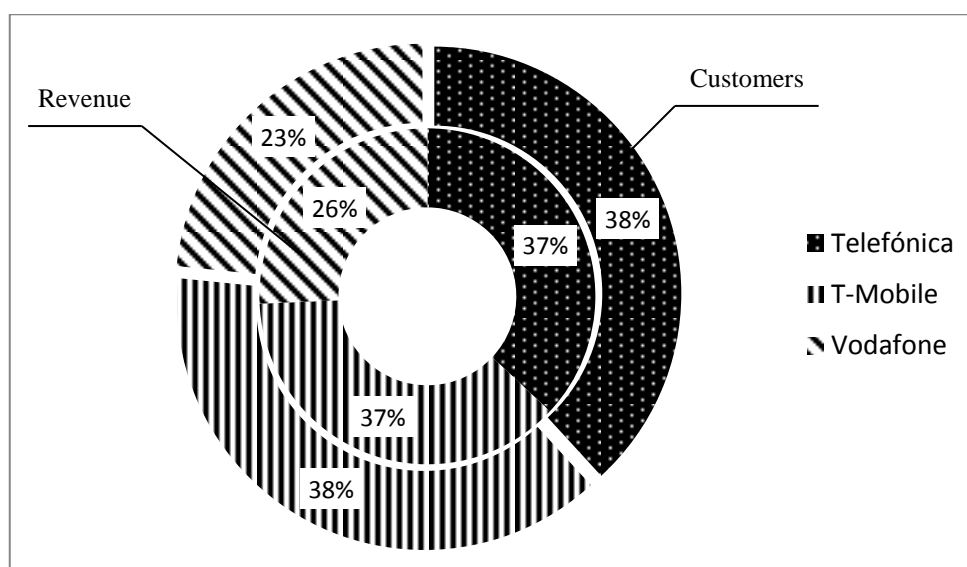
Mobile market experienced significant growth in previous years but the penetration reached high level and the market indicates saturation. There were 14.4 mil. active SIM cards in 2010, with only 0.9% y-o-y change. The players therefore increase the

¹⁷ Wireless broadband services belong under fixed voice. This information was obtained by interviewing Telefónica staff.

¹⁸ The prefix x in xDSL, is used as there are more yet very similar technologies of DSL connections.

competition for customers. This is to be identified corporate and SMB segment, where the market participants possess higher bargaining power. The industry trend is continuously declining sales in mobile telephony. Overall revenues fell by 3.1% onto CZK 45.9 bil. With growing customers base a fall in annual ARPU, from CZK 5764 in 2009 to CZK 5229 in 2010, -9.3% change. This was for example driven by special tariff offers with unlimited calls by all operators (Český telekomunikační úřad, 2011).

Figure 7 Market shares in mobile industry for 2Q 2011 [in %]



Source Company ARs, author's calculation

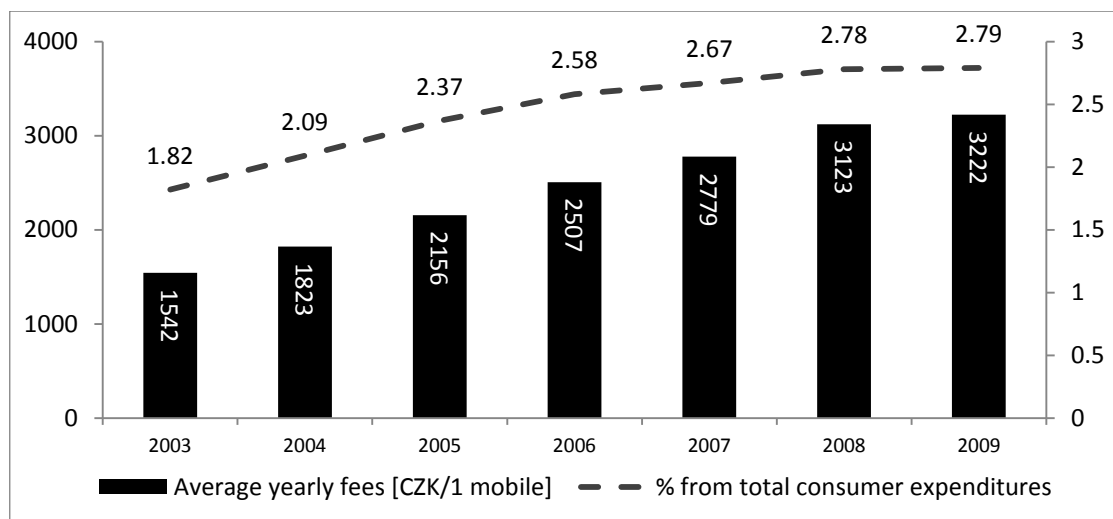
Telefónica competes with T-Mobile for the first position in the mobile market, both having around 38% market share. Vodafone continuously improved its position since 2000, mainly by taking the share from former hegemony Telefónica. The situation stabilized and the shares have been almost flat in last 4 years. The main concern regarding the future is the possible development in case of new major competitor entry. Telefónica has to be prepared to defend its position and not allow repeating the story with similar script as happened in the Vodafone one. Although there have been some pressures on prices on the mobile market, the expenditures of the Czech customers on communications take a not negligible share of their overall consumption expenditures (see Figure 8).

Internet mobile market is growing rapidly. According to Analysis Mason, this is expected to account for almost half of all non-voice revenues of telco operators (Kende, 2011). The current trend is led by continuous expansion of 3 Generation (3G) mobile broadband networks among all operators. Telefónica and T-Mobile are leaders in this

field as well.¹⁹ Telefónica covered more than 65% of population with 3G network in 3Q2011. T-Mobile recently announced even more comprehensive coverage of 80%, a great step from only 37% in 4Q 2010. This can be explained by the infrastructure sharing agreement signed between Telefónica and T-Mobile.²⁰ The cooperation is based on complementary 3G stations development with aim of faster network deployment and investment cost reduction. When announced, Telefónica coverage figures at least matched T-Mobile ones. Vodafone slightly differs in its mobile broadband strategy. It is based on its own 3G network and CDMA sharing service with MobilKom (owner of U:fon network). This company has recently filed for insolvency thus further cooperation is uncertain.²¹

Growing mobile internet is certainly promising trend but requires significant investments which will increase with advanced technologies such as 4G, which are supposed to be introduced by a new market entrant in 2012. These investments are not yet fully reflected in the revenues, as operators focus on customer acquisition through special discount offers. The negative trend observed in traditional voice services is therefore prevailing.

Figure 8 Household expenditures on telecommunication services



Source (Český statistický úřad, 2012)

¹⁹ 3G network has many subtypes. The one primarily used in Czech Republic is Universal Mobile Telecommunications System (UMTS)

²⁰ The case of infrastructure sharing belongs to the competence of UOHS. See Chapter 3.7

²¹ As company claims on its site. Problems occurred mainly due to CTU bad regulatory policy and competitor hostile behaviour.

3.3 Telefónica CZ

Telefónica Czech Republic is an incumbent operator providing telecommunication services under O2 brand. As the integrated provider, the company offers full range of *Convergent Telecommunication Services* – operating both in fixed and mobile networks. Its business activities are primarily concentrated in the Czech Republic; mobile operations are also run through a subsidiary in Slovakia. Spanish mother Telefónica, S.A. gained control in 2006.²² Its shares are quoted on the Prague Stock Exchange and traded in form of GDR on the London Stock Exchange as well. The parent company is the major shareholder keeping 69,41% stake.

The company operates more than 2.8 mil. fixed lines. Mobile services are delivered to approximately 4.9 mil. customers in Czech Republic and over 1 mil. in Slovakia. Its revenues are almost equally split between the fixed and mobile segments, with mobile accounting for 56%. The backbone of the company operations are voice services which therefore represent the dominant revenue source (50% in fixed, 70% in mobile). Voice is experiencing decline in line with the market development. On the other hand, data services are getting a larger part of the revenue pie.

In fixed telephony, company as the sole provider on the Czech market fights the declining trend by providing internet connection which now accounts for 25% of fixed revenues. Its 2011 launch of VDSL brings better connection for customers. This moves help to mitigate the churn of the most profitable customers. Company also started buying local WiFi providers to extend the customer base. This will have positive impact on revenues as well. Other services, IT and ITC solutions for public bodies and companies, generate solid revenues but this business is at best stagnant in the uncertain economic environment. Company is also venturing in modern services such as IPTV or Voice-Over-IP to keep pace with the development on the markets.

Mobile segment is hit by downturn market (-10%). Customers cut the expenses on traditional services during crisis and further optimized their behaviour by subscribing in large for tariffs with premium flat rate offers. The company is focusing to migrate its customers from prepaid to post-paid contracts, where it records higher ARPU. However, the newly acquired customers diluted the ARPU. The revenues drop of CZK 10 bil.

²² Convergent telecommunication services represent the migration of various services under one umbrella – into a single network. One can imagine it as an integration and unification of branding, policies, technologies within one company.

(44% y-o-y) of outgoing traffic charge was only partially covered by CZK 6.9 bil. growth in the monthly fees. The regulation in terms of Mobile Termination Rate (MTR) cuts and EU roaming limited prices also has negative impact on revenues.²³

The company is stressing importance of smart phone sales (over 50% of device sales in 2011, penetration reached 17,4% in 3Q2011). The 3G network deployment is in the final phase. These activities will strongly support revenues from mobile internet, which is the main market trend.

3.4 T-Mobile Czech Republic

Corresponding with the 1994 Czech government's intentions of introducing competition into the telco market a consortium led by CMobil B.V. won the licence for a GSM network in 1996. With the licence in hand in the same year the company RadioMobil was founded. On the 30th of September it began operating its mobile network Paegas. In 2002 was Paegas renamed to T-Mobile and the consecutive year of 2003 the legal name of the company was changed to T-Mobile as well. The actual ownership structure in the company is CMobil B.V. with a 60.77% and TMCZ HOLDCO with 39.23% stake belonging into the sphere of German T-Mobile group.

The acquisition of České Radiokomunikace mentioned before did not led to simple broadening of service and product portfolio. As Vodafone became a company capable of delivering convergent services by its acquisition of BroadNet Czech, T-Mobile followed the same goal when acquiring České Radiokomunikace. With this act the company became the last of three operators delivering convergent services. T-Mobile owns three licenses, GSM since 1996 in ownership till 2015 and two UMTS licences till 2024.

The company is facing contradicting trends from its predecessors. In 2011 it suffered a -1.7% y-o-y fall in customers taking in est. 5.3 mil. This customer outflow started in 2010 when the company customer growth was on verge with only 0.2% y-o-y change. Fall in customers is accompanied by a significant fall in revenues of -8.2%. The change was from CZK 29.3 bil. in 2010 to CZK 26.8 bil. in 2011. As a consequence of price competition the company experienced an ARPU fall of CZK 37 y-o-y basis.

²³ The regulation is described separately.

3.5 Vodafone Czech Republic

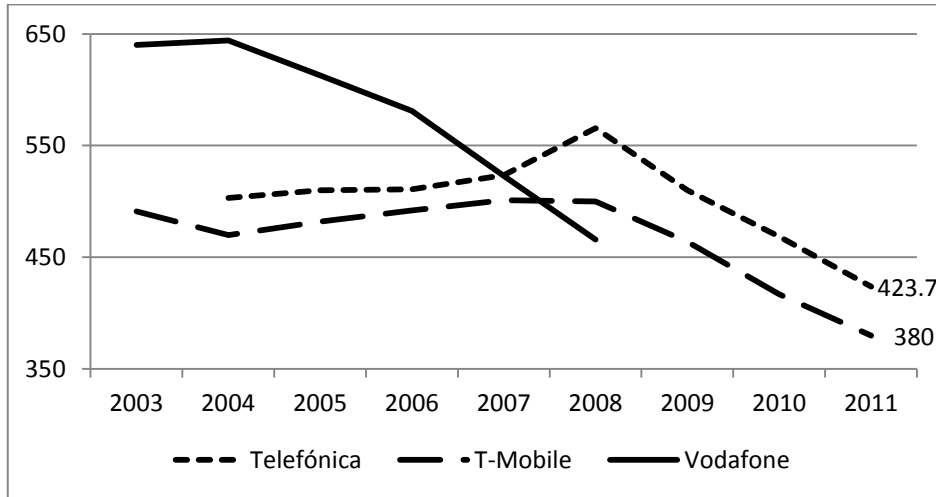
The company entered Czech market as Český Mobil acquiring a GSM 900/1800 licence in 1999 and starting commercial operations in 2000 under commercial brand Oskar. The company entered duopoly market conditions of former Český Telekom and Paegas and was betting on price competition with focus on customer migration. Because of its ferociousness and innovation potential the company was numerous times nominated for World Communication Awards. During 2004 the company underwent legal change of name from Český Mobil to Oskar Mobil. With significant changes on the horizon in 2005 was the company acquired by international carrier Vodafone. In 2006 was the company name changed to Vodafone Czech Republic which is still in its official name. With its historical focus only on mobile telephony and internet the company decided to broaden its portfolio horizon. In 2008 with the acquisition of BroadNet Czech became the company capable of offering as fixed services for business customers. With this was the company nearing Telefónica's portfolio offer becoming capable of delivering convergent services (all-in-one) and becoming a complex telecommunications operator. The company falls under the globally active Vodafone International group.

Beside the 2nd generation (2G) GSM 900/1800 licence valid for 20 years, the company expanded its services by acquiring a second 20 years license for a 3rd generation (3G) UMTS network licence (est. CZK 2 bil.). With this strategic move was the company capable of deploying higher quality internet services for its customers, although with comments from the company that 3G benefits according to 2G ones' might be exaggerated (Peterka, 2008). On the other hand the company stated that 3G investment is a logical in future expansion potential into 4G Long Term Evolution (LTE) network capacities.

