Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER'S THESIS

Definition of Relevant Market in Rail Transportation on the Route Prague - Košice using consumer survey

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Declaration of Authorship

The author hereby declares that she compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, July 29, 2016

Acknowledgments

Abstract

The aim of the thesis is to define the relevant market in railway transportation on the route Prague - Košice. In the theoretical part we describe the concept of relevant market, its use and importance for competition policy. We explain methods used for defining the relevant market and focus on the SSNIP test and its practical application, critical loss analysis. In the empirical part we conduct a consumer survey among passenger on the route Prague - Košice and use its results to compute elasticity of demand for rail transportation on the route Prague - Košice and then we perform critical loss analysis.

JEL Classification	C80, C81, D42, D47,K21, L41, L92
Keywords	relevant market, SSNIP test, critical loss analysis, critical elasticity, critical loss
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Abstrakt

Cieľom práce je definovanie relevantného trhu v odvetví železničnej dopravy na trase Praha - Košice. V teoretickej časti popisujeme koncept relevantného trhu, jeho využitie a význam pre hospodársku súťaž. Vysvetľujeme metódy, ktoré sa na vymedzenie relevantného trhu používajú a podrobnejšie sa zameriavame na SSNIP test a jeho praktické prevedenie formou analýzy kritickej straty. V empirickej časti sme uskutočnili spotrebiteľský prieskum medzi cestujúcimi na trase Praha - Košice a jeho výsledky použili na výpočet cenovej elasticity dopytu po železničnej preprave na trase Praha - Košice a prevedenie analýzy kritickej straty.

Klasifikácia	C80, C81, D42, D47,K21, L41, L92
Kľúčové slová	relevantný trh, SSNIP test, analýza kritickej straty, kritická elasticita, kritická strata
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Acronyms

CE   critical elasticity

CL   critical loss

ČD   České dráhy

EC   European Commission

EU   European Union

LE   LEO Express

RJ   RegioJet

TFEU Treaty on the Functioning of the European Union

SA   Student Agency

SSNIP small but significant non-transitory increase in price

ZSSK Železničná spoločnosť Slovensko

Master's Thesis Proposal

Author:	Bc. Zuzana Juhásová
Supervisor:	PhDr. Pavel Vacek Ph.D.
Defense Planned:	September 2016

Proposed Topic:

Definition of relevant market in rail transportation on the route Prague - Košice using consumer survey

Motivation:

The aim of the thesis is to define the relevant market in rail transportation on the route Prague - Košice. The definition of relevant market is important for competition policy and is used by regulatory authorities as the first step for the assessment of infringements of the competition rules. The route between Prague and Košice was chosen because of the past dominant position of the operator České dráhy on railway, high competition between rail and bus transport and recent entrance of new competitors on the railway market, which lowered the prices, improved the services and comfort and heightened the competition even more. In previous years, activities of operator Student Agency were intensely watched by competition authorities, especially on the routes within the Czech Republic. The company entered the Slovak transportation market as well, causing huge competition within public transportation. With its pricing policy, it even forced ZSSK to stop dispatching IC trains between Bratislava and Košice. Therefore, we will have a closer look at RegioJet and try to determine if it could be a hypothetical monopolist within the railway market on the route Prague - Košice.

Hypotheses:

Hypothesis #1: Bus is a perfect substitute for rail transportation on the route Prague - Košice.
Hypothesis #2: The operator RegioJet forms a separate relevant market on the route Prague - Košice.
Hypothesis #3: The demand for rail transportation on the route Prague - Košice is inelastic.

Methodology:

The first part of the thesis will be focused on theoretical concept of relevant market. We will describe the methods of defining the relevant market and the application of SSNIP test. Then the characteristic of transport situation on the route from Prague to Košice will follow. For the empirical part of the thesis we will conduct a consumer survey among passengers travelling by train from Košice to Prague during different times and days. Survey will be conducted by directly asking customers at the train station of the particular rail operator. The focus of the survey will be on the reaction of customers on a hypothetical increase in the price of their ticket. The data collected will be used to compute elasticity of demand for rail transportation. We will than perform the SSNIP test by critical loss analysis.

Expected Contribution:

We will study the market for transportation services from Prague to Košice and analyze the demand for rail transportation on the route and price sensitivity of passengers. Using the data from the survey, we will compute elasticity of demand for rail transportation. I will use the computed elasticity to define the relevant market for transportation from Košice to Prague. I will examine if the bus and rail transportation form one market and if bus is a perfect substitute for rail transportation.

Outline:

1. Introduction
2. Relevant market: definition, its importance, methods of defining relevant market
3. SSNIP test
4. Market situation: characteristics of transport, means of transport, providers on the route from Prague to Košice
5. Consumer survey: theoretical concept, application of tests
6. Results: discussion of the findings and their analysis
Conclusion

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Author   **Supervisor**

1 Introduction

Most recently, competition authorities tend to support their decisions by economic analyses. One of the areas where more economic approach is necessary is the definition of relevant market. The definition of relevant market is fundamental for the assessments of the infringements of the competition rules done by regulatory authorities. They have to ensure that a firm's behavior does not limit competition.

The objective of this thesis is to define relevant market in rail transportation on the route Prague - Košice using consumer survey. The topic was chosen for several reasons. The first is that the railway market is newly competitive market that emerges after recent liberalization and ensuring healthy competition on it is a current issue in the European Union. The challenge of railway transportation is that it is very specific. Operating on the railway market requires large initial costs and good infrastructure. It is regulated by the state and some operators receive high subsidies for providing transportation services. The route from the Czech capital Prague to the second biggest city in Slovakia, Košice was chosen because just recently, two new rail operators entered the market almost at the same time making the competition more intense. We want to study how strong competition between rail and other modes of transport is and which products consumers regard as substitutes.

The thesis is structured as follows: Chapter 2 deals with the theoretical concept of relevant market and what are the reasons for defining it. We describe the dimensions it has and what forms a relevant market. Chapter 3 lists methods that are used for market definition and each is shortly described. Chapter 4 than focus on SSNIP (small but significant non-transitory increase in price) test that is recently most commonly used by competition authorities. It explains its logic and practical implementation. It also points out on its downsides. Chapter 5 briefly summarizes specifics of the railway market and its definition. Chapter 6 describes in detail the transport situation on the route from Prague to Košice, different modes of transport on it and operators that provide transportation services there. Chapter 7 describes the practical implementation of critical loss analysis and Chapter 8 presents the results of the survey.

2 Definition of relevant market and its importance for competition policy

2.1 Definition of relevant market

"Relevant market" is a set of firms that produce or could potentially produce "products that are sufficiently close substitutes to take business away from any firm or group of firms that attempts to exercise market power." (Pitofsky 1990, p. 1806). Relevant market is comprised of product market (goods or services) and geographic market (locations of the producers or sellers of the products) and should be assessed as their intersection in a relevant time period. "Market power" is a firm's relative ability to profitably manipulate prices to a supra-competitive level. A firm with market power, after a price increase, will not lose its business to existing or potential competitors.

Market definition is an analytical tool used by competition and regulatory authorities[1] to assess most of the infringements of the competition rules[2], which could have negative impacts on consumers or on healthy competition among firms. The most common cases in which the analysis of relevant market is used are (i) abuse of dominant position, (ii) anti-competitive agreements, (iii) merger control[3] and (iv) calculation of fines[4].

The relevant market has to be identified with great care in order to avoid selecting too many substitute products or services and too wide of a geographical area, which would have misleading effects on assessment of market power. If the relevant market is defined too narrowly (we did not select enough substitutes) we

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[1] e. g. the European, Czech and other national courts, The Office for the Protection of Competition (Úřad pro ochranu hospodářské soutěže), the European Commission, the Federal Trade Commission, etc.

[2] the Czech law deals with competition rules, in particular with anti-competitive agreements and abuse of dominant position in "Zákon č. 143/2001 Sb., O ochraně hospodářské soutěže", the EU law in Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU)

[3] the Czech law deals with mergers in "Zákon č. 125/2008 Sb., O přeměnách obchodních společností a družstev" and "Zákon č. 586/1992 Sb., O daních z příjmů ve znění pozdějších předpisů", the EU law in Council Regulation (EC) No 139/2004 of 20 January 2004 On the control of concentrations between undertakings (the EC Merger Regulation)

[4] for more on fines imposed by the EC see e. g. Regulation No 1/2003, Guidelines, or Factsheet on Fines

might incorrectly presume that a firm is dominant because there are not enough relevant competing products. On the other hand, defining it too widely (we selected too many substitutes) might prevent us from proving the dominant position because the firm would face more competition. However, interpretation of the relevant market can differ in accordance with the intent of the analysis. The assessment of mergers is forward-looking. The competition authorities want to prevent the abuse of market power and therefore may tend to define the market more broadly by selecting too many substitute products. On the contrary, for the assessment of dominance and anti-competitive agreements in the past too narrow market can be defined by selecting not enough substitute products (Petr et al. 2010).

It has to be noted that the term relevant market in the context of competition policy is somehow different from its other uses, for instance as an area where a company sells its products, or more generally as an industry or a sector as a whole.[5]

2.1.1 Product market

Product market is defined by the European Commission (1997) as a market that is formed by those goods or services which consumers view as interchangeable or substitutable, while considering their characteristics, prices and intended use. Those goods or services constitute competitive constraints on the product of the firm being analyzed. Competitive constraints are constraints that limit the behavior of a firm when it wants to exercise its market power. There are three main types of constraints: (i) demand substitutability, (ii) supply substitutability and (iii) potential competition (ibid.).

Demand-side substitution

Demand-side substitution is the most important and effective constraint and comes from the firm's customers. They decide which products are substitutable for them and therefore form a relevant market. If the demand is elastic enough, in the event of an increase of prices, they can shift their consumption to substitute products which they regard as adequately interchangeable. In such a case a firm has to consider if the potential loss of demand will be offset by a higher margin resulting

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[5] for more on microeconomic definition of market see e. g. Mankiw (2012)

from higher prices and lower costs (due to lower output), thus making the strategy profitable.

The assessment of demand substitutability depends entirely on consumers and their preferences. They can view products with very different appearance, characteristics or intended use as close enough substitutes, regarding them as interchangeable. In this case, those products will form the same relevant market. Conversely, consumers can consider two products with very similar appearance, characteristics or intended use as not interchangeable. Therefore, those two products will form two separate relevant markets. Every product that is a close substitute for consumers should be included in the definition of the relevant market (O'Donoghue & Padilla 2013).

There are many factors that influence demand substitutability, for instance, consumers' preferences, opportunity costs (time and money spent adapting to another product), different quality of the products, or availability of other substitutes (Petr et al. 2010). Therefore, in practice, each case should be assessed individually with respect to its specific characteristics.

An example of demand-side substitutes can be a market with non-alcoholic beverages. The question of the analysis is whether or not beverages of different flavors belong to the same relevant market. In other words, if the consumers of flavor A switch their consumption to flavor B when faced with an increase of the price of the flavor A. Another analysis can study if some non-alcoholic beverages can form the same relevant market with low-alcoholic beverages. There can be also a situation when a particular brand of a non-alcoholic beverage forms a separate relevant market from other brands with similar flavor because the customers of the brand would not substitute it with another brand even after a price increase.

Supply-side substitution

Producers can face constraints that do not allow them to raise price profitably from the supply side as well. Supply-side substitution is a constraint that is connected with other suppliers that react to a price increase and can do so without incurring large sunk costs. In the short term, they can raise production of, or start producing the goods that are demand-side substitutes. These suppliers are not currently competitors but already operate on the market and would be able to easily switch production

without high additional costs. Their products can be potential substitutes for the product being analyzed and together form one relevant market.

Several cumulative conditions have to be fulfilled to determine if two products are supply-side substitutes (O'Donoghue & Padilla 2013, Motta 2004):

(i) it must be easy, rapid and feasible for other suppliers to switch their production

  o the producers must possess the assets, skills, technology and facilities to produce the product under consideration

  o they must have the access to the appropriate infrastructure and distribution channels

  o they must possess relevant marketing assets such as brand name

  o if they do not already have any of these assets, acquiring them should not incur considerable sunk costs

(ii) there must exist economic incentives for the producers to divert production, they cannot face opportunity costs

  o barriers to enter or exit the market must be rapidly and relatively cheaply overcome

  o the producers must have spare capacity available or it is relatively cheap to acquire new capacity

(iii) the consumers must regard the supply-side substitutes as valid substitutes for the products already existing in the market

An example of supply-side substitution can be a market with shoes. A shoe manufacturer producing shoes of size X can easily, quickly and without incurring additional costs switch the production to shoes of size Y and vice versa. Shoes of size X and Y are supply-side substitutes and form one relevant product market, but they are not demand-side substitutes. Consumers buying shoes of size X would not switch the consumption to shoes of size Y after the price of the shoes they need increases.

Potential competition

Potential competition is based on the ability of firms that do not currently operate on the market to enter in the long term. They can start producing demand-side substitutes which can be considered for the definition of a relevant market.

Potential competition is a different constraint than supply-side substitution. They can be distinguished in at least three respects. First is the length of time that it takes for a potential competitor to start supplying the product on the market. It may be more than a year after the price rise, while supply-side substitution takes place immediately. Second is their commitment to entry. As easily, quickly and without additional costs as a supply-side competitor can enter the market, she/he can exit it in the same fashion. A potential competitor has to make a strong commitment investing a considerable amount of resources that are not reversible. The last one is the price they respond to in the market. Potential competitors do not take into account current, modest and potentially temporary price increases. They rather focus on the price level prevailing after they start supplying the product (O'Donoghue & Padilla 2013).

1.1.2 Geographic market

The European Commission (1997) defines geographic market as the area where undertakings operate. The conditions of competition are homogenous in that area and therefore it can be distinguished from neighboring areas where the conditions are different.

These conditions are, for instance barriers to entry, different costs, different prices and consumer preferences as well as different government policies such as state regulations, state monopolies or different tax system. They should be sufficiently homogenous because the homogeneity defines the size of the area. In these terms, the relevant geographic market may be global, regional, trans-national, national, sub-national or even a single geographic location (O'Donoghue & Padilla 2013).

1.1.3 Time dimension

Time dimension is an important feature of market definition. A service provider can price discriminate consumers with respect to the time when the service is offered. If consumers are not time-flexible, the provider can set different prices for the period of peak demand and decrease the price when the demand is lower; and does not have to be concerned about losing profits (Petr 2010).

Time dimension is essential for both supply and demand. From the point of view of the demand side, we need to know if products are homogenous during all time periods. On the supply side we need to consider factors that can change the

conditions of competition, in particular how quickly a competitor can enter or exit the market (ibid.).

Time can be a critical feature of market definition especially in transportation sector. Different time schedules can form separate markets and therefore are not substitutable for consumers. The transport operators can set lower prices when the ticket is bought well in advance, or, conversely, a very short time before the departure. The prices of tickets can differ also according to peak hours or days, for instance in the morning or evening when people commute to or from work or on Fridays or Sundays when people travel out of or back to the cities during the weekend. Those consumers are not price-elastic because they cannot choose a different time for their journey.

Another example of the relevance of time dimension is in the market for restaurants. Some restaurants can be part of the same market during lunch time when the consumers need a quick, affordable and easily accessible meal, but form different markets when they want to go to a more luxurious dinner or have a celebration (Motta 2004).

2.2 Importance of the relevant market

The main objective of the relevant market definition for competition authorities is to identify those competitors of the undertakings in question that are able to impose constraints on the behavior of those undertakings and investigate how strongly the constraints are imposed by competitors, customers or consumers (European Commission 1997). This helps to determine the degree of independence of a firm which, in turn is used to assess market power of the firms and also type of competition in the market.

The analysis is used by competition authorities in the following cases:

(i) abuse of dominant position, (ii) anti-competitive agreements, (iii) merger control and (iv) calculation of fines. The first step of investigation of these cases is to determine the relevant market.

Abuse of dominant position

Competition law[6] prohibits conduct by firms that abuses their dominant position on a particular market. Examples of abusive conduct include exclusive dealing, tying and bundling, predation, refusals to deal and margin squeeze, excessive pricing and royalty rebates.

Anti-competitive agreements

The next application of the use of the market definition concerns prohibition of anti-competitive agreements between firms that may negatively influence trade.[7] There are two types: horizontal agreements (firms operate on the same level of the supply chain) and vertical agreements (firms operate at different levels of the supply chain). Examples of such agreements include price-fixing or market-sharing cartels.

Merger control

The third use of market definition is connected to the merger control regime. Mergers can lead to a reduction of the competition in the market and strengthen market power by creating a dominant player. This can, in turn, result in higher prices, reduced choice or less innovation, which are factors that harm consumers. Therefore, mergers have to be first examined by a competition authority.[8] The examination will show if the merger would impede effective competition.

Calculation of fines

The amount of a fine is usually determined by a certain percentage of annual sales of the product concerned by the infringement. The relevant sales are the sales of the product in question on the relevant market, so the relevant market has to be defined first.[9]

Some scholars question the importance of defining the relevant market, arguing that incorrect definition leads to misinterpretation of the structure of the market and the market power, and a bias in the overall analysis. Kvizda (2015)

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[6] in the European Union Article 102 of the Treaty on the Functioning of the European Union (TFEU)

[7] in the European Union it is prohibited by Article 101 (1) and (3) TFEU

[8] in particular by The Office for the Protection of Competition in the Czech Republic or by the European Commission if the merger is at the European level. The legal basis is set in Council Regulation (EC) No 139/2004, the EU Merger Regulation.

[9] for more on fines imposed by the EC see e. g. Regulation No 1/2003, Guidelines, or Factsheet on Fines

suggests that the origins of this critique lie in the inconsistency between the microeconomic theory and the procedures used by regulatory authorities and courts to define the relevant market. He summarizes the most important studies that argue for and against the definition of the relevant market and he concludes that it has its theoretical rationale, at least in cases such as markets with heterogeneous production, potential supply-side substitution, or when there are no available and reliable sources about costs and price trends. In addition, the definition of the relevant market is used in practice by European, as well as Czech, competition authorities, and it is also part of competition legislation. Therefore, it makes sense to use this concept and apply it to the assessment of anti-competitive practices.

3 Methods of defining the relevant market

There are various methods that can be used to determine a relevant market. Application of each method depends on characteristics and specifics of the market under investigation, and on the availability of the data needed to make an analysis.

In general, we can divide the methods into qualitative and quantitative. In simple words, we can say that qualitative methods are based on the appraisal of the characteristics, basic features or intended use of products. Quantitative methods, on the contrary, use statistical data and econometric models. There is no rule regarding which method should be used.

Even though the assessments are made by an expert, there can be problems with objectiveness of assessment, transparency and relevancy of results. For some sectors and some products the estimations may be relevant and robust, but for others it can be impossible to define the relevant market precisely enough with just one method.

It is preferable therefore to use both qualitative and quantitative methods where possible, because they complement each other and make the analysis more relevant and reliable. However, recently the competition authorities tend to use more economic approach, i. e. quantitative methods.