Although facing revenue decline as illustrated in *Figure 6* the number of clients is continuously rising over this period. Reaching est. 2.9 mil. customers in 2008 the company acquired in next 2 years 270 000 new customers reaching about a 3.17 mil. customer base. The trend of falling revenues and rising customer base is due to more fierce price and service competition on the customer side. The company as 3rd operator facing obligatory challenges of market saturation had to cope as well will points of sale strategy issues. With pioneer internet in services putting high importance is put on

developing store chain. In 2011 the company had 5500 points of sale with 133 own branded stores and 56 franchise stores.

Figure 9 ARPU fall in the last 9 years [in CZK]



Source Annual Reports, company websites

3.6 CTU – The Doubtful Regulator

Telecommunications is a highly regulated industry. It provided a certain amount of comfort for operators in Czech Republic, but recently it started showing significant threats for them. Czech regulator created till now comfort by preventing entry of 4th proper competitor and not enforcing opening of the wholesale mobile market for Mobile Virtual Network Operators (MVNO) so far. The oligopoly market structure with favourable margins is sustained for now. The question is, for how long. The recent development, however, indicates worsening regulatory conditions. The EU cap on roaming prices applicable since July 2011 causes decreasing revenues with direct impact on earnings industry wide with possible outlook on further decrease.

The regulator does not exert governance on the telecommunications market as a unified entity. CTU divides the telco market into so called Relevant Markets (RM). In effect are two methodologies for RM categorization. The OOP/1/07/2005-2 divides the telco market into eighteen RMs meanwhile the newer OOP/1/02/2008-2 into twelve RM.²⁴ Yet the division of the markets is in general not important for the means of the thesis as they provide particular insights. What is more important is the authority of CTU the

²⁴ The distinction between the two approaches follows the regulatory steps of the EU. Both of them interlap and complement each other and most importantly are still used in telco praxis.

identify market subjects with significant market power and in some particular markets induce price regulation (2005). To be identified as significant market power can have several implications from operation and technological aspect towards amendments because of sovereign position misuse. Based on identifying a subject as significant CTU can but does not need to exert price regulation. Only Telefónica accounts for est. three price regulations, the other operators are without price regulating ordinances. An exception is the MTR market. no. 16 in the OOP/1/07/2005-2 and no. 7 in the OOP/1/02/2008-2 methodology. This price setting influences all three major operators on regular, est. half yearly basis. Regular price cuts in the Mobile Termination Rates (MTR) have negative impact on the revenues, but this item also enters the cost side, so this change can be interpreted almost profit neutral (mentioned before in influencing Telefónica *Chapter 3.3.*).²⁵ The variation comes in only from technicalities as operators charge per second rates among themselves, but the customer is charged for each started minute. The overall regulatory expectations are determined by two cross-linked major events.

3.6.1 Mobile Virtual Network Operator

A MVNO is an alternative on the market whereas the operator does not own a licence for a frequency and so does not own any infrastructure. The MVNO leases a whole part of a network from an already established network operator. The case of MVNO is accompanied by media buzz, as illustrated in *Chapter 1.2.4*. The regulator had to react. For a long period of 2010 and even before, CTU was aligned behind its standpoint that the telecommunication market provides the space for an entry. The entry should have been negotiated out between the potential new MVNO entrant and a host network operator (one of the three operators).²⁶ Office states this in official replies to the letters of the Napíš ČTÚ initiative (Český telekomunikační úřad, 2011). Logically, no operator wants a new competitor, but that was not CTU's concern. Following the RM division, the office investigates the RM's for any evidence of breaching the industry rules. The mobile origination service RM no.15 was considered as fully competitive and so it was closed with no possibility of entering it. This was the problem for MVNO's, they

²⁵ Mobile Termination Rate is a fee mobile phone operators charge their industry peers to terminate calls on their networks and are a significant input cost when providing the retail service of fixed-to-mobile and mobile to mobile calls.

²⁶ The host operator provides the contracted capacity of its network based on the contract details.

needed this market open. The CTU's statement that MVNO had to bargain with one of the three operators was not correct and caused confusion (Peterka, 2011).

Change occurred on the 30th November 2011 when CTU announced by measure OOP/1/XX.2011-Y that RM no.15 is no longer competitive and its opening is being reconsidered after further revision will be undertaken. Office anticipates in case of definite changes to RM no.15 are to occur, the best would be to connect them with the digital dividend auction. Yet, with the process of auction in 2012 gaining on momentum the CTU's MVNO proposed roadmap is according to experts unsatisfactory. New MVNO can be set up only on a new or prolonged licence. This process can take up to 6-7 years. According to Peterka (2012) the real reason can be that the current operators rather than being afraid of new full market entrant are afraid of a MVNO entrant. Possible MVNO price wars can be more destructible in the eyes of the old three than a market entrant who maybe won't even come.

3.6.2 Digital Dividend - New Operator Entry

The second determinant of regulatory expectations is the frequency spectrum auction often called Digital Dividend (DD). This auction is focused on introducing Long Term Evolution (LTE) network services into the national telecommunications market. The LTE networks are so called 4 Generation (4G) networks focused on high-speed data for mobile phones and data terminals.²⁷ It is important to not forget that frequency package capable of running LTE network is just a part of the DD. Some remaining frequencies are in the DD process introduced as wee. High importance is paid on the LTE network because of its attractivity and future potential, meanwhile remaining free 3G frequencies might be considered as less attractive because of market saturation. DD is a complex process of transformation analogous parts of the frequency spectrum to digital ones, frequency auction itself and improvement of other services related.²⁸ The purpose of this process is the maximization of DD's economic value. This economic value is described by Kramosil (2009) in three dimensions: socio-economic dimension, the frequency spectrum efficiency/technological development and telco market benefits.

²⁷ The most widely used technology is 3G.

²⁸ Frequency Spectrum is a list of radio frequencies with their stated purpose. The owner and maintainer of the frequency spectrum is the state. The operators own licences for some of these part and have their networks set upon them.

With the DD's procurement processes, legal actions and expert discussions starting already in 2008, nothing significant was happening till spring 2012. Similarly as with the MVNO, the CTU was facing the critique of the Napiš ČTÚ initiative for not acting promptly in these matters and so not following the interests of end customers.²⁹ Ground breaking shift in the DD process happened on 22nd March 2012 when CTU informed about the start of the selection procedure on the 22nd June 2012. With a series of procedural steps, with no circumstances influencing the timetable of the auction, the results of the DD auction should be known in December 2012. This process might lead to introduction of a fourth operator on the Czech market (Český telekomunikační úřad, 2012).

The solution is though, not so easy and straight forward. The auction faces several issues as; technicalities of setting up the network, the price of this licence (whole spectrum offered costs est. CZK 9.2 bil.), time of 5-6 years for the process of set-up.³⁰ Important fact is that also all three operators have the intentions to take part in the auction, so maybe there will not be even a new entrant (Peterka, 2012). Most recent news, as of May 2012 is that CTU has to literally look for a party interested (ihned.cz, 2012).

As it seems the road towards Digital Dividend and changes in oligopoly member has a still long way to go. The remaining three operators will pursue various means for lobbying against any changes in the market structure as the actual status-quo is for them suitable. The one who will still be left in "change expectations" will be the end customer, as the changes are promised to arrive but no one knows when (Peterka, 2012).

3.7 Safeguarding the Competition

Doing business on a free market is like a competition. The companies are in some cases tempted to bypass the mutual competition and set their own rules.

UOHS

All the changes in the regulatory environment are heading towards final phase where all sector specific regulation is being substituted by purely competition based regulation.

²⁹ One should not forget that higher competition would create pressure on price level.

³⁰ The frequency spectrum is not put into the auction as a whole. It is divided into several small parts, and more combinations of these parts are possible.

The *ex-ante* regulatory efforts of CTU and UOHS's *ex post* ones' converge. In fact, regulation disintegrates on its own. However both organs are not to lose their positions as the UOHS competition decisions are case specific meanwhile CTU sets the framework so that the question of minimizing transaction costs is still not answered (Modernizace soutěžního práva se dotýká i telekomunikací, 2004).

The first predecessor of UOHS was founded in 1991. UOHS's modus operandi is set up by laws no. 272/1996 and 187/1999.³¹ The office has 3 main areas of focus: ensure that the market behaviour is in compliance with competition rules and benefits the customer, supervising public procurements and check-up on state aid provision policy. In telco the competition rules play the priority, usually with *ex post* cases of punitive findings against market distorting behaviour. The competition rules are maintained by law no. 143/2001, particularly interesting part of this law is co called *Leniency programme* where specific cases of cartel behaviour are tolerated!³²

3.7.1 Cases in Czech Telecommunications Industry

Without going into details of legal steps of procedural actions and punishments enforced by UOHS, the office informed that former state monopoly Český Telekom was in its past existence back from 2005 the most often punished company overall (UOHS, 2005). With this the former state monopoly not only lacked management competence but basically breached the rules set by its major shareholder.

From approximately eighty five cases where a punishment fee was to be paid, which were classified as maximal ones in the office's history, eleven cases involved the three biggest actual market players. The violations ranged from the misuse of dominant market position to cartel behaviour. The most evident cartelization was identified in 2000/2001 where Eurotel, T-Mobile and Český Mobil came to a mutual agreement on common business conditions. UOHS found out about this situation and bestowed a fee of CZK 44 mil.³³ Part of this procedure fell under the *Leniency programme* and some amercements were lowered.

With the competition rules numbers infringement falling down in recent years (most of them in 1/2 of 2010s), man can anticipate improvement in corporate behaviour or only

³¹ First legislative acts in Czech lands treating competition rules (cartel practises) was during the Austrian monarchy in 1870.

³² Toleration in this case means that a punitive amercement might be forgiven or significantly lowered.

³³ This price is far from big. Český Telekom received a CZK 210 mil. amercement in 2004.

more sophisticated rules breaching. Sure is that, the legislative is becoming more forcible and companies need to take into account the rising interests of their stakeholders. The challenge for UOHS in the near future is the entry of a new player into the market.

4 Characterizing a Telecommunications Oligopoly

4.1 Basic Assumptions

The previous chapters illustrated a process of a shift from state owned monopoly structure towards introducing free market principles based on competition, liberalization and privatization. As showed, this process usually gets stuck somewhere in between these two extremes. The presence of a small number of competitors on the market which act strategically, but they are aware of their market peers is called an oligopoly. Each oligopoly is built upon strategic interactions arising among its members. With taking each other's actions into account the firms collectively realize that the actions of one firm affect firm-specific demand curves of all members of the oligopoly industry. It is acknowledge that price and output choice strategies made by one, affect the benefit formation performance (profit generation) of others and lead to mutual interdependence. For that reason oligopoly belongs to imperfectly competitive market structures.

For fully understanding the oligopoly structure fundamental assumptions have to be valid for the structure for being considered as an oligopoly. Katz & Rosen (1994) derive from monopoly and perfect competition four assumptions valid in an oligopoly.

Four fundamental assumptions:

1. **Oligopoly members are price makers.** Firms decide on price policy on their own, but they recognize that their actions have impact on their competitors' behaviour and so have clear impact on whole industry's strategic pattern.
2. **Members behave strategically.** Strategic behaviour in this situation is a logical consequence as both monopoly and perfect competition do not provide the opportunity for alignment of strategic behaviour. The single monopoly power does not need to think strategically. The perfect competition on the other side

does not provide space for strategy development as the high number of participants makes it hardly possible.

3. **New entry into the market might be completely blocked or perfectly free.** Meanwhile perfect competition allows and monopoly blocks market entry, the oligopoly provides different results under different conditions.
4. **Buyers are price takers.** In the market is no space for shifts in influencing the market price. Even with the customers publicly discontent with the actual situation they have to accept the oligopoly's price conditions with no or insignificant room for bargaining.

4.2 Market Structure Circumstances

4.2.1 Seller Concentration – Size and Number

The number of firms in an industry affects the degree of strategic behaviour and the extent of price making/taking bargaining process on the seller-buyer side. With many firms in the market, an action taken by any of them has insignificant impact on the others. In contrast with relatively few market participants, each player is a significant part of the market and firms carefully follow all the mutual interdependencies in place (Soukupová, a další, 2004).

For the degree of concentration is commonly used the Herfindahl-Hirschman Index (HHI) as a measure of the size of firms in relation to the industry. This index is used by for ex. the U.S. Department of Justice, the Federal Trade Commission (DOJ-FTC (2010)) to measure market concentration for antitrust purposes. Corresponding with the DOJ-FTC methodologies, market below 1500 is “un-concentrated” (perfect competition), between 1500 and 2500 “moderately concentrated” and above 2500 “highly concentrated” (monopoly). Another way of measuring seller concentration is Concentration Ratio, but for further requirements of the thesis is not used.³⁴ Further evidence will be provided in *Chapter 5.4*.

³⁴ UOHS does not provide any methodical tools for measurement of concentration on any market. In 2010 the office conducted some concentration of measurement in agricultural sector with no further measurements. Into some extent the concentration is followed by CTU with the HHI index but it does not provide any information regarding methodology.