An important consideration for the decision about the method used is the type of substitution we want to analyze. We can use different methods for defining the demand-side substitutes than for defining the supply-side substitutes.

Other factors that influence the suitability of the method to be chosen are based on the assessment of the product's characteristics:

- physical and/or technological similarity - products that have the same physical and technological features belong to the same market. The applicability is, however, limited to, e.g., capital goods, intermediate products, raw materials, etc.; but not to consumer goods.
- consumers' reaction - substitutability of products is assessed with respect to consumers' reactions. Factors such as advertising,

availability of information for consumers, etc. are included in the assessment. This concept can be applied universally for any goods because it uses analysis of consumers' preferences and willingness to substitute products. To assess the reactions on a hypothetical increase in price, analysis of price trends and elasticity of demand in the past, consumer surveys are used.

- functionality - substitutability is determined objectively according to the function products have. The use of this concept is limited to products for which we can undoubtedly specify its use and substitutability.

3.1 Qualitative methods

Qualitative methods presume that the similarity of products' characteristics can determine the degree of substitutability. Qualitative assessment is usually the starting point of a market definition. Assessment of the most basic qualitative characteristics of products narrows down the set of potential substitutes to those that are relevant and plausible. Clearly, we would not consider chocolate being on the same market with screwdrivers and we do not need any formal analysis to conclude that their prices are not sensitive to each other. Qualitative methods therefore can help us choose potential substitutes for quantitative analysis.

3.2 Quantitative methods

Quantitative methods use analytical tools to assess the substitutability between products. They are based on a principle of different consumers' perception of a product's characteristics. The degree of substitutability is measured by the effects of these characteristics.

There are two approaches to the use of quantitative methods: (i) elasticity approach and (ii) price-test approach (Kvizda 2015, p.18). The methods which result from elasticity approach study the sensitivity of consumers to price changes. The methods that result from price-test approach study the comparability of prices and their development. These price analyses are based on intuition that if two products are on the same relevant market, their prices cannot differ significantly and diverge in

the long-term. Therefore, they are intended to determine if the changes in prices are correlated.

Quantitative methods include:

- price correlation analysis - assumes that if the prices of two goods move together in time (a strong positive correlation[10]), then they should be substitutes because a change in their relative prices[11] would trigger a process of demand-side or supply-side substitution that would bring the relative price back to its starting point. Application of correlation analysis can be dangerous because it presents several problems: defining the threshold correlation coefficient is arbitrary, the correlation may be spurious, it cannot be used for non-stationary time series, and it can be invalid on markets with imperfect substitutes or asymmetric shocks to demand (O'Donoghue & Padilla 2013, Davis & Garcés 2010, Horowitz 1981, Cartwright et al. 1981).

- co-integration analysis - estimates possible relationships between economic data series that are non-stationary, i. e. it varies over time without any long-run stable relationship. Two non-stationary price series are co-integrated if their linear combination is stationary and exhibits a long-run relationship. If prices of two products are co-integrated, it means that there is a strong relationship between them and they may be interchangeable, and therefore in the same market. This analysis is superior to price correlation analysis because it uses relative price changes, and therefore trends cancel each other out and do not influence the results. However the problem is that the analysis cannot be used in short-time horizon (Bishop & Walker 2010, O'Donoghue & Padilla 2013, Coe & Krause 2008).

- Granger causality analysis - tests "whether lagged values of one variable contain marginal predictive content for another variable above and beyond what is contained in that variable's own lag" (Coe & Krause 2008, p. 987). It explains the change of the price of a product using the price change of its potential substitute taking into account

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[10] the correlation coefficient is 1 if the prices of two products move perfectly in line with each other; 0 if there is no relationship between the prices and -1 if

[11] the ratio of the price of one product with respect to the other product

past values of their prices. If two products are in the same market, then their price series would be expected to be linked. The advantage of this analysis is that it can define the relevant product and geographic market at the same time. However, it has limitations in short-time horizons, and problems with determining the benchmarks for substitutes (Bishop & Walker 2010, Cartwright et al. 1989).

- stationary analysis (unit root test) - tests if prices tend to return to the equilibrium level after a shock to one price series. If two products are in the same market their prices should not diverge too much, so that a shock to the price of one product should have only a temporary effect on their relationship. When a shock raises the price of product A, consumers start to substitute away to product B, causing the price of product A to fall and the price of product B to rise. Eventually, the relative price of the products returns to a long-run equilibrium level. On the contrary, if there is no long-run equilibrium relationship between prices, the products are not in the same market, then a shock will have permanent effect on the relative price. This analysis is more reliable because it uses relative prices, and therefore is immune to inflation, variable exchange rates or other problems of price correlation analysis. However, the analysis can be used only for stationary price series and it does not work for substitutes with different reactions to demand shocks (Bishop & Walker 2010, Coe & Krause 2008).

- shock analysis - examines products, producer, margins and market shares in the market after an external shock. It uses past events to give information about the nature of competition in the market. After a shock has occurred to an industry we examine if the response of the industry is anyhow important to us. The types of shocks include: new product launches, exchange rate shocks, differential input cost shocks, effect of advertising campaigns. If there is a shock to one product and we see a response in another product, they are supposed to be in the same market. The problem of this analysis is that there might not have been any shocks to the industry in the recent past, or the responses to

them are not present or very informative, so that the analysis cannot be carried out (Bishop & Walker 2010, Daljord et al. 2007).

- SSNIP test[12]- is based on the assumption of a hypothetical monopolist who permanently increases the price of a product by a small but significant amount. It tries to find out if the price increase would be profitable, i. e. if the hypothetical monopolist's customers would switch their consumption to an alternative product. The analysis can be obstructed by the lack of available data, especially on margins (Motta 2004, O'Donoghue & Padilla 2013).

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[12] small but significant and non-transitory increase in price

4   SSNIP test

The name of the SSNIP test - Small but Significant Non-transitory Increase in Price - tells us the logic of it; if it would be profitable for a hypothetical monopolist to increase the price of a product by a small but significant amount permanently, ceteris paribus.

The SSNIP test is based on the estimation of the change in profits of a hypothetical monopolist resulting from the change in behavior of consumers after the price of the product increased by 5 - 10 % (Motta 2004). If the demand for the product is not very elastic, the price increase causes only a small number of consumers to switch to substitutes and the producer's profit rises, then the product forms a separate relevant market and it doesn't have any real substitutes. If the demand for the product is more elastic and after a price increase consumers switch their consumption to substitutes, causing the producer's profit to fall, then the relevant market does not consist only of this product and we need to define it more widely (Kvizda 2015).

The test is also referred to as "hypothetical monopolist test" and is based on the demand-side substitutability. It originated in 1982 in Horizontal Merger Guidelines issued by US Department of Justice. At the beginning, the test was used to analyze market shares for merger control purposes. Only later it started to be used for market definition in general, and recently has become the most common method for market definition (Motta 2004). The test can be used for both, product and geographic market definition.

The SSNIP test is performed in three stages. In the first stage, the candidate products for hypothetical monopolization are defined. They form the so-called "candidate market". A candidate market is a market formed by the products or services of the allegedly dominant firm under investigation.

In the second stage, the effects of demand-side substitution are examined; how the profits of the hypothetical monopolist will be affected by a price increase. The question is whether customers would prefer to buy a substitute product from outside the candidate market rather than to pay more.

In the third stage, the effects of supply-side substitution are examined. The question here is if the producers from outside the relevant market, after a price increase, would be able to quickly enter the market and offer substitutes (O'Donoghue & Padilla 2013).

The process of defining the relevant market begins by choosing a single candidate product because we want the narrowest candidate market. Only after the market cannot be defined, i.e. the price increase would not be profitable for a hypothetical monopolist, can we add a substitute product from outside the candidate market and start the analysis from the beginning. The process continues until the market in which a hypothetical monopolist would be able to raise prices profitably for a sustained period of time is defined.

The more we widen the relevant market, the lower the elasticity of demand. Even in the case of a very wide relevant market, we need to get to the point where the demand is so inelastic that the price increase in the whole market would be profitable (Mankiw 2012).

4.1 Application of the SSNIP test[13]

The definition of the SSNIP test is easily understandable, but it is more important to implement it correctly. There are two approaches to the application of the test. The first way is to use price analyses such as price elasticities, cross-elasticities, correlation analyses, etc., which are indirect application of the test because they do not give a direct answer as to whether products form the same market. The second and most commonly used is critical loss analysis, which is direct application of SSNIP test because it directly answers the question of whether products belong to the same market or not (Jones & Sufrin 2008).

The basic idea of critical loss analysis is to compare the real loss of profits caused by a price increase with a benchmark - critical loss - to which increasing the price is still profitable. Profit of a hypothetical monopolist is equal to total revenues from which we subtract fixed and variable costs. Fixed costs do not change with the amount of output produced; therefore firms which are deciding to lower or rise production consider only variable cost. A price rise has two effects. Some customers

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[13] this part draws heavily on Hüschelrath (2009)

switch their consumption to a substitute product (if available) thereby decreasing the demand for the product, and therefore decreasing the profit of the monopolist[14]. On the other hand, a higher price (ceteris paribus) constitutes a higher margin that generates a higher profit per every item sold. Increasing the price is profitable only if the second effect prevails. If the first effect was stronger, the hypothetical monopolist would lose by increasing the price. Hence, profitability depends on the price elasticity of demand for the product and the margin. The critical loss is therefore defined as a percentage decrease in demand that causes the unprofitability of a price increase. If the real loss were smaller than the critical loss, increasing the price would be profitable and the candidate market is the relevant market. Otherwise, we need to add a substitute product to the candidate market.