4.2.2 Costs and Pricing

Fixed and common costs³⁵ are substantial as the telecommunication industry requires constant research & development, telecommunications network maintenance and amplification. With this, each market participant shows out high sunk costs because of licence purchase at the beginning of its market operations. The relatively low marginal cost (MC) and Long Run Incremental Costs (LRIC)³⁶ do not allow covering total costs incurred to the company. The practise of low marginal costs is due to the fact that it does not matter how many subscribers use the network.³⁷

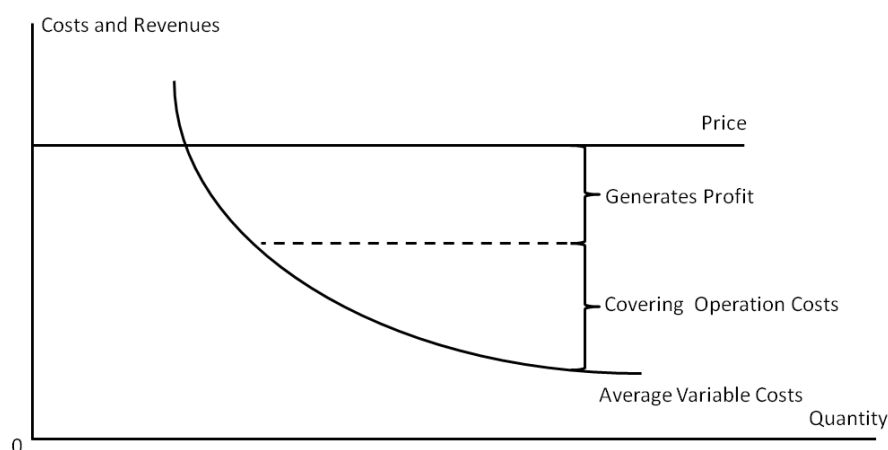
Cost based pricing tools are common for oligopoly market structures. With falling average variable costs from operations a price mark-up strategy is of best application (Haucap, 2003), so that the prices actually exceed the marginal costs. The firm needs to identify the absolute minimum price it must obtain from its customers. To this minimum price it adds a margin usually consisting of two components (see *Figure 10*). The first component covers typical operation maintenance cost necessary for keeping the network running into extent the customers do not experiences any network outage. The second one creates the profits the company wants to reap. This second component is on the operator to decide. As Fergusson (1993) claims most usual is to set a percentage which should reflect the general practise in the industry, with other options as analyzing the demand size or the behaviour of competitors. This pricing methodology leads to price aligning among the operators. From indirect price aligning is just a step to managed price aligning and so towards a possible cartel situation in the industry.

³⁵ Costs not assigned directly to any particular business unit or sector.

³⁶ LRIC models are used in telecommunications regulation to determine the price paid by competitors for services provided by an operator with significant market power. Some literature can understand under LRIC - Long Run Investment Costs. For more information see (Courcoubetis, et al., 2003)

³⁷ Based on an interview with telecommunications expert it does matter, as a “full” network has quality issues.

Figure 10 Mark-up pricing



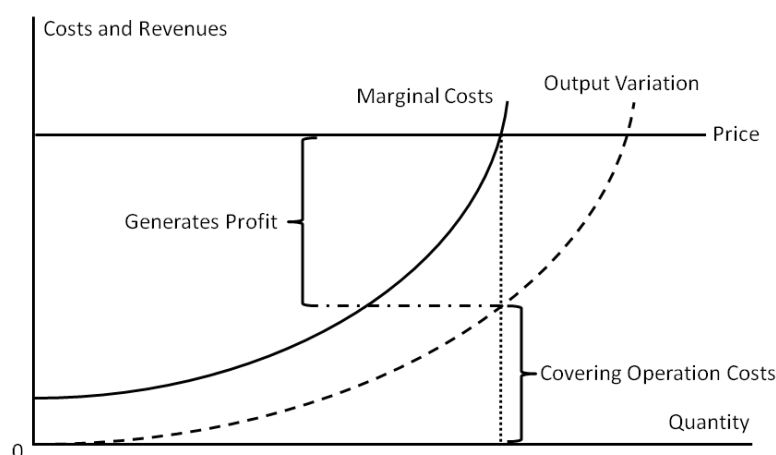
Source (Ferguson, et al., 1993), Author

The other approach is very similar, where (Price Policies and Theory, 1954) identifies similarities with price mark-up approach. With telecommunications being a sector where the end products/services are close substitutes, instead of allowing the price to be determined by costs plus an allowance for profit (mark-up), the firm might decide on the price first and hold it constant for a longer time period. In the second step the company develops a strategy for profit generation according to the price level set and quantity of its output.³⁸ With this the operator can have several price lines set up for different parts of its network serving different customers (see *Figure 11*). The price line method is effectively used when the firm wants to hold the prices for a longer time period. This is many times characteristic for telecom firms as they offer post-paid customer packages, usually lasting 1-2 years.

Regarding the industry specifics, it is important mentioning switching costs. Switching costs occur when customers want to step over from one operator to another one. Each operator faces them and has to have own processes strategies dealing and minimizing them. The switching costs react according to the flow of customers among the operators, high numbers of leaving/new customers directly influence the switching costs. Switching costs are an important factor when considering market entry. If switching costs are low, the new market entrant can effectively lure away old operator's customers, high switching costs imply a less attractive motivation in switching operators.

³⁸ For telecommunications the quantity is hardly measurable, good approach is quality. As with lower quality in product/products services the customer leaves, so as the quantity falls down.

Figure 11 Price line



Source (Price Policies and Theory, 1954), Author

4.2.3 Telecommunications Market Size and Demand

With the assumption that the demanders are price takers, a telecommunication operator faces the market represented by a whole or wide part of the population. No one is excluded and no demand side participant is large enough to exert any influence on the price.³⁹ The strategy of setting price first has to be maintained. Market penetration is a measure of the amount of sales or amount of product or service compared to the total theoretical market for that product or service. There is no direct evidence of a maximum product/service penetration (see *Figure 12*). The ease of consuming more in telecommunications or switching to another or more operators gives the potential for penetration rise.⁴⁰ The ceiling of market saturation is when the market has been maximized in the current state of the marketplace. At the point of saturation, further growth can only be achieved through product/service improvement, market expansion (facing specific part of the market) or rise in overall consumer demand.

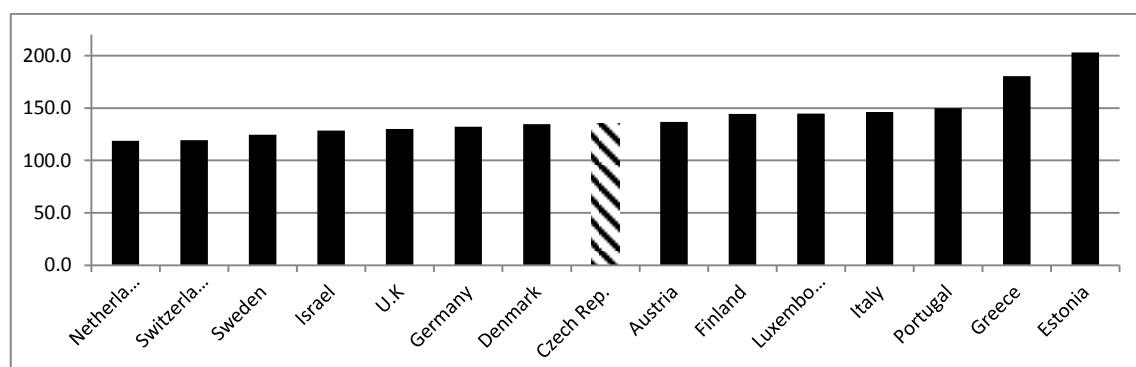
Kim (2005) provides another view on the market which operators are facing. He takes on the approach of network externalities as they exist when the amount that the customer is willing to pay for access to network depends on how many other customers are connected to the network. The utility the customer gets rises with the number of users. The value of a network is a function similar to n^2 - the number of users' increases,

³⁹ One market price is taken into account. Price deals with large businesses that are capable of bargaining on price are not taken into account.

⁴⁰ Buying a SIM card/ fixed line (into some extent)/mobile internet became easy. The only trade-off is the monetary price of purchasing it.

the value of network increases exponentially.⁴¹ Further extension and a more precise one is a decomposition of network externalities to the ability to communicate on-net (inside one network) and the ability to communicate off-net (customers of other networks).

Figure 12 Mobile penetration, subscription per 100 inhabitants



Source (OECD, 2011)

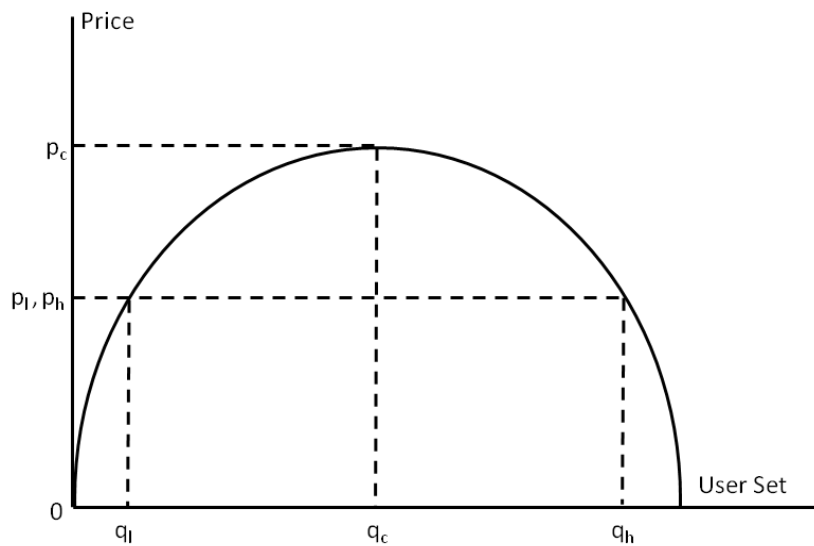
The origin of n^2 theory was provided by Rohlfs (1974) as he alleges that people typically belong to groups, each of which has a strong community of interest within itself. In this group are few significant contacts (clients) who are responsible for a substantial part of the whole communication inside the group. The author defines User Set as the number of participants in the network who maximize their utility by joining the network, whereas multiple equilibria at a given price can exist. As he further explains if the User Set is moving towards the entire population the continuous adjustment process in the industry can only remove individuals from the User Set – meaning the number of users begins to fall at some point in time. The population User Set will have to readjust itself to equilibrium User Set. Rohlfs takes it further and proposes a demand curve for a uniform calling pattern.⁴² The demand curve abstracts fractions of User Sets which are similar to group approach and defines a Critical Mass - q_c with corresponding price level p_c , the network has to achieve. Corresponding the critical mass is the price growth, which when reaching the maximum of the parabola falls down (see *Figure 13*). A very small equilibrium user set might be consistent with utility maximization, since the smallness of the User Set itself makes the service unattractive to potential customers (q_l & p_l). The operator needs to exert activities to

⁴¹ This can be adapted for the whole industry, the more customers; the higher is the value of industry.

⁴² Uniform Calling Pattern is a theoretical example similar to its real world prototype Universal Telecommunication Service (UTS). UTS are a baseline level of basic services provided to the customers. It is most commonly put in force by regulatory supervision.

grow its user set, by reflecting the price strategy. A much higher User Set might be as well possible for the same population at the same price level (q_h & p_h). Reader should see the $p_l = p_h$ paradox. Any disequilibrium along the curve is accompanied by User Set adoption with constant growth/fall due to the necessity of price increase/reduction.⁴³

Figure 13 Demand for uniform calling patter – Demand for telco services



Source (Rohlfis, 1974), Author

⁴³ Reaching parabola maximum resembles economies of scope; meanwhile the fall in prices resembles economies of scope approach.

4.3 Oligopoly Models

A satisfied customer is the best business strategy of all.

LeBoeuf (2012)

An oligopoly is a market form in which a market or industry is dominated by a small number of competitors – oligopolists. Oligopoly is the study of market interactions with a small number of firms - competitors. The competitors, so called oligopolists, dominate the market, act independently on their own, but on the other hand strategically align their behaviour with their industry peers. With oligopolist's self-interest behaviour defined, the general notion of equilibrium can be applied to the specific case of the oligopoly. When each firm is satisfied and does not want to alter its behaviour unilaterally, man recognizes the Nash Equilibrium.⁴⁴

The theory of oligopoly is related with game theory, where both theories complete each other. According to Myerson (1997) game theory is “the study of mathematical models of conflict and cooperation between intelligent rational decision-makers.” Based on the conflict and cooperation behaviour it is possible to use game theory in the environment of oligopolies.

There are numerous approaches for describing the strategic behaviour among oligopolists. All of them are subjects of game theory. First and the most instructive is the variable approach. In the real environment firms are interested in two variables - price and quantity. These two variables influence how the oligopolists' compare and evaluate their positions with their peers. Second approach tries to answer the question *how many times the interaction among the players (the game) is played?* Based on this it is possible to distinguish static (played once) and dynamic games (played several times). Third approach is elaborating on the information present in the industry. Acting on your own meanwhile understanding your competitors is a situation where a collection of information is necessary. Whether the player has a complex knowledge about the industry situation or a constrained one, the theory distinguishes Complete and Non-complete Information games. The last remark concerns the product in first

⁴⁴ Nash Equilibrium – a market is at a Nash Equilibrium when each firm is choosing the strategy that maximizes its profit, given the strategies of other firms in the market

approach. Whether the product is homogenous or heterogeneous plays an important role and more complex and advanced game theory applications.⁴⁵

As described in *Chapter 3* there are three dominant players in the Czech telecommunications industry.⁴⁶ Game theory usually for simplicity deals with duopoly market situations; this chapter tries to propose a model description for Czech telecommunications three company market - triopoly. The models further described will be the Cournot model, Bertrand model and model of Collusive behaviour.

4.3.1 Telecommunications Model Assumptions

- Output in telecommunications is a homogenous product/service offered by the operator. Models stake these two as one. The price is considered as general price level.
- Inverse market demand function $P(Q) = a - bQ$, where $a > 0$ and $b > 0$ for express demand behaviour by describing prices as function of quantities. More on the topic of demand for telecommunication services was illustrated in *Chapter 4.2.3*
- Total output of the industry $Q = \sum_1^N q_i$
- As in a triopoly, number of firms N , $N=3$
- one period
- Marginal costs are assumed to be identical among all three players.

4.3.2 Cournot Equilibrium

Cournot-Nash equilibrium of output level choice is a non-cooperative simultaneous model where each firm faces the whole market demand. The firm assumes the other firm's output will not change if it changes its own output level; it is so called simultaneous quantity setting. The final chosen output maximizes oligopolist's output and so its utility (profit).

The general profit maximization problem for i -th firm is:

⁴⁵ The typology was derived from Gibbons (1992). More advanced Game Theory elaborates on various combination of approaches mentioned.

⁴⁶ The description omits U:fon as its market share was marginal. See *Chapter 3*

$$\max p(q_1 + q_2 + q_3)q_i - MC(q_i)$$

So that profit for i -th firm, where $i = 1,2,3$ is:

$$\pi_i = p(q_1 + q_2 + q_3)q_i - MC(q_i), i = 1,2,3$$

Firm 1's profits depend on the amount of output chosen by firm 2 and 3. In order to make a strategic decision firm 1 must forecast firm 2's output decision – each player must forecast the choices of other players.

The first order condition for i -th firm with full industry output $Q = q_1 + q_2 + q_3$ is as:

$$\frac{\partial \pi_i}{\partial q_i} = p(q_1 + q_2 + q_3) + \frac{\partial p}{\partial Q} q_i - MC(q_i) = 0$$

According to Varian (1992) with three firms the marginal revenue equals marginal costs. Therefore it is possible to derive:

$$p(Q) + \frac{\partial p}{\partial Q} q_i = MC(q_i), i = 1, 2, 3$$

This equation can be taken further:

$$p(Q) \left[1 + \frac{\partial p}{\partial Q} \frac{Q}{p(Q)} \frac{q_i}{Q} \right] = MC(q_i), i = 1,2,3$$

Where the fraction $\frac{q_i}{Q}$ stand's for firm i 's industry output the $\frac{\partial p}{\partial Q} \frac{Q}{p(Q)} = \epsilon$, whew ϵ stands for elasticity of market demand. Knowing this the next step is:

$$p(Q) \left[1 + \frac{q_i}{Q} / \epsilon \right] = MC(q_i), i = 1,2,3$$

As Varian further postulates, the Cournot model is a very good example of a situation where the actual monopoly is somewhere in the middle, between a monopoly and perfect competition.⁴⁷ If $\frac{q_i}{Q} = 1$, man would reach the monopoly condition, as $\frac{q_i}{Q}$ nears 0 the Cournot model approaches a competition based market.

⁴⁷ This idea was presented already in *Chapter 1.1*

For any linear demand function with an inverse demand equation $P(Q) = a - bQ$, the marginal revenue has the function $MR = a - 2bQ$ and so that the first order condition for i -th firm is (Samuelson, et al., 2003):

$$\frac{\partial \pi_i}{q_i} = a - MC - 2bq_i - \sum_{i \neq j} bq_j = 0$$

With this one derives the Reaction functions for triopoly:⁴⁸

$$R_1(q_2, q_3) = \frac{a - MC}{2b} - \frac{(q_2 + q_3)}{2}$$

$$R_2(q_1, q_3) = \frac{a - MC}{2b} - \frac{(q_1 + q_3)}{2}$$

$$R_3(q_1, q_2) = \frac{a - MC}{2b} - \frac{(q_1 + q_2)}{2}$$

From this it is possible to derive firm 1 provided supply as:

$$q_1 = \frac{a - MC}{2b} - \frac{q_2}{2} - \frac{q_3}{2}$$

Considering the assumption of all the triopoly players operating under same conditions, the equilibrium for Cournot model equilibrium is:

$$q_i^c = \frac{a - MC}{4b}, i = 1, 2, 3$$

Then the total Cournot industry output is:

$$Q^c = \frac{3}{4} \frac{a - MC}{b}$$

With the price in the triopoly model as:

$$p_i^c = \frac{a + 3MC}{4}$$

⁴⁸ Reaction function is a graphical tool for showing a decision maker's best course of action for each set of choices made by other decision makers.

4.3.3 Collusive Behaviour

In the Cournot model was the assumption of each operator's objective as maximizing its own profit and coming to a decision independently of the other firms. A change might occur when this assumption is relaxed and possibility of coordinated actions among the firms emerges. Collusion situation might occur in unstable markets or in case of risk avoidance. An industry where the operators collude to some degree in setting their prices and outputs is called cartel. With empirical examples of allowed and punished telecommunication cartels in Chapter 3.7.1 the next steps describe triopoly cartel model.

The objective of a cartel is profit maximization of the entire industry. This situation is reached when the industry wide revenues are subtracted by costs of individual operator. The general profit maximization problem for i -th firm where $i = 1, 2, 3$ is:

$$\pi_i = p(q_1 + q_2 + q_3)[q_i] - MC(q_i)$$

This leads to optimality conditions:

$$p(q_1+q_2+q_3) + \frac{\partial p}{\partial Q} [q_1 + q_1 + q_1] = MC(q_1)$$

$$p(q_1+q_2+q_3) + \frac{\partial p}{\partial Q} [q_1 + q_1 + q_1] = MC(q_2)$$

$$p(q_1+q_2+q_3) + \frac{\partial p}{\partial Q} [q_1 + q_1 + q_1] = MC(q_3)$$

When the operator considers expanding its output q_i , it will generate more profit from selling more output and the reduction in profits from forcing the price down. But in the second effect, it takes into account the effect of lower price on the own output as well as the whole industry output. The cartel's intentions are maximizing the total industry profits, not only individual firm ones'. Therefore:

$$\sum_{i=1}^3 \pi_i = p(Q) \sum_{i=1}^3 q_i - \sum_{i=1}^3 MC(q_i)$$

The optimal conditions imply that marginal revenues of a homogenous product must be the same no matter which triopoly firm produces it. This goes hand in hand in with the $MC(q_1) = MC(q_1) = MC(q_1)$ rule as it is a condition for maintaining the general

equilibrium. If one firm has a cost advantage, with its marginal cost curve being below the other ones, it will produce more output in the cartel equilibrium.

4.3.3.1 Cheating in a Three Member Cartel

Establishing and maintaining a cartel might be not so easy and it is connected with a number of difficulties. The biggest challenge is to find a universal agreement to which all the future participants would agree because each cartel member wants to maximize its own bargaining position, taking for itself the most operator-attractive markets share.⁴⁹ As a consequence, there is always a temptation to cheat

Continuing with the triopoly model introduced in Chapter 4.3.3, the operators are maximizing industry profit by choosing (q_1, q_2, q_3) . What happens when one firm diverts from this optimal industry setting and decides to produce more output q_1 ? The marginal profit for this firm 1 will change and so it will breach cartel's industry profit maximizing intentions (Varian, 2006):

$$\frac{\partial \pi_1}{\partial q_1} = p(q_1 + q_2 + q_3) + \frac{\partial p}{\partial Q} q_1 - MC(q_1)$$

Expanding and rearranging the optimality condition from 4.3.3 for firm 1:

$$p(q_1 + q_2 + q_3) + \frac{\partial p}{\partial Q} q_1 + \frac{\partial p}{\partial Q} q_2 + \frac{\partial p}{\partial Q} q_3 - MC(q_1) = 0$$

Gives:

$$p(q_1 + q_2 + q_3) + \frac{\partial p}{\partial Q} q_1 - MC(q_1) = - \left(\frac{\partial p}{\partial Q} q_2 + \frac{\partial p}{\partial Q} q_3 \right) > 0$$

As a consequence:

$$\frac{\partial \pi_1}{\partial q_1} > 0$$

For this, firm 1 believes that the remaining two firms will keep their output fixed. In that case it can increase its own profits by increasing its own production. Firms acting

⁴⁹ Market can be divided through the Quota Rule. Maximizing the combined profits of the cartel members, the cartel has to decide how to divide the profits among its members. The Quota Rule is simple as it just assigns each member a share in the production of Q (Ferguson, et al., 1993). In telecommunications this can be transformed in dividing the market into segments of interest.

together in a cartel maintain a kind of status quo so that the market does not get spoiled from special offers of one particular firm.

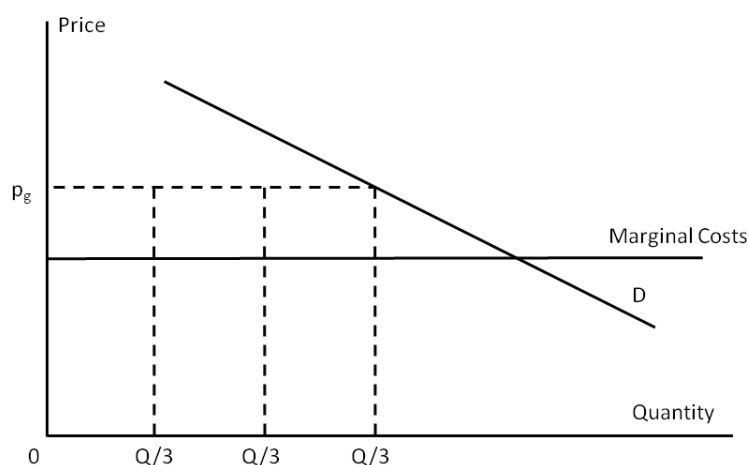
4.3.4 Bertrand Equilibrium

Equilibrium among firms choosing prices is known as Bertrand-Nash equilibrium. Firms which choose prices are known as Bertrand rivals, therefore in the triopoly model the equilibrium consists of p_i for $i = 1, 2, 3$.

Continuing onwards with a standard form market demand function $P(Q) = a - bQ$ to determine what the firms intend to do, an idea about the firm specific demand patterns should be known.⁵⁰ All the three firms are interdependent as in the cases mentioned before – the demand for one firm’s output depends on the other firm’s strategic behaviour (Hořejší, 2011).

Figure 14 illustrates the market demand curve and the common level of MC.⁵¹ Firms are operating in a situation with great comfort, dividing the market with no price competition but with other differentiation means, far above their MC. This situation is valid only when all three firms on presented price and incline towards profit maximization. For any of the firms’ price above p_g would mean losing to their competitors, but charging below p_g firm takes whole industry sales for its own.

Figure 14 Oligopoly matching prices



Source: Author

⁵⁰ For the illustration the *Figure 14* & *Figure 15* are depicted with elastic demand curve.

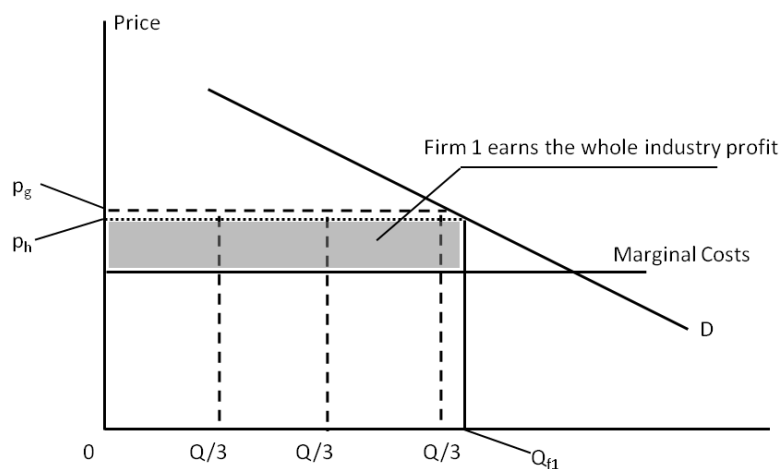
⁵¹ In the Bertrand-Nash equilibrium the market demand curve is not of inverse character as in the Cournot-Nash equilibrium case as here the quantity is a function of price.

Following this the firms have three behaviour options:

1. Firm 1 charges higher prices than the remaining two. As a consequence customers leave firm 1 and go to competitors. Firm 1 sells no output and firm 2 and 3 face the whole market demand.
2. Firm 1 undercuts the other firms with a lower price and the previous case is reversed. Firm 1 faces whole market demand and the remaining two firms take nothing.
3. All three firms charge the same price. When the three firms set equal prices, consumers are indifferent between the three. Yet for the general assumption the customers have to be evenly divided between the three firms. With this each firm sells $Q/3$ of the market quantity demanded.

Charging below has significant implications for the industry. Firm 1 by undercutting competitors' prizes with p_h almost triples its product output as the prices are attractive in the customers' eyes and they migrate to firm 1 with cheaper portfolio (see *Figure 15*). This move also generates higher industry production belonging to firm 1 Q_{f1} . This behaviour is hardly tolerated by remaining two competitors. Firm 2 and 3 begin undercutting their prices as well, starting a price war. Industry comes to a conclusion that as each firm is capable of additional cost cutting.