The formal process of the critical loss analysis has three steps:

1. determination of the critical loss and critical elasticity
2. estimation of the actual elasticity and the actual loss in case of a price increase
3. comparison of the computed values and decision about profitability or unprofitability of the price increase and conclusion about the relevant market

4.1.1 Calculating critical loss and critical elasticity

Critical loss of volume is a value for which the profits of a hypothetical monopolist before and after SSNIP (5 - 10 %) are equal. In other words, the revenues from raising the margin are equal to the loss from a fall in demand.

The starting point is the equation for the relationship between the profits (assuming linear demand curve):

$$\pi_0 = \pi_1 \tag{1}$$

where

π_0 is profit before a price increase,

π_1 is profit after the price increase.

The profit before a price increase is given by

$$\pi_0 = (P_0 - c)Q_0 \tag{2}$$

the profit after a price increase by

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[14] we assume that possible cost savings from lower production do not exceed lost revenues

$$\pi_1 = (P_1 - c)Q_1 \tag{3}$$

where

P_0 and P_1 are the initial and new prices, respectively

Q_0 and Q_1 are the initial and new quantities demanded, respectively

c is a constant marginal cost.

Hence, in the situation of unchanged profit and increased price, the equation can be rewritten as:

$$(P_0 - c)\,Q_0 = (P_1 - c)Q_1 \tag{4}$$

we know that $P_1 = P_0 + \Delta P$ and $Q_1 = Q_0 + \Delta Q$

where $\Delta P = P_1 - P_0$ and $\Delta Q = Q_1 - Q_0$, so the equation becomes

$$(P_0 - c)\,Q_0 = \left(P_0 + \Delta P - c\right)(Q_0 + \Delta Q) \tag{5}$$

and after rearranging we obtain

$$\frac{\Delta Q}{Q_0} = \frac{-\Delta P}{P_0 + \Delta P - c} \tag{6}$$

and for the critical loss we have the formula

$$-\frac{\Delta Q}{Q_0} = \frac{X}{X + m} \tag{7}$$

$$Critical\ loss = \frac{X}{X + m} \tag{8}$$

where

$X = \Delta P / P_0$ is a percentage price increase

$m = (P - MC)/P$ is the initial margin.

Alternatively, we can write the equation as:

$$\%\ Critical\ Loss = 100x\, \frac{\%\Delta Prices}{\%\Delta Prices + \%Initial\ margin} \tag{9}$$

The value of the critical loss, as can be seen from the equation, is directly proportional to the value of the price increase and inversely proportional to the value of margin. It follows, that a higher margin lowers critical loss so that if the monopolist has high margins every customer that switches to a substitute constitutes a higher loss.

Another possibility is to calculate critical elasticity. Critical elasticity is the value of own-price elasticity of demand for which the price increase will not affect the profits of the producer. In other words, it is the elasticity for which the revenues from higher margin are equal to the loss caused by lower demand. Using the same logic as for deriving the critical loss formula, we can derive the formula for calculation critical elasticity of demand (Massey 2000):

$$Critical\ elasticity = \frac{1}{X+m} \tag{10}$$

As the critical loss, the critical elasticity also depends on the initial margin and the price increase. If the initial elasticity of demand exceeds the critical elasticity, then it means that the loss of sales caused by the price increase will not be offset by a higher margin and the products in question do not form the relevant market. With increasing margins, the critical elasticity decreases; lower critical elasticities indicate prices above the competitive level because the margins are higher (ibid.).

It has to be noted that we again assumed a linear demand curve for which elasticity increases as price rises. We expect consumers to be more sensitive to prices that are higher.

Let us make an example and assume that a firm wants to raise the price by 5% and the margin is 20% before the price increase, the critical loss can be computed as:

$$CL = \frac{0.05}{0.2 + 0.05} = 0.2$$

A firm with 20% margin raising the price by 5% can lose at most 20% of demand without any negative effects on its profit. If it loses less than 20%, the price increase is profitable.

For the same situation we can compute the critical elasticity using the formula ():

$$CE = \frac{1}{0.2 + 0.05} = 4$$

For values of the price elasticity of demand higher than 4, increasing the price by 5% would be unprofitable and vice versa. If the actual price elasticity of demand is 4, the profit remains unchanged.

The calculation of the critical loss or critical elasticity itself is straightforward but it largely depends on the accuracy of the input data. We need the exact value of the margin, which can be difficult to obtain. The first reason is that the data on prices, margins and costs are a part of the business secret of firms and they are not willing to share them even with the competition authorities. Secondly, in some cases we need to distinguish between variable and fixed costs and allocate them to the particular product, which in some industries may require the help of a professional expert. However, as Hüschelrath (2009) points out and what Gaynor et al. (2013) suggest, using accounting data to allocate the costs is more rigorous than just relying on what

firms claim to be their margins. They have incentives to identify a large fraction of the costs as fixed, and therefore lowering the variable costs so that the margin is higher. Incorrect identification of variable costs can lead to incorrect market definition. High margins tend to be associated with defining the market too widely and lower margins with defining the market too narrowly.

4.1.2 Estimating actual loss and elasticity

Nevertheless, the computed value of critical loss does not tell us whether a firm loses any profits in reality. To determine this we need to proceed to the second step - computation of the actual loss of the firm. For the estimation we need to know the actual reactions of the marginal customers. The starting point is computation of own-price elasticity of the product that represents the percentage change in demand with respect to the percentage change in price (Hüschelrath 2009). In other words, how much of the product demanded is lost because of the $x\%$ increase in price. Estimation of the own-price elasticity of demand follows from the basic formula (Mankiw 2012):

$$\varepsilon = \frac{\%\Delta Q}{\%\Delta P} \qquad (11)$$

Actual loss after rearranging can be computed as:

$$AL = x * \varepsilon_{own} \qquad (12)$$

where

ε_{own} is own-price elasticity;

$\varepsilon_{own} = \frac{P}{Q} * \frac{\Delta Q}{\Delta P}$;

x is % price change of the product.

It can be seen that the higher the own-price elasticity, the higher is the actual loss.

The information about elasticity of demand that is needed for the estimation of actual loss can be obtained through several methods. The easiest case is when the firm has already increased the price (more times) in the past. We can than estimate hypothetical decline of the demand now. Another approach is to use econometric models and tools to analyze time series to predict a hypothetical decline. The downside of this method is the necessity of relevant data. They may not even exist or firms are not willing to share them. An alternative and widely used approach to obtain the data needed is a consumer survey. A sufficient number of consumers are

asked directly if in the case of a price increase they would switch their consumption to a substitute product. However, it does not answer the question about decline in demand directly, but we have to make the conclusions according to the information about demand from the results of the survey (Massey 2000). An advantage of this method is that it is independent of the firm's willingness to provide data.

4.1.2.1 Consumer survey methodology

For the design of the survey we need to keep in mind specific features of our research problem. The first step is to choose the most appropriate method for obtaining the data, then select the right questions, and sample sufficient number of adequate respondents. We have to carefully consider specific criteria such as response time, costs of obtaining the data, quality and validity of the data and flexibility of design of the survey (Wang 2010).

When we want to conduct a survey we need to think first about the purpose of the research and what kind of information we want to get out of it. Kozel et al. (2011) defines two steps to follow, the first is to define the problem of the research, formulate the aims, create the questionnaire and analyze the situation; the second is to collect the data, analyze them and make conclusions.

The aim of the consumer survey is to obtain information about consumer preferences and how they change with respect to a price increase. This information helps to model the elasticity of demand.

The next question is how to get the data. There are three methods:

(i) observing, (ii) interviewing, and (iii) using an experiment (Kozel et al. 2011).

The survey can be conducted by four main techniques:

- face-to-face
- by mail
- by phone
- online

Interviewing by mail and phone has many disadvantages. Even if it were possible to identify the targeted group, it would be very hard to get the customers' phone numbers or addresses. Moreover, the method is too time-consuming and costly.

In case of online interviewing the situation is not clear. A form with questions could be easily and affordably created and then customers could be asked to access it and fill it in. However, problems with this method could include low validity of the answers, longer response time and lower response rate.

Advantages of face-to-face interviews are direct contact with the respondents, and therefore higher motivation to answer, immediate responses and the possibility to explain the questions if necessary. According to Kozel (2011) we can get the highest number of responses returned from this method, and it does not make any difference if the questionnaire is filled in by the respondent or by the interviewer.

To ensure the validity of the research we need to survey enough respondents. The key for determining the required number of responses is to estimate the population, i. e. the size of the market. According to the size of the population, we can choose the appropriate method for computing the required sample size (Kvizda et al. 2013).

Kvizda et al. (2013) following the methodology of Bartlett et al. (2001) recommend the following formula to compute the minimum number of returned questionnaires:

$$n_1 = \frac{n_0}{1 + \frac{n_0}{population}} \qquad (13)$$

where:

n_0 is required return sample size based on Cochran's formula

$n_0 = \frac{t^2 pq}{d^2}$, where t is the standard normal quantile,

p is the estimated proportion of an attribute that is present in the population,

q is $(1 - p)$,

pq is the estimate of variance

d is acceptable margin of error for proportion being estimated, i. e. confidence interval

$population$ is the population size

n_1 is the minimum required number of obtained responses.

4.1.3 Comparison of the critical and actual loss

The last step in critical loss analysis is to compare the results from the previous two. If the SSNIP caused the decline in demand to be lower than the computed benchmark, i.e. the actual loss were lower than the critical loss, then the hypothetical monopolist's profits would be higher. We could conclude that the candidate market is the relevant market. If the other situation were the case, i. e. the actual loss were higher than the critical loss, then the candidate market is too narrow.

However, we should not be tempted to make conclusions about the relevant market too quickly. It might seem very easy to compare the losses and determine the broadness of the market. But the analysis has to take into account specifics of the industry and the market. For instance, an unprofitable price increase may not be just a result of the existence of relevant substitutes. Another reason could be that some customers just stopped buying the product because the price was too high or moved to another geographic market.

4.2 Criticisms of the SSNIP test

Even though the test has many advantages, it raises several questions about its application. The most common problem is known as "cellophane fallacy".[15] It refers to a situation in which there already exists a strong dominant firm in the market that has set the prices at a supra-competitive level. The elasticity of demand might be large in this case because the price is so high that the consumers would switch their consumption to products that they would not normally regard as credible substitutes when the price is at a competitive level. Therefore, the prevailing price cannot be used for the test because it would lead to defining the market too widely and subsequently underestimating dominance (O'Donoghue & Padilla 2013).

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[15] The term "cellophane fallacy" originated in the U.S. vs. DuPont case in 1956. The question was whether cellophane represented a market itself or whether other "flexible packaging material" should be included. DuPont sold 75% of all cellophane, but its market power on all flexible packaging material market was just 20%. The U.S. Supreme Court ruled out that the relevant market comprised all flexible packaging material clearing DuPont of alleged dominance because it found considerable evidence of demand-side substitution between cellophane and other flexible packaging material, e. g. greaseproof paper. If the Court took into account DuPont's market power on the cellophane market and considered that it had been already monopolized than the price would be at supra-competitive level which would mean that consumers switched their consumption to products that would otherwise not be substitutes for them.

The problem of cellophane fallacy can be resolved. However, there is no single or best solution. Which solution to choose depends on the availability and the extent of the evidence of the excessive prices. We could estimate the competitive price before performing a critical loss analysis. However, this is not very realistic because the definition of competitive price is very vague and estimating it can be troublesome. Moreover, finding the competitive price level would directly reveal dominance, so there would be no need for the test. Using both qualitative and quantitative evidence might also help to avoid defining relevant markets incorrectly. It is important to consider if the differences in products influence demand and if the characteristics and the intended use of the products influence substitutability. As another solution we can use other comparable markets that are more competitive than the one under investigation as a crosscheck. If the price levels do not differ significantly, it is probable that the cellophane fallacy should not be of our interest. An alternative check can be observing if the allegedly dominant firm reacts to price changes and new product introduction of potential rivals. The products are then most likely substitutes and the areas where the rivals operate are probably the same geographic market. The next proposition is to use SSNDP test - Small but Significant Non-transitory *Decrease* in Price. On the contrary to SSNIP test, it examines how a hypothetical price *reduction* of 5-10 % would influence the sales of a firm. If the prevailing price were above the competitive level, a price decrease would cause a relatively small increase in the volume of sales. Conversely, reducing competitive price would lead to a small or big output response depending on the substitutability of the products. A small increase in sales therefore indicates a proper antitrust market where market power can be exercised (O'Donoghue & Padilla 2013).

Froeb and Werden (1992) point out "reverse cellophane fallacy". It is a situation that arises for basically the opposite reason than cellophane fallacy. If the prices are below the competitive level we might observe limited switching to substitute products after a small increase in prices because of the small variation in relative prices. In this situation we would conclude a narrow market with a high potential to exercise market power. We can encounter this difficulty mostly during predatory pricing investigations but also in other contexts. An example is firms with high "menu costs" that change their prices very infrequently but by a larger amount. The prices might seem to be below the competitive level and firms might appear to have a strong incentive to increase them. But, in truth, even though they could

increase the prices, they would not do it because frequent small changes are too costly (Davis & Garcés 2010).

The next complication we can encounter is caused by putting too much importance on the characteristics and functionality of the product, which could have different meaning in terms of substitutability for the customers. Bus and rail transport might as well not be substitutes for some customers, and therefore form two separate markets. The tendency to focus on the question in general, if the product is substitutable for every customer, can lead to the so-called "toothless fallacy" (Hüschelrath 2009).

5 Specifics of market definition in railway transportation sector

The features of railway transport industry need to be considered while defining the relevant market. The demand for the transport services can be met by different rail companies or by other modes of transport, and therefore we need to distinguish demand-side substitution with regard to different modes of transport and consider it in the definition of the relevant market (Kvizda et al. 2013). We also need to model the demand curve to find out reactions of consumers. The process requires specific input data about prices and costs and is therefore not universally applicable.

For market definition, it is important to estimate the margin and distinguish between fixed and variable costs. In addition, assessment of a specific route requires allocation of costs and profits just for that route. This can be a complex task, though, sometimes even impossible, because the data are not easily comparable (ibid.). The firms often do not report the costs correctly and transparently. Even though the competition authorities have the power to get the information, many analyses cannot be performed because the data do not have appropriate or uniform structure.

Thus, besides quantitative methods, the use of qualitative methods is also needed to supplement, correct or verify the results of quantitative analysis. The main qualitative method for defining product market is a consumer survey, in particular its face-to-face version conducted directly in the train on the route in question. Before making the survey itself, we need to design the questionnaire accurately with respect to the specific case under investigation. The questions asked should include a question about the reaction to a hypothetical increase in price, and also some additional information about consumers that could divide them into groups and define the degree of substitutability correctly. The results of consumer surveys can be used for application of SSNIP test if the data on costs and revenues are available; or for direct determination of the degree of substitutability of different modes of transport; or as supplementary information for other tests (Kvizda et al. 2013).

One of the problems for the definition of the product market is inhomogeneity of the product. When choosing the candidate market we have to view the

transportation itself as the basic unsubstitutable service. The next necessary step is to identify demand-side substitution, i. e. if there are real alternatives for consumers at the particular time; and supply-side substitution. If it is realistic that another carrier would enter the market and offer substitutes.

The geographic market for passenger transport services is formed by the particular studied line and can include starting and final stations or more complex flows with overlaps. It is highly unlikely that passengers travelling between Prague and Košice would choose another destination as a substitute in the case of a price increase; so including other routes in the geographic market definition would not make sense.

Steps of the definition

1) Choosing the candidate market - passenger rail transport consists of different segments that can form a separate market, such as high-speed trains, intercity trains, commuter trains, regional trains, night trains or international trains.

2) Identifying potential substitutes, both from intermodal and intramodal competitors.

3) Estimating effects of a price increase based on the past experience, if possible.

4) Determining the line, describing the characteristics of it, finding providers that operate there and specific products they offer, choosing the time dimension, determining the hypothetical monopolist, estimating critical and actual loss, applying the SSNIP test and consumer survey, and concluding about the relevant market.

5) Verifying the validity of the methodology and results, consequences of potential errors.

6 Characteristics of the transport situation on the route from Prague to Košice

The topic of this thesis is transportation between Prague and Košice. There are several ways how to travel between these two cities. Bus and train are probably the most common means of transport. Another possibility is to travel by car, either own or by ridesharing. There is also the possibility of a direct flight from Prague to Košice and vice versa.

To understand the demand for transportation services between Prague and Košice, it is appropriate to first shortly describe the cities. Prague is the capital of the Czech Republic and a business centre in the Central Europe. Košice is the second biggest city in Slovakia located in the eastern part. It is a transport hub connecting east Slovakia with the west. It also has an airport. The eastern region has always had a high unemployment rate and historically people have come to Prague to work, mostly in the construction industry or for seasonal work. Also a lot of young people study at the universities in Prague because of their better reputation and more opportunities to find a job after school. Besides, Prague and Košice are historic cities with many sightseeing attractions so we can expect a lot of tourists travelling back and forth. Other purposes for coming to Prague are business trips, cultural and sporting events or visiting friends and family. All of these factors influence the demand for transportation services.

We expect most of the passengers on the route to be students or people working in Prague. They can be regarded as "regular" passengers who travel mostly on Fridays and Sundays. We can think of these days as of peak days. During the rest of the week (off-peak days), we can expect "occasional" passengers like tourists or people on business trips to travel on the route. Because of the relatively high prices of the tickets and the time the journey takes, we do not expect the majority of passengers to travel more than once a month.

6.1 Railway transport

The first type of transport and our primary focus is railway. The route goes from Prague, through Pardubice, Olomouc, Ostrava, Čadca, Žilina, Poprad to Košice. The distance is approximately 700 km. The fastest journey takes 7.5 hours and the longest 10.5 hours. Until fall 2014 the only company operating on the route Prague-Košice was Czech state-owned České dráhy (ČD) in co-operation with Slovak state-owned Železničná spoločnosť Slovensko (ZSSK). They dispatched four trains a day in each direction, one in the morning and three in the evening. The first competitor that entered the market was RegioJet (RJ) in October 2014. The third provider, LEO Express (LE) started the operation in December 2014.

In reaction to the entrance of the competitors ČD/ZSSK reduced the number of trains, introduced a new, more luxurious train - Pendolino, which is the fastest connection, and modified its pricing policy. Because of high demand for its services, since June 2015 RegioJet has also started to operate a night train[16], adding sleeping cars in December 2015. LEO Express added new connections in February 2016, a night train from Prague and a morning train from Košice.