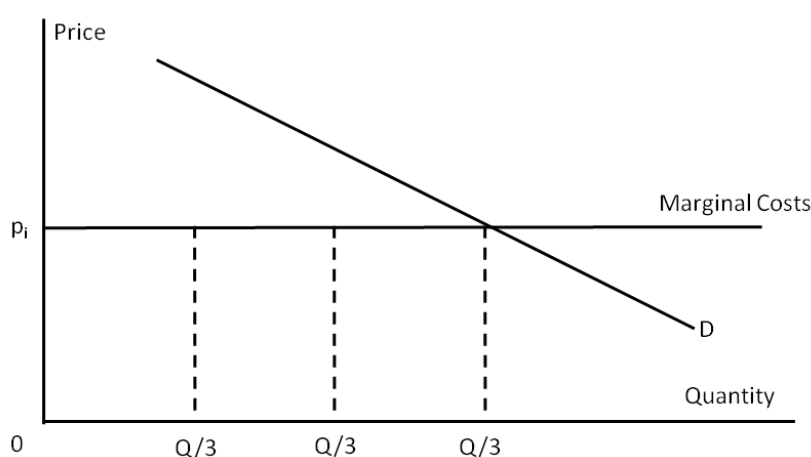
Figure 15 Firm undercutting the prices



Source: Author

Following the price cutting trend all three firms direct their price strategies towards their marginal costs, which are industry wide approximately equal for all players. The game stabilizes on $p_i = MC$ for $i = 1, 2, 3$.⁵² On this equilibrium level, no firm is motivated to cut prices lower as the price cutting firm would sell its portfolio below its costs. In the same logic, diverting from this price upward makes no sense as the remaining competitors would reap all the industry benefits by staying. With this the Bertrand-Nash Equilibrium is the similar to the equilibrium in Perfect Competition (see *Figure 16*). That is why the self-enforcing mutual interdependence of all triopoly participants entails them setting their prices equal to marginal costs.

Figure 16 Bertrand-Nash equilibrium similar to Perfect Competition



Source Author

4.4 New Market Entrants

As Shy (1995) states, “why it is so that firms do not enter an industry despite the fact that the existing firms in the industry make above normal profits,” the process got stuck somewhere in the middle between monopoly and perfect competition. In an ideal case there should be inflow of additional competitors into oligopolistic structures, but as one knows, this does not always happen. As Katz (1994) states, entering a perfectly competitive market is easy as the price before entering and after entering is easily estimable as the high number of competitors does not allow great price modifications. Entering the market with few competitors with aligned and mutual interdependent price policies is not an easy case. When deciding about entering a market, the subject has to question itself about its post-entry equilibrium (status quo) in the relevant market. The

⁵² Being more in detail, in reality all firms choose price level slightly above this level reaping the benefits of higher price.

desired outcome of a market entry should be delivering positive economic profit to the company. Each entry is connected with barriers to entry which are an important structural characteristics pattern of any industry and methods of entering the relevant market.

4.4.1 Barriers to Entry

Barriers to entry have significant impact on competitiveness and performance of the industry. A classical definition of an entry barrier is provided by Bain (1956): “A barrier to entry is an advantage of established sellers in an industry over potential entrant sellers, which is reflected in the extent to which established sellers can persistently raise their prices above competitive levels without attracting new firms to enter the industry.”

Case attractive and a simple definition presented by Fisher (1979): “A barrier to entry is anything that prevents entry when entry is socially beneficial.”⁵³

To the most widely acknowledged entry-detering barriers belong, economies of scale and sunk cost economies. Beginning with the economies of scale, the incumbent environment usually owns plants and equipment of firm specific scale and usually covers the whole market.⁵⁴ Assuming a saturated market the added output of both the incumbent and new entrant will exercise pressure on prices, whereas rather than going into a possible price war the incumbent might offer some part of its output to the new entrant (combination $R_{inc} : R_{ent}$). This situation is observed in *Figure 17*.⁵⁵ On the other hand customers might be loyal to the existing incumbent environment and might reject the new entrant. So far customer loyalty is highly unlikely in the telco industry analysed as the major industry changes come as pressure from the customer base. The mutual revenue maximization between the new entrant and incumbent cloud is reached only with letting the entrant into the market without any deterrence actions. So far the introduced idea of price war should not be neglected if the incumbent cloud has space for undercutting the prices.⁵⁶

⁵³ Definition by Fisher is elegant when taking into account public discontent presented in *Chapter 1.2.4*

⁵⁴ Economies of scale are in the case of telecommunications the number of users. The more users the network has the more difficult it is for the new entrant to steal them. The user prefers to stay with his/hers group (as mentioned in *Chapter 4.2.3*) and not to start a new group from the beginning.

⁵⁵ *Figure 17* and *Figure 18* consider games with perfect and complete information. Under perfect information game conditions players have the same information for strategical decision making. Complete information states the information is available to all participants and no one can be left out.

⁵⁶ Application will be presented in *Chapter 5.4*

Key to the pay-off matrixes:

- R_{max} – industry maximum (incumbent) revenues with no entrant
- R_{inc} – incumbent revenues
- R_{ent} – entrant revenues
- *price war & sunk costs* – incumbent behaviour patterns

Figure 17 Market share for the new entrant

		Entrant	
		In	Out
Market cloud	Let in	$R_{inc} : R_{ent}$	$R_{max} : 0$
	Price war	$R_{inc} - price\ war : -R_{ent}$	$R_{max} : 0$

Source: Author

Continuing with sunk costs, the incumbent has to react to the new market entrant and alter its behaviour to the situation. In *Figure 18* with additional investments into the business the incumbent can enjoy lower marginal costs and high quality portfolio appealing to customers. The sunk cost lead to higher revenue gains in later periods which the new entrant cannot face effectively. With the cushion created by the initial investment the incumbent cloud will be more comfortable to engage in a price war, knowing that new entrant has no cushion for price bargaining. The investment into sunk costs might be considered in this case optimal as the entrant will have to face negative payoff and will consider whether to enter or leave out the market. As Ferguson (1993) claims this threat is credible and should be deterred (combination $R_{inc} : -R_{ent}$).

Figure 18 Sunk cost commitment as effective

		Entrant	
		In	Out
Market cloud	Let in	$R_{inc} - sunk\ costs : R_{ent}$	$R_{max} - sunk\ cost : 0$
	Price war	$R_{inc} : -R_{ent}$	$R_{max} - sunk\ cost : 0$

Source: Author

The presence of sunk costs is of high importance for the situation in the Czech telecommunications industry. With the Digital Dividend launching in 2012 the

regulatory CTU has listed several commitments and obligation which the subject interested in the DD has to oblige with. More on the specifics of the DD and the auction process will be provided in *Chapter 5.4*.

4.4.2 Industry Entry Practise – Auction Process

Entering a market which is considered by the state of great importance is usually undertaken with an auction process. Auctions are commonly used in selling natural resources, various public procurement proceedings rights to use certain geostationary positions and others. A frequency auction (in the thesis many times mentioned Digital Dividend) belongs to the group as well. The mentioned objects of an auction have one in common, they are scarce. Their scarcity implies a limited number of potential auction participants and so a limited number of users, here operators. The auction process has advantage in that the auction is conducted publicly with no space for bribing or any insider dealing. Firms usual choose between non-equity and equity entry. With firms many times feeling unsecure about a pure non-equity or equity a licence creates a synergy between both methods as the auction combines both non-equity criteria of establishing the network itself, with equity criteria of the license itself (The Impact of Corruption on Entry Strategy: Evidence from Telecommunication Projects in Emerging Economies, 2006). It is possible to view an auction as a partial information game in which the valuations of auction objects presented by each participant are hidden among each other. Logically the player should know its own valuation. The valuation has to be based on present value of the future strategy of undertaking with the frequencies. However in an industry specific conditions the way *how to deal* with the auction objective can be quite known, there some level of common valuation can be present. If one would see the auction as a game, its equilibrium would be a function of auction rules, information bidders have, system how the winner is determined and finally the price. An auction is economically efficient when it manages to maximize Social Welfare – the object will be allocated to the bidder who offers the highest price.⁵⁷ Nevertheless as Courcoubetis (2003) states; “designing an auction for a particular situation is an art”. There is no standardized auction process which can be used in all auctions.

Switching the attention to a frequency auction as a mean for entering a telecommunications market, it is important to remember that it is very likely the only

⁵⁷ A definition of Social Welfare is provided in *Chapter 5.2*

way, how to enter a telco market.⁵⁸ The only other options of entering a telco market would be direct rights granted to one chosen operator or establishment of a Mobile Virtual Network Operator.⁵⁹ Frequency auctions are complicated as most usually they do not consist of an auction of one particular frequency spectrum licence, but a number of them with possible combinations among them. Combinatorial bidding leads towards two synergy effects. The first can be achieved by a market player already present in the market, which considers extending its network and introduce in it the new frequency providing so an additional or wider range of services. According to Courcoubetis (2003) combinatorial bidding belong to the most complicated ones, nevertheless it has the best preconditions for delivering true valuations of the auction's object and so reach maximization of Social Welfare.

4.4.3 Oligopoly with an Entry

A monopoly or perfect competition industries which are not facing a potential entry are not engaged in a strategic process. Monopolist because of lack of competition and perfect competition because of high number of competitors causing alignment of strategies rather irrelevant as the ambiguity of diverting from the industry trend is high. Potential market entrant behaviour was described already in *Figure 17* where the entrant managed to gain some share of the market pie. However the market entry was conducted under perfect and complete information condition assumptions. The real process might be similar to games with incomplete information.

Figure 19 is describing such an entry. New entrant is considering an entry into an oligopoly market. Yet the entrant is unsure about the industry members marginal costs; are they high or are they low? This decision is of crucial importance as the new entrant bases on it its entry price decision and might predict the incumbent cloud's payoffs and so the its reactions.. However in real situation any new entrant would at least approximately know the cost structure of its market peers.⁶⁰ Again, the basic assumption of an oligopoly has to be maintained, see *Chapter 4.1*.

The first decision is made by the oligopoly members. The participants decide about their cost structure. Yet this decision is not available for the potential entrant. The

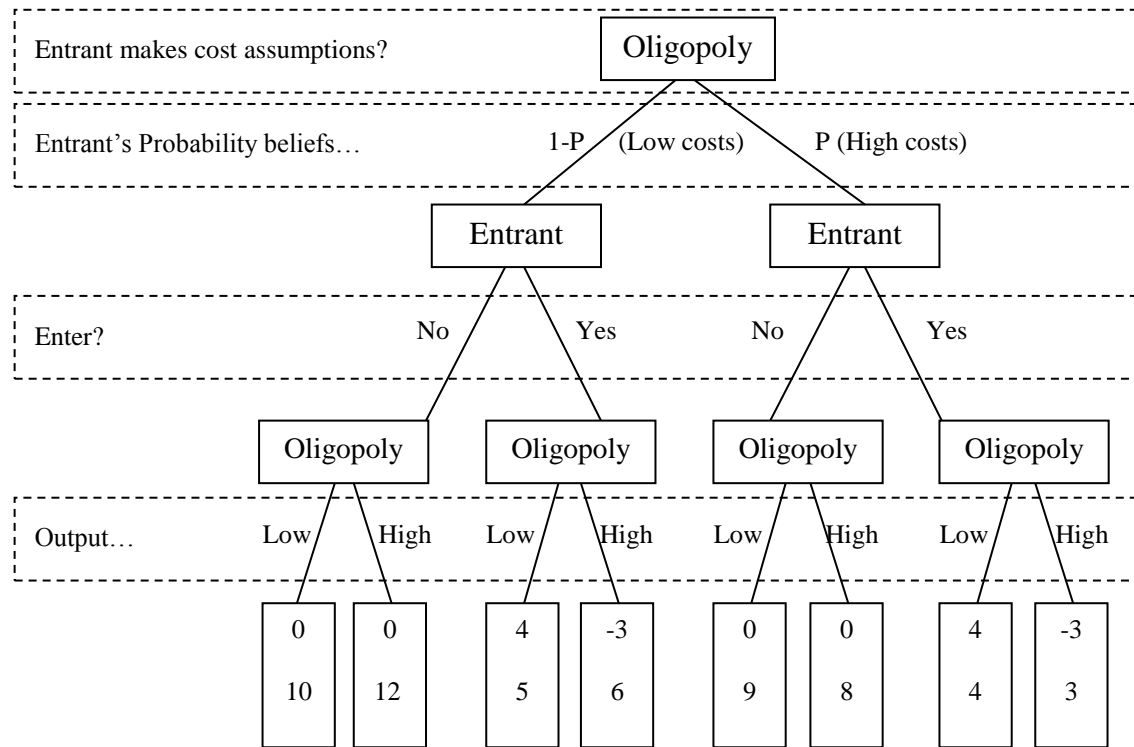
⁵⁸ This assumption is under the assumption that the new market entrant considers launching a wide portfolio of services and not only just a small one.

⁵⁹ The basics of a MVNO have been outlined in *Chapter 3.6.1*

⁶⁰ Even the type of market entrant does matter. Is it an industry skilled entrant or a pure new comer without industry relevant knowledge? Theoretical applications can hardly filter such an assumption.

strategy outlined only represents the beliefs which the entrant can have about the cost strategy in the oligopoly. The desirability of potential entry has to be formed based on the oligopoly behaviour observations.

Figure 19 An entry game of incomplete information



Source Author, (Katz, et al., 1994)

Entrant payoff is first (above) in each box. The entrant has to estimate the first move of the oligopoly.

The decision whether to enter the market or not is so based on the cost based assumption, where the entrant tries to foresee the post entry equilibrium, meaning industry conditions. The oligopoly has low costs, the new entrant moves in. Following, oligopoly chooses High Output and the entrant suffers a loss of -3. If the incumbent has high costs and the entry occurs, the proper response will be to opt for Low Output and the entrant will earn 4.⁶¹⁶²

The new entrant can use probability for trying to form understanding of oligopoly cost structure and reaction pattern. Let P stand for probability that the oligopoly sticks to

⁶¹ The values have been taken over from (Katz, et al., 1994). They have been estimated with backward induction. Real-time application would require forecasting and estimating – playing the game.

⁶² This game can be considered of sequential character, the entrant reacts after it witnesses the strategic move of the oligopoly.