The following tables show detailed schedules valid from December 13th, 2015 - December 10th, 2016:

Table 18: Train timetable from Košice to Prague

Operator	Train	Departure	Arrival	Duration	Capacity
ČD/ZSSK	SC 240 Pendolino Košičan	14:47	22:19	7:32	331
	EN 444 Slovakia	20:20	6:38	10:18	210
	EN 442 Bohemia	22:08	7:39	9:31	386
RegioJet	RJ 1012 RegioJet	7:44	15:58	8:14	476
	RJ 1020 RegioJet	21:22	5:58	8:36	656
LEO Express	LE 1354 LEO Express/1358	4:45	13:22	8:37	237
	LE 1350 LEO Express/1352	23:23	8:22	8:59	237

Source: own realization, www.cp.sk, www.cd.cz, www.zelpage.cz

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[16] At the beginning the trains went only on Thursdays, Fridays and Sundays.

Table 19: Train timetable from Prague to Košice

Operator	Train	Departure	Arrival	Duration	Capacity
ČD/ZSSK	SC 241 Pendolino Košičan	6:43	14:05	7:22	331
	EN 445 Slovakia	22:00	7:41	9:41	270
	EN 443 Bohemia	23:09	8:39	9:30	326
RegioJet	RJ 1003 RegioJet	7:46	15:44	7:58	476
	RJ 1021 RegioJet	21:46	6:14	8:28	656
LEO Express	LE 1361 LEO Express/1363	14:11	22:55	8:44	237
	LE 1367 LEO Express/1369	19:11	4:03	8:52	237

Source: own realization, www.cp.sk, www.cd.cz, www.zelpage.cz

All the companies have different types of trains and offer different services on board. Apart from price, these different services can also influence a passenger's decision about the operator they would choose for their trip; therefore what follows is a description of classes of trains, services offered and ticket prices.

6.1.1 České dráhy/Železničná spoločnosť Slovensko

Until recently, as incumbents both companies dominated the whole market of railway industry and were the only providers of train services in the Czech Republic and Slovakia. They operate together on the line between Prague and Košice, ČD on the Czech part and ZSSK on the Slovak part. They dispatch one morning train and two night trains in both directions.

Pendolino, the morning train, has 2nd class cars, a 1st class car and a bistro car. Passengers in the 2nd class receive a free bottled mineral water, are offered a selection of daily newspapers and can order refreshments from the bistro car, which the cabin crew will bring to their seat. Passengers in the 1st class are provided with sparkling wine as a welcome drink, a hot beverage and a snack. There is free Wi-Fi with on-board portal available throughout the whole train.

The night trains have 2nd class cars, sleeping cars and auto carriers with which passengers can transport their automobiles or motorcycles. The sleeping cars offer compartments with sleepers for one, two or three people, and couchettes for four or six people. Passengers can buy refreshments, drinks or order breakfast.

The price of a regular ticket (regardless of the type of a train) for an adult in the 2nd class is 1272 CZK[17], in the 1st class it is 1907 CZK, for a driver with a car it is 1709 CZK, and for a driver with a motorcycle it is 1472 CZK [18].

ČD offers discounts for pensioners (25%), students (40%), disabled people (75%), and children 6-15 years old (50%), children up to 6 years old travel for free. In Slovakia, pensioners, children and students travel for free and disabled people have a 60% discount[19].

Apart from a regular ticket, there is the possibility to buy a special offer ticket - First Minute ticket[20]. It can be purchased via the ČD eShop, using the telephone (TeleTiket service) or at the train stations.[21] It is sold at a discounted fare and can be bought no earlier than 60 days and no later than 1 day prior to the departure of the train. There are only a limited number of tickets offered for each train. The ticket is valid only on the specified train and date, and it is issued in the passenger's name and cannot be transferred to anyone else. It cannot be returned or exchanged. The price starts at 414 CZK for the 2nd class, 911 CZK for the 1st class and varies according to the day of the trip, how far in advance the ticket is purchased and how many tickets are available. The ticket cannot be combined with any other discount or special offer.

In all of the trains, reservation is obligatory and is not included in the price of the ticket. No discounts apply for any type of reservation. The following table shows the prices for all reservation types:

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[17] All the prices in this section and in the rest of the thesis are taken from the official e-shops of the companies (www.cd.cz, www.regiojet.cz, www.le.cz) and they can differ when bought by a different method than online.

[18] Up to 4 accompanying passengers can travel with a driver of a car and 1 with a driver of a motorcycle. They can buy a 2nd class ticket for 566 CZK.

[19] Both companies offer the discounts only for the respective routes on which they operate. It is not possible to buy one ticket with a discount from ČD and a "free ticket" from ZSSK; it has to be done separately.

[20] Včasná jízdenka in Czech, called Europa Expres in Slovakia

[21] There is a service fee of 50 CZK when buying at the station and also a service fee is charged as a part of a telephone order.

Table 20: Prices of reservation for ČD/ZSSK trains

Type of reservation		Price/person
Seat		83 CZK
Couchette	6-berth	166 CZK
	4-berth	248 CZK
Sleeper	3-berth	331 CZK
	double	497 CZK
	single	1159 CZK

Source: own realization, www.cd.cz

6.1.2 RegioJetThe first and biggest competitor for ČD/ZSSK is RegioJet. Having already operated on the route between Prague and Žilina, it seemed inevitable that the line should be extended to Košice. So it was in October 2014 and the prices of tickets were unbeatable. One-way ticket for an adult in Standard class cost 243 CZK. It was a day train, starting early in the morning in Prague (Košice) and ending in the afternoon in Košice (Prague).

Not only were prices incomparable, but also the comfort offered by the train is much better. The cars are more modern; all of them are air-conditioned, there are electric sockets in each compartment and free Wi-Fi with on-board portal for many entertainment possibilities. In every car there is a steward/stewardess that takes care of the passengers' comfort. The tickets can be bought online; they do not have to be printed and can be cancelled without any commissions up to 15 minutes prior to the departure. There are three classes: Standard, Relax and Business. All of the passengers receive a free bottle of mineral water, daily newspapers and magazines, can order coffee, tea or juice anytime during the journey for free and can borrow headphones. In Standard class passengers travel in compartments for 6 people. They can choose a quiet compartment or compartment for children. The Relax class is in an open car with leather seats and the possibility of a single seat. In Business class passengers travel in 4-person compartments with leather seats that can be adjusted. There are also quiet compartments. The passengers can choose from a wider variety of free newspapers, magazines and beverages. Furthermore, all of the passengers can order refreshments either through on-board portal or from a steward that passes through the train regularly. In addition, night trains have cars with 6-berth couchettes and 3-berth sleepers and passengers receive free breakfast in the morning. They can also buy a personal-hygiene kit and a lock for their luggage. There is also security on board and a waking-up service.

While the services remain the same, the prices have changed noticeably. At the beginning, there was no distinction between prices during different days. Now, there are "peak days" - Thursday, Friday and Sunday evening from Prague and Thursday, Friday, Sunday and Monday morning from Košice with higher prices. The rest are "off-peak days" which have lower prices. The prices also differ for night and day trains. All the prices for an adult for a one-way ticket are shown in the following table (the reservation of a seat is included in the price):

Table 21: Prices of tickets in RegioJet trains

Class	Off-peak day		Peak day	
	Day	Night	Day	Night
Standard	380 CZK	280 CZK	500 CZK	380 CZK
Relax	500 CZK	400 CZK	600 CZK	500 CZK
Business	600 CZK	500 CZK	700 CZK	600 CZK
6-berth couchette	-	480 CZK	-	600 CZK
3-berth sleeper	-	700 CZK	-	800 CZK

Source: own realization, www.regiojet.cz

The tickets can be bought online, via a mobile application, an SMS, or in person at selected train stations and shops. RegioJet also offers discounts for children 6-15 years old (50%), students up to 26 years old (25%), ISIC/EYCA/Alive card holders (10%) and disabled people (75%). Children up to 6 years old and a person accompanying a disabled person travel for free.

6.1.3   LEO Express

The second competitor, entering the market only two months after RegioJet, was LEO Express. The train left Prague in the afternoon, from Košice it departed at night. The price of a ticket in Economy class for an adult started at 349 CZK. The trains are modern, open, low-floor, air-conditioned and equipped with high-tech interior. There is free Wi-Fi, daily newspapers and magazines and each seat has an electric socket. Passengers can borrow games, headphones or a lamp (in the night train) and buy refreshments from stewards. There are three classes: Economy, Business and Premium. The train consists of five cars; four are Economy class with a kids' zone. The last car is divided into Business and Premium class. In Business class passengers receive hot or cold beverages and small refreshments for free. In night trains they also receive a night kit and can borrow a blanket. The seats are bigger, leather and have tables. Premium class is separated from the rest of the car. There are only six leather, adjustable seats with tables. The compartment is a quiet zone. The passengers have free service including, beverages, a lunch menu and other refreshments.

Because of high competition LE was forced to change their pricing policy. Now the cheapest ticket for a one-way trip for an adult in the Economy class can be bought for 269 CZK, in the Business class for 739 CZK and in the Premium class for 859 CZK and the prices can go up to 829 CZK, 1359 CZK and 1669 CZK,

respectively. The amount paid depends on how far in advance the ticket is bought and how many of them are left.

There is a discount for return ticket (20%), for adults over 60 years old (30%), for a group of more than 4 people (20%), for students 6-14 years old (72.5%) for students 15-25 years old (35%), for ISIC/IYTC/ITIC/ALIVE card holders (10%), for children 6-14 years old (50%), for disabled people (75%) and children under 6 years old travel for free.