High Costs and $1 - P$ designate entrant's belief about Low Costs trend in the oligopoly. With this it is possible to calculate the expected payoff from entering the industry as:

$$P \times (4) + (1 - P) \times (-3) = 7P - 3$$

Not entering the market yields for the entrant payoff of 0. Hence the potential market entrant will come to the market if:

$$p \geq 3/7$$

With this condition not fulfilled the new entrant will rather choose to stay out the industry. As Katz (1994) states the potential entrant will come in only if it is sufficiently optimistic about the high costs and its competing behaviour will be limited. Yet such a one sided estimation on the entrant's side can have several setbacks. The most appropriate tool for supporting the above mentioned entry condition is to observe the behaviour of the oligopoly members for a longer time so that a behaviour pattern can be deduced.

5 Application

If you don't change your game to gain advantage, one of your competitors will, and there is not much value in being the best chess player when everyone is playing checkers.

Hugh Courtney (2000)

5.1 Concentration of Czech Telecommunications

For measuring the concentration of the Czech telecommunications industry with using the Herfindahl-Hirschman Index two key conditions have to be fulfilled.

1. The market has to be geographically determined.

Meeting the criteria of the first condition is easy, as the market borders are clearly set by the national borders. This definition corresponds with the official CTU policy.⁶³

2. The services/products used for calculating the HHI have to be clearly defined.

The calculation should consist of well-defined services. The number of substitutes should be as low as possible. The analysis provided by Informační Institut (2012) measures the industry concentration on mobile calling Relevant Market as this type of calling can hardly have any other substitute (Over the Top operators, OTT).⁶⁴⁶⁵ The thesis deviates from these conditions and proposes telco market consisting of revenues of three main and only operators. There are no alternatives to three operators, so imagining an end customer wanting to choose any telecommunication service (mobile or fixed, telephony or internet) the customer has to approach one of the three operators to satisfy demand. For reaching the HHI based on revenue based relevant market, following steps have to be fulfilled.

Under R_{RM} the paper understand *Relevant Market Revenues*. In this case these revenues consist of Operator Revenues - R_i .

⁶³ For more on the market definition see CTU: Analýza trhu č. A/7/09.2009-11

⁶⁴ The topic of Relevant Market (RM) was first mentioned in *Chapter 3.6* CTU does not consider telco market as a whole; instead it divides it to so called RMs, which serves as more precise and accountable measurement subjects.

⁶⁵ Under OTT operator man understands Google, Skype and other 'operators' providing telephony services (globaltelecomsbusiness.com, 2011).

$$R_{RM} = \sum_{i=1}^3 R_i$$

Where:

$$R_i = \text{Sales of Goods}_i + \text{Sales of Own Products and Services}_i + \text{Work Capitalization}_i$$

Following telecommunications operator Market share s_i has to be deduced from R_{RM} as:

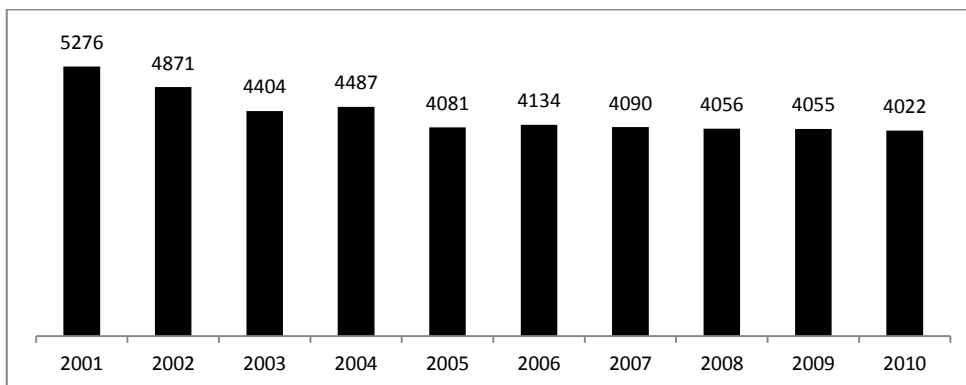
$$s_i = R_i / R_m$$

Next it comes to calculating the 3 player HHI index itself:

$$HHI = \sum_{i=1}^3 s_i^2$$

With the methodology defined the calculations delivers the following results:

Figure 20 Czech telco concentration using the Herfindahl Hirschman Index



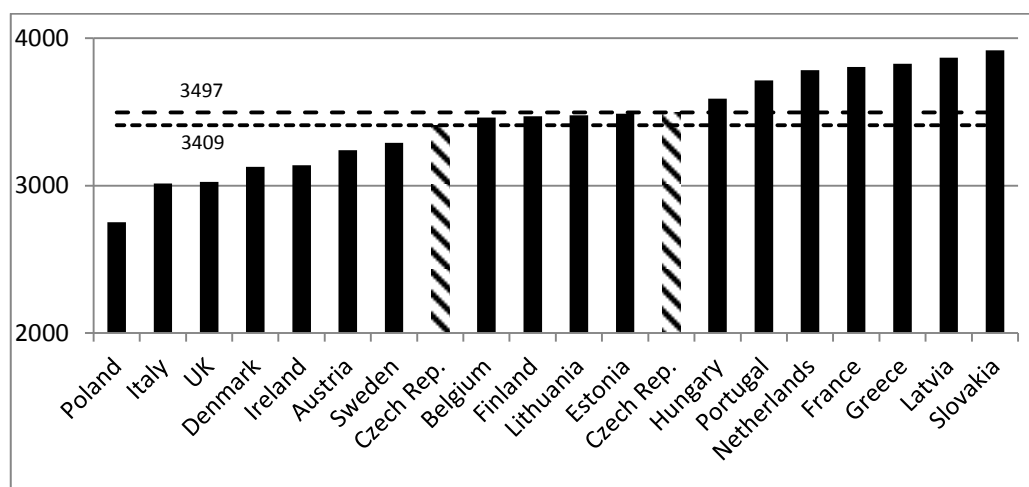
Source: Author

Regarding the HHI index, it is of common understanding that industries with low concentration HHI stand for high competitiveness leading to higher quality and cheaper services provided to end customers. The average HHI index for the last five years 2006-2010 stands for 4071. Both the yearly concentration numbers as well the average calculated stand for a highly concentrated industry. Industries with high concentration usually represent contradictory observations to low concentration ones', leading to lower competitiveness among market players and sturdy price competition conditions.

The already mentioned research conducted by Informační Institut (2012) states somewhat lower concentration of 3474 for 2010 in the mobile calling Relevant Market. This number still supports the thesis findings of highly concentrated market.⁶⁶ Other considerably lower HHI index observations are provided by Asociace provozovatelů mobilních sítí (APMS, 2012). This clear lobby group provides considerable lower HHI index values (see *Figure 21*). With different methodology approach APMS shows relatively good standing point of the Czech telco industry in comparison with international peers.

Although different methodologies for measuring the market concentration the conducted measurement as well as third party opinions support the general idea of disrupted market conditions and price discriminatory approach to end customer. Introducing more competition into the market would lead to softening the concentration numbers so that the industry and market benefits from the changes eminent in the telco industry.

Figure 21 HHI index comparison according to APMS



Source (APMS, 2012)

⁶⁶ A simultaneous calculation conducted by Informační Institut provides HHI of 3559 in 2010.

5.2 Pricing in Czech telecommunications

Telecommunications are a highly regulated industry. Among traditional pricing strategies as mentioned in *Chapter 4.2.2*, the regulatory authority has power to identify subjects in the telecommunications market which hold significant market power and can undertake coercive actions against market participants (Chapter 3.6).

With the basic and most commonly used principles of pricing in telecommunications industry a third possible option emerges – Ramsey Pricing.⁶⁷ Real time marginal costs are difficult to compute and they can be low or close to zero as a telecommunication service operators have typically fixed costs. These fixed costs have to be recovered. With price mark-up and price lining strategies giving the operator space for almost free price determination, raising the prices arbitrarily might significantly reduce Social Welfare.⁶⁸ Exact marginal cost pricing does not allow recovering operator's costs. If the operator is very large and operates with economies of scale (costs which increase less than proportionately with output level) marginal costs are low (Courcoubetis, et al., 2003). Revenue under marginal costs would not satisfy fixed costs of operations (property loans, investment projects and interest on loans and maintenance).

The issue of maximizing Social Welfare is tightly connected with the telecommunications demand function presented by Rohlfs (1974). The approach of Ramsey Pricing is about maximizing weighted objectives of the operator. Weighted objectives are considered because of the fragmentation of the market under separate business lines and different characteristics patterns in customer demand. As a consequence more attention can be prioritized to an objective with higher weight. The issue with Ramsey Pricing is that the operator intending to use its price policy according to them has to face equally competitive market players. Weighted objective allows the operator to put different importance on the parts of portfolio offered and so maximize its revenue generation. Even Ramsey Pricing cannot be considered as a standard pricing tool for the telecommunications industry as a whole. This methodology is widely used, but the major condition for its use is market fragmentation. Therefore, this condition is

⁶⁷ There are other additional pricing strategies, yet Ramsey Pricing is attractive as used by regulators.

⁶⁸ Considering the public disappointment one can postulate that Social Welfare is disrupted. Social Welfare of the society can be defined as the sum of all users' net benefits, i.e. the sum of all consumer and producer surpluses.

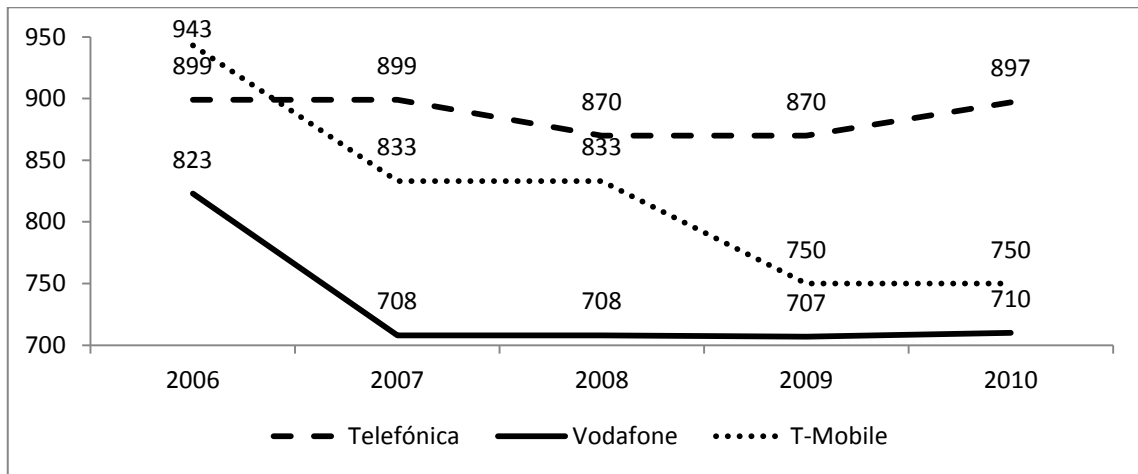
fulfilled in the telecommunications market only when it is applied on Relevant Market fragmentation done for example by CTU.

Following in the steps outlined in the paragraph above, pricing according to Relevant Markets would seem as the most through one. Yet the end customer is not facing prices aligned according to 18 or 12 relevant markets. These prices are rather set for the regulatory authority to oversee the competition behaviour among industry players. It is more common practise that the end customer faces prices which are subordinated to basic pricing strategies as their creation is related to empirical observations of market conditions and competitor behaviour rather than complex numerical model based price determination. The observation of real price development is difficult because of time constraints as the operator regularly changes its service portfolio and price policies.

Yes using available market sources provided by CTU, it is possible to identify vague trends in the price policies of Czech telco members. Hardly speaking about any price strategy, *Figure 22* provides a rather stagnating development in Medium Consumption Basket price development with changes occurring only at operator T-Mobile. It is of utmost importance to mention that these observations are under continuous change as CTU cannot maintain yearly conformity among observations. For this reason, when not applicable, the most similar basket is used to the previous year basket. Additional baskets are in the Appendix but as well even in case of a trend among them the development does not need to justify that the shifts in price levels occurred due to price competition among three oligopolists. Information on methodology provided in the publication focused on price development by CTU (2011).

With the two additional baskets provided by CTU (in *Appendix*), the reader obtains mixed price developments among the operators for various products, hardly speaking of any strategies among them. As a consequence considering a general trend in price development can be justified; the stable development pattern can be a proof of price aligning among market players without any price wars occurring in the industry. With rather than price competition the oligopoly members focused to customer promotions, active marketing and other promotion activities.

Figure 22 Medium consumption basket price development [in CZK]



Source: (Český telekomunikační úřad, 2011)

5.3 Behaviour in an Oligopoly

All transactions between a buyer and a seller are undertaken unilaterally and the actions affect only the counterparty. A buyer is an agent or player who enjoys a certain service or goods which are produced or delivered by the seller. The seller carries the costs and wants to be compensated by the transfers paid by the buyer. Game theory provides space for strategic bargaining approach can determine price paid for certain goods and services because of the difference between production costs and the utility held by the end customer. The difference between the two is bargaining gain. In situations where the bargaining power is concentrated mainly on the buyer's side, the buyer has a good outside options and the price will cover only little more the production costs. In contrary, if the bargaining power is concentrated mainly on the seller's side, the price will be little less than the buyer is maximum willing to pay for the service or goods (Stähler, 1998).

The application of bargaining theory in oligopoly is hard to achieve if not impossible. As the reader knows from *Chapter 4.1* producers are price makers and customers price takers. Yet it is possible to identify some potential for bargaining approach. The customer can be offered different price than standard, or special price tariffs apply in various customer segments. With the bargaining strategy's limited or no presence in an oligopoly, the industry players have the opportunity of *undertaking to customers*.⁶⁹ Under undertaking one would understand bringing better services to customers with the

⁶⁹ A more suitable synonym for undertaking to customers would be engaging them.

possibility of price negotiation, meaning a fall in prices. Yet undertaking to customers can have profit-increasing function.

As Ferguson (1993) presents, the gesture of undertaking to customers might be considered as a device for retaining operator's goodwill among the customers, but the reason behind it is rather more utility self-serving on the side of operator than on the customer's side. Taking into account the price development patterns mentioned in *Chapter 5.2* together with the collusive behaviour for industry wide profit maximization, the operators can have rather incongruity outcomes as will be illustrated in the following paragraphs.

Imagining a situation where operators set their prices.⁷⁰ In presented *Figure 23* each operator has the incentive to set a low price (dominant strategy). Maintaining a high price with a competitor choosing low price leads automatically to lower prices. Consequently the low price strategy delivers higher pay-off as customers flock to the operator due to ease of switching among operators. Both operators playing high price does not pay off as they will migrate to low prices. Low price strategy for both operators prevails.⁷¹

Figure 23 Keeping prices low strategy

		Player	
		High price	Low price
Remaining operators	High price	800:800	790:840
	Low price	840:790	795:795

Source: Author

Yet the operator can come up with the idea that it will pay the customers the price difference between its high price and the low price offered by the remaining competitors. On the other hand, this approach does not have to be applied only as a price cut when customers identify a better offer. The price cut can come up as special discount without mentioning the ambition of catching up the competitors. Naturally the operator follows its competitors and reacts for it to survive whereas the competitors might follow the same price adjustment strategy.⁷²

⁷⁰ The price level will be similar to the one presented in *Figure 22*

⁷¹ The payoff matrix is designed as; the price which is being set reaps the whole benefit. There are no costs involved.

⁷² For illustration prices similar to the medium consumption basket are chosen.

With firms now undercutting their high price levels to match the prices of the competitors, the overall equilibrium will stabilize with all operators playing high prices (see *Figure 24*). The price matching strategy is represented as (840 – 790), nevertheless the high price strategy delivers higher pay-off for the operator. Therefore aligning their price levels together and after that choosing high price appears as more attractive for the market players as fighting in a low price game. Although the gains are not as significant as in the industry with great price difference, for an operator facing the whole market is this strategy of high attractiveness. This apparently precompetitive gesture of lowering the prices can be viewed as a strategy to ensure that industry wide higher prices will prevail with the end customer thinking about consuming at low prices. The supportive argument for the strategy described in this part is that it allows a kind of collusive behaviour among the oligopoly members, which is hidden from the eyes of the customer.

Figure 24 From undertaking the customer to higher prices

		Player	
		High price	Low price
Remaining operators	High price	800:800	790:790
	Low price	790:790	795:795

Source: Author

This strategy gains on importance when it is clear which strategy do the operators follow. Do they want to keep the market share or maximize profitability? For the Czech telco the idea of maximizing profitability is of high probability whereas the importance of market share is not marginalised (Courtney, 2000). The operators are being used by their foreign mothers as cash cows. Best example is the behaviour of Czech Telefónica, as the company’s objectives are pressed to profit maximization with a minimum of reinvestment as the dividend is consequently harvested by Telefónica Spain.⁷³ In case a potential new entrant would hold information and knowledge about the strategic objectives of the Czech oligopoly cloud a price war strategy would seem as very attractive if not the only possible way.

⁷³ The Czech subsidiary’s strategy is to maintain the most stable and dividend yield as the Spanish mother milks the company through the dividend.

5.4 Entering Czech Telecommunications

5.4.1 Auction is the only way

Regulator CTU officially presented the form of the Digital Dividend auction as Simultaneous Multiple-Round Auction (SMRA) type with being bid ascending and the opportunity of withdrawal of the bid is at place. The choice of an ascending auction rather than a sealed-bid (envelope) auction is that bidders reveal information as the bid process progresses and so the occurrence of Bidder's Curse will be limited.⁷⁴ An SMRA auction is considered efficient, fair and transparent, so maximizing the utility condition. The issues of complementarity and substitution also affect bidding strategies in the auction process. Hence the DD is bringing maximum utility only with a relatively high number of participants taking part in it. Raising interest about the DD auction was one of the concerns of CTU as it, the operator had to approach potential subjects interested. Regulator promoting the auction and trying to lock in participants is definitely a unique Czech reality. On the other hand, the higher number of participants the better. If CTU exercises effort to bring in auction competition, it will end up in only more competitive and so benefit bringing process (ihned.cz, 2012). Bidding occurs in rounds. It continues as long as there is bidding on at least one of the objects (hence the name simultaneous). In each round, the bidders make sealed-bids for all the objects in which they are interested (for the Auction object see *Figure 25*).

Figure 25 Digital Dividend auction and what is played for?

Kategorie	Frekvenční pásmo	Frekvence	Nabídkové bloky	Spektrální limit	Minimální rozsah nabídky	Vyvolávací cena (mil. Kč/1 blok)	Aktivitní body (body/1 blok)
A	800 MHz párové spektrum	791 - 821 MHz 832 - 862 MHz	6 bloků 2 x 5 MHz	2 x 15 MHz	není stanoven	1 100	4
B1	1800 MHz párové spektrum	1805 - 1880 MHz 1710 - 1785 MHz (nealokovaná část spektra)	1 blok 2 x 15 MHz	2 x 23 MHz včetně stávajících přídělů v pásmu 1800 MHz	není stanoven	450	4
B2			1 blok 2 x 0,8 MHz				
B3			9 bloků 2 x 1 MHz				
C	2600 MHz párová část spektra	2500 - 2570 MHz 2620 - 2690 MHz	14 bloků 2 x 5 MHz	2 x 20 MHz	2 x 10 MHz	100	1
D	2600 MHz nepárová část spektra	2570 - 2595 MHz	9 bloků 1 x 5 MHz	není stanoven	1 x 15 MHz	50	0,5

Source: Compiled by (Peterka, 2012), based on CTU provided DD auction materials.

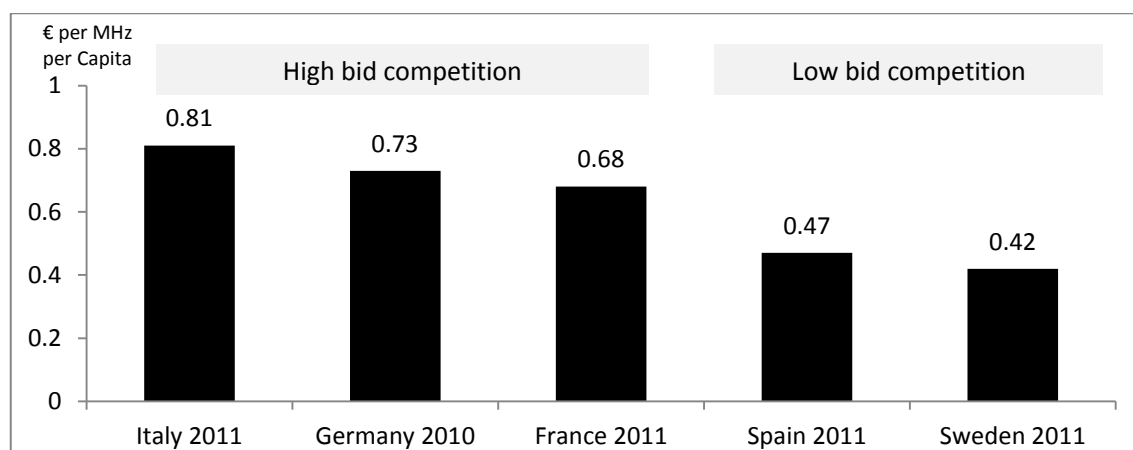
The most attractive as already mentioned in *Chapter 3.6.2* is the LTE compatible Kategorie A 800 MHz (Category A) frequency band. Limiting factor for the auctioneers is the Spektrální limit (Spectrum Cap) rule limiting the maximum ownership.

⁷⁴ Bidder's (Winner's) Curse is a situation when the winning bidder overpays the auction. There are two ways in doing this. First the winner's bid exceeds the value of the auctioned object making the bidder actually worse off. The value of the object is less than the bidder anticipated, net gain is still possible, but it might be smaller than the bidder first anticipated.

The auctioneer reads the bids and posts the results for the round. For each object, he states the identity of the highest bidder and his bid. As the auction progresses, the new highest bid for each object is computed, as the maximum of the previous highest bid and any new bids that occur during the round (Courcoubetis, et al., 2003). A more detailed overview of the auction rules is provided in the Auction Rules Methodology Appendix (Český telekomunikační úřad, 2012).

Regarding the auction, the previous paragraphs mentioned that the SMRA auction is considered as bringing higher utility – Social Welfare maximization, if the number of participants is rather higher than low. As the number of participants for Czech auction is not known in the time of writing the thesis, whereas the final prices are known only during the auction process. Research conducted by Arthur D. Little provides justification of higher number of participants bringing in more benefit (see *Figure 26*).

Figure 26 Prices in LTE spectrum auctions



Source (Arthur D. Little, 2012)

5.4.2 The French Example

A good example of a market entry into an oligopoly telco market took place during 2011/2012 in France. The new entrant Free Mobile aspired to challenge the industry rules of the French mobile telecommunications sector. The situation around the French entrant carries many similarities with the Czech case of a new market entrant.

French mobile telecommunications market was before 2012 divided among three market players; Orange (brand of France Telecom) taking ext. 40% of the mobile market, followed by SFR with est. 30% of the market and Bouygues Télécom with est. 20% of the mobile market. Around October 2006 the regulator Autorité de Régulation des Communications Électroniques des Postes (ARCEP) declared intentions and public

consultations about issuing a fourth licence. With numerous parties interested in the bidding process for the new license the remaining three operators began a strong lobby campaign against the entrant of a fourth operator approaching the governmental bodies holding decisive power and starting an awareness campaign for general public (Reuters, 2009).⁷⁵

It might appear as not surprising that ARCEP and The Conseil de la Concurrence (CC) fined a EUR 534 mil. amercement payment to the three operators in 2005 for breaking competition rules. Every month between 1997 and 2003 the mobile operators exchanged detailed and confidential information on the numbers of new and leaving customers. With a market difficult to penetrate such an agreement led to reducing uncertainties over competitors' strategies and aligning a common market approach. The three oligopoly structure's intentions were to stabilize and divide the market shares amongst each other (The Conseil de la Concurrence, 2006).⁷⁶ With this, no wonder that the expectations from a new competitor have been high. The auction for the fourth frequency took place in 2009 with the already mentioned Free Mobile as a winner (the action was for 3G network, LTE auction underway in 2011/2012). The price for the new licence was est. EUR 240 mil and the operator signed a covenant to launch its network service in January 2012.⁷⁷ The French customer was greatly disappointed by the approach of the old three member oligopoly and was waiting for the new arrival restlessly (Pospíšil, 2012).

Free Mobile launched operations on the 10th of January 2012 and in one week accounted for 500.000 new customers! The operator started a devastating price competition offering a 50% price cut of their contract with the former operators. The old operators were accused of cash-milking their customers, bringing no value for them and intentionally providing confusing information about the services they were offering.⁷⁸ New entrant officially announced that its presence is because the customers deserve real benefits. The old operators had to face anger of their customers illustrated by their massive outflow and even demonstration of dissatisfaction. Following the market

⁷⁵ It is a very similar case as in Czech Republic. However the French market consists of 6 MVNO operators as well. As the reader knows, they are not present on the Czech market.

⁷⁶ Document had been recovered with hand written notes as "pacification of the market" or "Yalta of the market," with further documented evidence of communication among the market players.

⁷⁷ Free Mobile does not own its own network yet. Its services are undertaken as national roaming provided by Orange.

⁷⁸ Free Mobile used the example of a one page Terms of Contract document on its side, in comparison with a 70 page Term of Contract manual of the old operators.

conditions they had to react and “unexpectedly” were capable of cutting their prices by 30 to 50% to match Free Mobile’s aggressive pricing strategy (Pospíšil, 2012).⁷⁹

With this development the objectives of an auction – Social Welfare maximization, had to be fulfilled. Taking the licence’s price as agreed between Free Mobile and ARCEP, the value it did bring in into the French market of higher customer satisfaction, aggressive pricing and service competition is clearly the greatest benefit of the whole process of new market entry. The evidence of tougher French telco market is France Telecom’s (owner of Orange) 2012 Q1 results where it lost 615.000 clients and the group’s overall revenues fell 1.8% to EUR 10.92 bil. France Telecom stated that it was due to the market being shaken by competition from an “ultra-low-cost” mobile operator (Reuters, 2012).

The evidence of this development shows that the three member oligopoly market failed to react to the market entry of the fourth operator. Their strategy was to keep with the old prices till the very whereas the newcomer proved that the industry could work even with lower price levels. Market entry deterring practices were not effective as the operators have no other option as the entry strongly encouraged by the regulatory authority and other institutions. One interesting strategy of an old operator was to excuse the old price levels with high number of staffing. The customer switching to the new operator would endanger work placements in the old operator’s employees...

⁷⁹ Whereas the thesis is focusing on the Czech telecommunications market considers all three players as convergent services, Free Mobile providing only mobile telephony services has this ambition as well. It is owned by Iliad which offers services of fixed telephony and internet. Further integration is very likely.