6.2 Bus transport

On the route between Prague and Košice four bus companies operate; Tourbus, Eurobus[22] and Student Agency (SA)[23] daily and SAD Prešov in the direction to Prague on Monday to Thursday and on Sunday, and in the opposite direction on Monday to Friday. The following table shows all the connections:

Table 22: Bus timetable in the direction Prague - Košice

Operator	Departure	Arrival	Duration
Tourbus	6:10	18:30	12:20
	17:30	5:05	11:35
SAD Prešov	18:45	6:30	11:45
Eurobus	20:30	5:55	9:25
SA	7:00	17:40	10:40
	7:50	19:20	11:30
	19:00	4:00	9:00

Source: own realization, www.cp.sk

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[22] The bus starts in Uzhhorod, Ukraine and goes through Michalovce in Slovakia, to Košice. There used to be another connection starting in Michalovce, going through Košice to Prague, but it was cancelled in January 2015 because of lower demand caused by the entrance of new train operators on the route Prague - Košice (www.busportal.cz).
[23] Student Agency changed the name of the buses in the Czech Republic to RegioJet at the beginning of 2016. For our purposes, we will continue to use the name Student Agency for buses, so that they are not confused with the train RegioJet.

Table 23: Bus timetable in the direction Košice - Prague

Operator	Departure	Arrival	Duration
Tourbus	7:00	19:30	12:30
	19:15	6:50	11:35
SAD Prešov	18:30	5:55	11:25
Eurobus	20:30	6:10	9:40
SA	5:00	16:30	11:30
	11:00	22:10	11:10
	21:00	6:40	9:40

Source: own realization, www.cp.sk

There are two main possibilities for travel; through the north or through the south. More commonly used is the northern way, going from Košice, through Poprad, Žilina, Brno to Prague. Košice and Žilina[24], and Brno and Prague are connected by a freeway. The fastest journey is approximately 640 km long and takes 9 hours. The southern way goes from Košice through Rožňava, Zvolen, Trenčín and Brno to Prague, taking at least 11.5 hours and being approximately 780 km long. From Košice to Brno there is only an expressway, the route continues from Brno to Prague on the freeway.

All the buses have stops at the main bus stations in both cities. The main bus station in Košice (Autobusová stanica Košice) is located right next to the main train station (Železničná stanica Košice). In Prague, the main bus station (ÚAN Florenc) is just 15 minutes by walking (or one metro stop) away from the main train station (Praha hlavní nádraží). Therefore, the departure and arrival points in both cities are considered comparable. Thus, it should not have any influence on the decision of passengers about their mode of transport.

The companies offer tickets for different prices, but they are stable and usually do not vary with regard to any particular day or how far in advance they were bought. However, prices can go up during major holidays like Christmas or Easter, especially if there are additional connections added. The following table shows prices for different passenger categories and companies:

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[24] the highway from Košice to Žilina is not completely built yet, some parts are still under construction

Table 24: Price list for different passenger categories and companies

Categories	Companies			
	Tourbus	SAD Prešov	Eurobus	SA
Adult	560 CZK	560 CZK	649 CZK	610 CZK
Student under 26	504 CZK	450 CZK	584 CZK	519 CZK
Children 5-12	280 CZK	280 CZK	324 CZK	519 CZK
Children under 5	0 CZK	0 CZK	0 CZK	519 CZK

Source: own realization, www.amsbus.cz

Bus transport seems to be the closest substitute for the train. The ticket prices are comparable and the time of the journey is also similar. Furthermore, passengers can travel during the day or night like they can by train. In addition, the departure and arrival points of the bus and train are very close to each other.

6.3 Car

Another possibility is going by car. It may seem to be the fastest and most comfortable means. The journey takes around 7 hours through the north way and almost 8 hours through the south way without stops and any traffic restrictions. However, it is not realistic to drive for 7 hours without stopping. Also costs are higher than the price of a public transport ticket.[25] On the other hand travelling by a personal car has many benefits. The driver is not restricted by any time schedule, departure or arrival points or by the weight of luggage.

Here we have to mention ridesharing as well. To some extent, it combines the benefits of driving your own car with the benefits of public transport. One can agree with the driver on the departure time and point, about the stops and arrival point. The passenger does not have to drive the car, so they can use the time more efficiently. However, even though there are now websites that connect people offering and those looking for rideshare, one can never be sure that both groups are trustworthy based on the ratings from their past journeys. There are no guarantees that the journey will take place and the drivers are also not required by any regulation to give the money back in case of big delays. As for the price, it usually varies between 500 - 700 CZK, which is not very different from a bus ticket.

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[25] assuming the price of gas approximately 29 CZK/l, gas mileage 7l/100 km and distance 700 km, just the cost of gas is around 1400 CZK

In any case, we have to also consider this option as a potential substitute for public transport. If we could not define the relevant market consisting only of public transport, we would have to also include private transport and perform the test again to see if trains, buses and cars form one relevant market.

6.4 Air

The only operator of the flights between Prague and Košice is Czech Airlines.[26] From Prague to Košice it operates daily, except Tuesdays and Saturdays. The departure times are at 12:05 and 22:20. From Košice to Prague, the departure times are on Mondays, Thursdays and Fridays 5:00 and 14:45; on Tuesdays 5:00; and on Wednesdays and Sundays 14:45. It does not operate on Saturdays either.[27] There are three classes: Standard, Flexi and Business, and they differ in purchase conditions, services offered and price. The starting price of a ticket is approximately 2500 CZK [28]. The duration of the flight is approximately 1.5 hours. The journey by public transport from the city centre to the airport in Košice takes around 15 minutes and in Prague no more than 45 minutes.[29] Passengers can check-in online or via mobile application 36 hours prior to the departure which shortens the time spent at the airport. If they have only cabin luggage they can go directly to the security check. If we add another 1.5 hours that a person could spend at both airports, we arrive at approximately 4 hours for the whole journey. Still, it is half of the time that it takes by other means of transport.

We do not consider air and rail transportation close enough substitutes. The first reason is that most of the economic literature that studies competition between railways and airplanes only considers high-speed trains, which do not operate on our route, making the duration of the journeys incomparable. Also, the flight tickets are much more expensive so we do not expect marginal passengers on trains or buses to switch to airplanes.

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[26] we consider only direct, non-stop regular flights
[27] the time schedule is of June 2016, the departure times may vary during the year
[28] we do not consider here any special, seasonal or last-minute offers
[29] in both cities we consider the main train stations as the final arrival point because they are located in the city centre, the bus stations are also very close and the durations of journeys by different modes are therefore easily comparable

7 Practical implementation of the critical loss analysis

The empirical part of this thesis will focus on the practical implementation of SSNIP test. The studied field is public transportation. The route between Prague and Košice was chosen because of the past dominant position of ČD/ZSSK on railway, high competition between rail and bus transport and recent entrance of new competitors on the railway market, which lowered the prices, improved the services and comfort and heightened the competition even more. In previous years, activities of operator SA/RJ were intensely watched by competition authorities, especially on the routes within the Czech Republic. The company entered the Slovak transportation market as well, causing huge competition within public transportation. With its pricing policy, it even forced ZSSK to stop dispatching IC trains between Bratislava and Košice. Therefore, we will have a closer look at RegioJet and try to determine if it could be a hypothetical monopolist within the railway market on the route Prague - Košice.

7.1 Candidate market

The aim of this thesis is to define the relevant market for transportation services on the route from Prague to Košice. Our hypothesis is that bus is not a perfect substitute for rail and rail forms a separate market. We have chosen railway on the route Prague - Košice as a candidate market and other modes of transport will be studied as potential substitutes. Because of the recent entrance of two new rail operators almost at the same time and consequent cancellations of some bus connections, it seems that railway has a good position in the market. The trains now offer much better services and comfort for lower prices and they also offer more connections to choose from than before. Therefore, it will be interesting to see if passengers travelling by train consider bus transportation as a real substitute. In addition, RegioJet has gained big popularity among passengers and transports approximately 1000 passengers on this route daily, which makes it the biggest

operator on the route (Vlaky Regiojet CZ 2016). Therefore, at the end of the thesis we will try to define the relevant market separately for the rail transportation on the route Prague - Košice where RegioJet will form the candidate market. The main reason for this is to see if its trains with special services are for passengers so unique that it could form a separate relevant market.

7.2 Estimation of critical loss

The best application of SSNIP test is the critical loss analysis which was thoroughly described in section 3.1. Performing the analysis might seem straightforward, but in practice there are some serious problems arising that make it impossible to arrive at plausible results.

As previously mentioned, crucial variables for computing critical loss are percentage price increase (X) and margin (m). While X is chosen by the researcher (in practice 5 or 10%), m cannot be estimated accurately. Margin is a business secret for every firm and it is unrealistic to obtain this information.[30]

We have chosen X to be 10% because for ticket prices of around 500-700 CZK, a 5% increase seems relatively too small and passengers would not be sensitive to it, which would bias the analysis. Because we do not know the margin, we will continue with a more general approach. For the reasons mentioned in Chapter 3, we will not try to compute margin using costs and profits, but we will create a table with different possible values. The relevant market will then be defined for the particular maximum value of margin for which the price increase would not be profitable anymore. Table 25 shows the values of critical loss and critical elasticity for different margins.

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[30] an exception is competition authorities that have legal power to request data on margins

Table 25: Critical loss and critical elasticity for 10% price increase and different values of margin

Margin (m)	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Critical Loss (X/(X+m))	0.67	0.50	0.33	0.25	0.20	0.17	0.14	0.13	0.11	0.10
Critical Elasticity (1/(X+m))	6.67	5.00	3.33	2.50	2.00	1.67	1.43	1.25	1.11	1.00

Source: own computation

7.3 Estimation of actual loss

Next we need to estimate actual loss, which is needed for comparison with the critical loss. The computation is a bit more complicated, but we can get all the necessary information. The formula is

$$. \qquad AL = X * \varepsilon_{own} \qquad\qquad (14)$$

We have already chosen X to be 10%, so the key variable to be determined is the own price elasticity. That will be done using our consumer survey.