6 Conclusion

6.1 On the objectives

The reader would agree that it is not something new that the rules of the game of any industry are complex and many times difficult to track down and understand. It is very common that ex-ante conclusions about trends and strategy might be misleading and only ex-post description of actions are possible. The complexity of the telecommunications industry is far more extensive than the example provided in this thesis.⁸⁰ Nevertheless this work tries to provide a brief insight into the topic of telecommunications which are many times represented as oligopoly market structures, where each competitor tries to design its own strategy not forgetting about the high interdependence among the players. In thesis not involved the importance of other horizontal and vertical business partners. Possible games for the best supplier or contractor on the side of the operators are very likely to occur as well.

The level of difficulty of the chosen industry was multiplied by many parties interested in its actual condition and future development. Regulator, the state, customers, domestic and international organizations, all these groups want to have their say about how it will look like in telecommunications. Theoretical approach of normative economics about describing telecommunications oligopoly how it should look like is an extremely challenging task. Providing strategic models and trying to reach a final conclusion about the industry might prove many times as impossible and even contra productive. The author during the process of writing this thesis found numerous justifications in literature that real industries practise is many times different. Looking at the industry from the opposite approach of positive economics; the numbers of variables which enter the industry and have an influence on it are extensive. The complex reality of telecommunications is highly demanding on industry specific knowledge base. As a consequence any formation of real application models describing the genuine industry processes and patterns would exceed the goals of the thesis.⁸¹

⁸⁰ One of the best resources on the topic Economics of Telecommunications is for sure from Courcobetis (2003) Pricing Communication Networks

⁸¹ A good example of the complexity, importance and attractiveness of telecommunications are investment banks which usually hold specific departments which focus on analysis of only telecommunications players.

This thesis tries to transcend these difficulties and yet provide or rather propose facts on the Czech telecommunications oligopoly status quo. In the beginning the thesis outlined two objectives; the next paragraph summarizes and comments on them.

6.2 First Objective

The first objective was focused on proposing details on theoretical foundations of telecommunications industry. What is of the utmost importance is that the value of any telecommunications operator can be determined by its customers.⁸² Important parts in a lifetime of any operator are its start, when the operator needs to lock in customers. Second are the situations when the market is nearing its saturation point and finally a new market entrant arrives as the customer decides to leave. The significant aspects is that the customer usually does not leave alone, but takes his/hers social circle with him/her.⁸³

Switching the attention towards pricing, the approaches of price mark-up and price lining seem as prevalent in the Czech telecommunications. However, price lining might be more widely used. The operators conduct their business in a very comfortable environment, till now (spring 2012); there are no pressures with real power, enforcing any level of price competition. This way the operators can decide on prices almost as they want. In any case, if necessary the operators could easily switch to mark-up pricing to act more strategically in their decision making. As further in the analysis mentioned there are other, more complicated pricing strategies in telecommunications (Ramsey Pricing) yet their justification because of unified telco market and not segment separated is hard to prove.

Commenting on the model is a challenging task. First the author opts for Bernard-Nash equilibrium model as the operators clearly focus on the variable of price and align their strategies according to it. However better theoretical understanding foundations are provided when using a Cournot-Nash equilibrium model. Last, the case of a Collusive behaviour and so maximizing the output of an industry would seem valid as well. All three operators try to maximize their revenue generation with no signs of stealing market shares or customer base among each other.

⁸² The thesis does not cover the financial valuation and final value of a company.

⁸³ Other option is that the customer was already carried away in other customer's social circle.

6.3 Second Objective

The concentration of the Czech telecommunications market was proven as high. Yet taking the methodological approach of heterogeneous revenues for the basis of calculation might be criticised, the calculation supported the concentration calculations provided by other studies. It is interesting to note that the issue of industry concentration is complicated in the telecommunications industry as it is always complicated to set-up industry borders as the industry is many times divided into smaller segmented markets. On the other hand the technical segmentation according to Relevant Markets can have many times no relevant value.

It is impossible to determine a pattern in the price level development during any time period. The fragmentation of telecommunication services means fragmentation of pricing policies as well. Empirical observation justifies the fact that the prices are high, however the operators are still free to follow pricing strategic presented in the theoretical part and so opt for their strategies of maximum revenue generation (*see Figure 6*) and profit maximization (*see Figure 4*).

Behaviour in an oligopoly is outlined by the industry's power to set even a higher price level without going into any price competition, making all the oligopolists better off. Various customer attractive special discounts and offers can actually lead to price increase in case they are launched by all the industry members. With a limited, almost no bargaining power, the customer has no other option of price adaptation. Only a new market entrant could introduce change in the industry.

Entering Czech telecommunications can have two general strategies. The first is that significant sunk costs are necessary at the beginning. These sunk costs are represented by the frequency auction. If the subject wants to enter, it must pay. The second reality is price war; the oligopolists can enter a price war with the new entrant and so actually scare him off. However the strategy of Czech operators is rather profit maximization at all costs, therefore rather an agreement about leaving a new operator some part of the market is very likely to occur. The other aspect of an entry or even any other action is its value. The entry is a game; therefore every market entrant has to calculate the value the entry will bring into the company.

6.4 How Professionals see the market structure

Global consultancy Boston Consulting Group (BCG) claims that a stable competitive market has never more than three significant competitors, where the largest has no more than four times the market share of the smallest one. With telecommunications industry the costs are a function of market share. With rising market share implying therefore the deployment of higher quality networks, providing better services and getting to the customer. With changing market share the costs and the chained factor of revenues and profits need to react. Large number of competitors is in the long-term unsustainable and will eventually shift to market structures with lower players, whereas the opposite extreme – monopoly is destined to be unable to compete with any challenger immediately its sovereign position is cancelled. Therefore the logical consequence of an industry structure of something in the middle is a very usually market form. The consultancy conceives the most probable and perhaps the optimal relationship exists with three competitors, where the largest account for 60% of the market and the smallest for no less than 15% of the market (Henderson, 1976).

This hypothesis fairly corresponds with the mobile market shares presented in *Figure 7*. The fourth operator might face challenging environment as its market share generation capabilities might be strongly constrained by the oligopoly. Going against the BCG proposal, the presence of regulatory is here to mitigate such a situation. With three members market considered as saturated, the regulator can create comfort for a new market entrant, almost enforcing its market entry.⁸⁴ With unreasonably high price levels, the new entrant might challenge the old oligopoly members and with its new strategy can catch a significant market share to sustain its future growth as witnessed in case of France. The best case scenario for Czech Republic is that there will be a new entrant so that a similar development pattern than in France would occur. Though as of May 2012 nothing is decided, as all current players declared intentions of taking part in the frequency auction. From this point of view everything can be open, being sure that a potential entry of a fourth operator will be warmly welcomed by general public and considered as a challenge by the remaining market players.

Introducing additional industry professional views on the number of players and competition, the ITU obviously strongly encourages additional, new subjects. In a

⁸⁴ Good example on number of market participants was provided by Katz (1994). In his textbook he identified seven oligopoly market structures with five of them consisting of three or four players.

similar way the organization does not explicitly specify any optimal number of market participants as the consultancy does, yet it identified three steps how to nurture competition in the industry. All of them, first provided by former ITU former Secretary-General Tarjanne (1999), are highly attractive and relevant, not only for the Czech telecommunications market, but other similar markets as well.

First step is reducing entry barriers into the industry and facilitating investment and divestment. All markets are prone to cartelization and price fixing. Additional competition will mitigate these trends, whereas the best possible solution is when the new entrants are a foreign/outside subject. Foreign subject is better as it can bring in new innovative business models (as the French example) and might be more inclining towards fierce price competition than a domestic 4th operator which can be under the influence of the old industry members. As far as it is known to the time of finalizing the thesis, there are both domestic and foreign subjects interested in the frequency auction. Deciding which of the two types is better would be rather short-sighted as the criteria for all of them are the same; however the idea that foreign might be better sounds very attractive.

Second step is promoting free flow of information, especially price and service quality. Witnessed in *Chapter 5.2*, any price comparison is very hard to put together. Many times the price policies and their various combinations are too complicated and confusing. Better comparability among the prices and services offered would greatly benefit the Czech telecommunications markets.

Third step is connected with the already mentioned globalization of telecoms. Telecommunications are globalizing, so should as well the regulatory authorities and competition policy makers. Telecommunications industry shows similar development patterns all over the world; coordination of actions, policy recommendations and even frequency spectrum auctions are a field where convergence is possible.

6.5 Final remarks

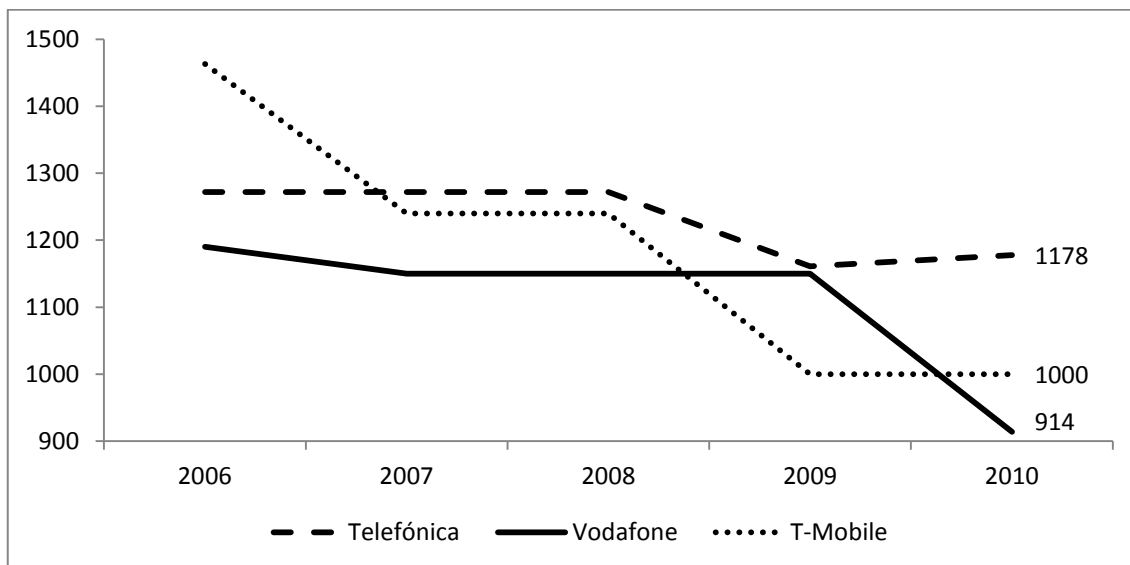
Strategic behaviour whether game-theory based or not, is a very sound justification for any series of actions where players intend to maximize their payoffs meanwhile not neglecting their competitors. The best examples and application for game-theory appear to be pricing strategies and market entry strategies, as were illustrated in *Chapter 4.4* and *5.4*. Trying to propose a type of final model for telecommunications industry is a thesis exceeding task, however some strong points of decision making in telecommunications industry have been presented.

Any strategic decision making process is usually connected with a wide range of uncertainty in any future prediction (Courtney, et al., 2000). The thesis provided some general examples of real case applications of basic game-theory models and approaches. More complex and precise models might be considerably difficult if impossible and often of disputable practical application. Yet some basic and simple models developed for practical approach on the Time Value of Money might be an attractive decision making tools in further game-theory simulations.⁸⁵

⁸⁵ Attractive approaches might be strategic simulations of Future Cash Flows, Net Present Values and others.

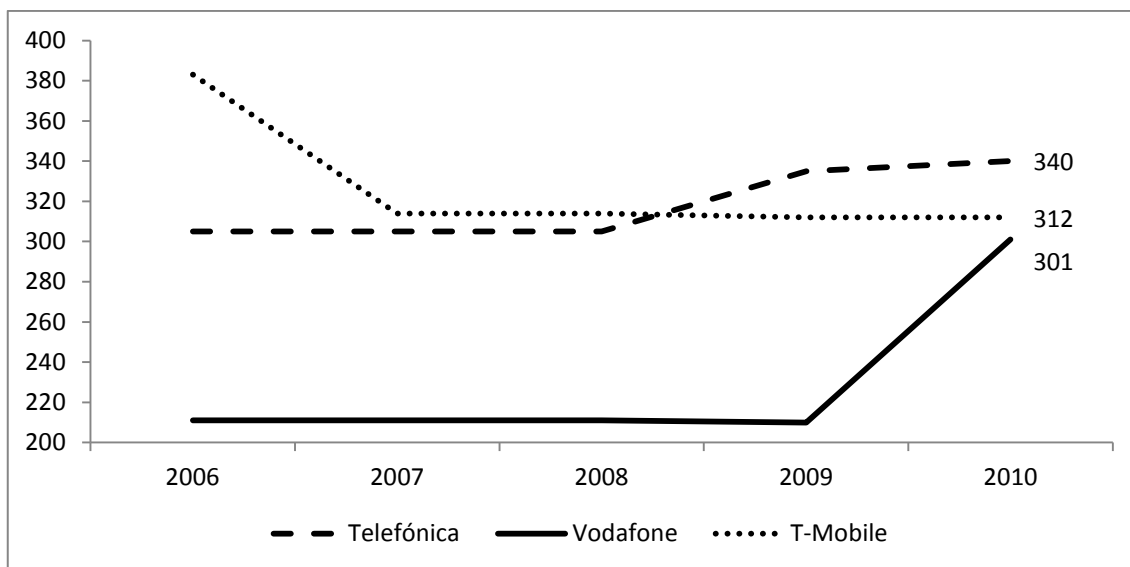
7 Appendix

Figure 27 High consumption basket [in CZK]



Source (Český telekomunikační úřad, 2011)

Figure 28 Low consumption basket [in CZK]



Source (Český telekomunikační úřad, 2011)

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