8   Consumer survey

8.1   Method of the survey

Before conducting the survey itself, we had to choose the appropriate method of its realization. Considering all of the advantages and disadvantages of the methods described in part 3.1.2.1, we have chosen the face-to-face method for conducting consumer survey. The passengers will be asked questions chosen in advance and in a defined order directly by an interviewer, or they will be given a prepared form to complete. The survey will be conducted at the main train stations in Prague and Košice, on the platforms from which the particular train will leave or directly on the train. These facts are known in advance so that it is easy to identify the targeted group.

The next necessary information is how many respondents we need to survey in order to ensure the validity of the research. We will use the formula (13) from part 3.1.2.1:

$$n_1 = \frac{n_0}{1 + \frac{n_0}{population}}$$

where $n_0 = \frac{t^2 pq}{d^2}$

The value of t can be found in the statistical tables, and for our chosen 5% significance level is 1.96. The problem is with estimating p before the survey. Bartlett et al. (2001) suggest setting it equal to 0.5 because it "maximizes the size of the sample for any given confidence interval or confidence level". They also recommend using a 95% confidence interval, hence setting d to 0.05. The simplest way to approximate the population size is to compute the capacity of the trains going from Prague to Košice in the specific time period. The survey will be conducted during four days, so that we will compute the maximum capacity (seats[31]) and multiply it by four. The maximum capacity does not constitute the precise number of the population because the trains do not have to be fully booked or the passengers might travel to other destinations. However, this should not cause any problems

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[31] for the maximum capacity we consider only the number of different seats in a train because reservation of a seat is obligatory and one cannot travel without it (standing)

because the number will be higher, thus only overestimating the real population, and therefore also overestimating the minimum sample size, which can result in more accurate outcomes for the survey. We can compute the population size using the Tables 1 and 2 from Chapter 5. Summing the capacities of all the trains we get 5066, and multiplying it by 4 days we have population size of 20264.

Substituting the values into the formula we get:

$$n_0 = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} \cong 384$$

$$n_1 = \frac{384}{1 + \frac{384}{20,264}} \cong 377$$

So the minimal number of respondents for our survey is 377.

8.2 Realization of the survey

The consumer survey was conducted over four days; so as to make sure that peak days and off-peak days were included. Friday and Sunday were chosen because they are expected to be peak days when people travel from school, work, home, and back; Saturday because the demand is expected to be lower and Wednesday because it is not a peak day but we expect more business trips. Included were day trains and night trains from all of the companies operating on the route. The total number of respondents was 377, of which 177 were women (46.9%) and 200 were men (53.1%).

**Figure 1: Distribution of respondents according to gender**
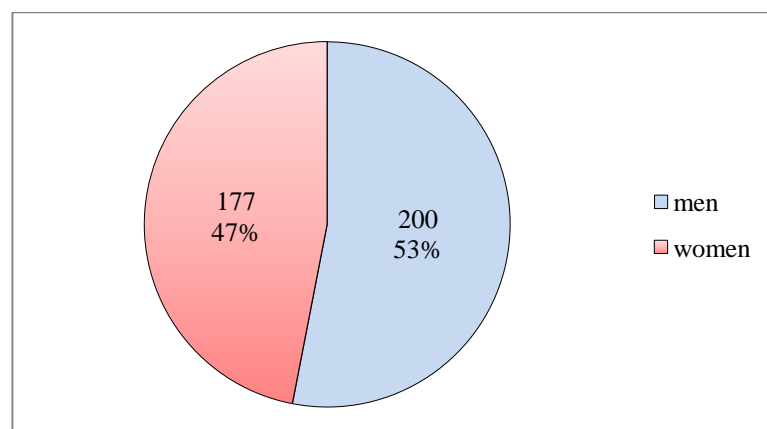
Source: own realization

The method used was direct interview (interviewer asked the questions), the respondent filling out the questionnaire or a combination of both, where the questionnaires were distributed among passengers in the train and the interviewer helped them whenever there were any problems with the questions. The survey was very successful, out of all the passengers asked, only 32 (7.8%) refused to fill out the questionnaire. The response rate[32] was 92.2%. All people that were willing to participate in the survey returned a filled out questionnaire, so the completion rate[33] was 100%. It helped that the questions were not very difficult, and it was fast to answer them. The mention about the academic purpose of the survey also helped. People were more enthusiastic and even wished me good luck with my thesis. However, there were some problems we have not considered. It is possible to identify the passengers that travel on our particular route only after the platform from which the train leaves is announced. In some cases it was only 10 minutes prior to the departure, which did not allow much time for collecting enough questionnaires. This was the case especially for morning trains of ČD/ZZSK, and both day and night trains of LEO Express. Therefore, we have fewer responses from these trains. It was also impossible to interview people on the platform. They were not willing to answer any questions or fill out the form. We assume, that because of the nature of the journey (it is long, people do not take it every day and usually have a lot of luggage), people were nervous, impatient to enter the train and did not want anyone to bother them. Only after they were seated in the train, did they become more relaxed and prepared to take the survey. The following figure shows the total numbers of respondents according to the particular days, times and company:

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[32] response rate is defined as: number of completed surveys/number of people asked
[33] completion rate is defined as: number of completed surveys/number of respondents who took the survey

Figure 2: Distribution of respondents according to particular days, times and company
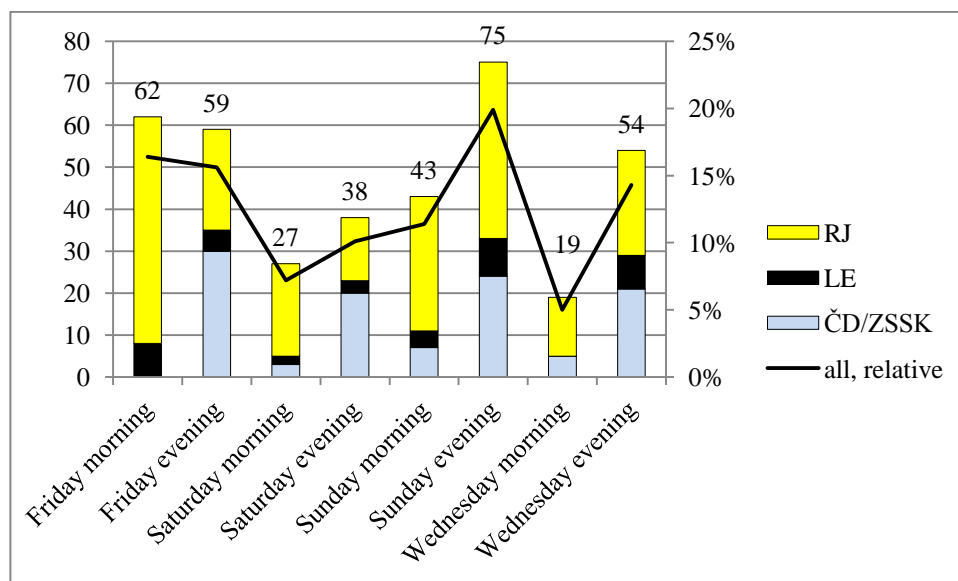
Source: own realization
Note: the line in the figure shows relative numbers of all respondents and it represents specific demand curve for rail transportation on the route Prague - Košice

Our assumption about peak days and off-peak days was confirmed by the collected data. The majority of respondents travelled during peak days, on Friday 32.1% and Sunday 31.3%. On Wednesday travelled 19.4% of respondents and on Saturday 17.2%.

The age distribution of the respondents is captured in the following figure. The biggest age group was people under 26 years, almost 39%, followed by 31% of passengers between 27 and 39 years old and 27.1% of passengers from 40 to 62 years old. These three groups were relatively equally distributed, but there was not even 3% of passengers from the last group, over 62 years old.

Figure 3: Age distribution of the respondents
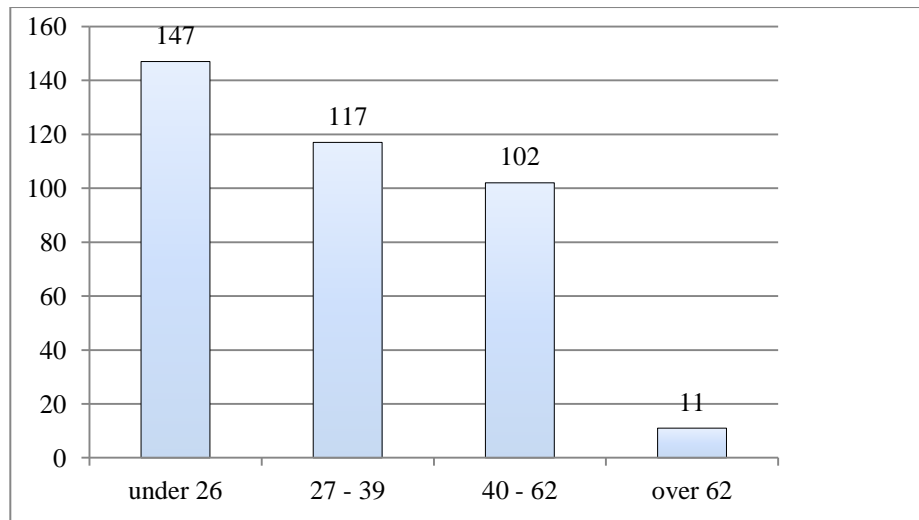
Source: own realization

8.3 Results of the survey

Now we will present the results of the survey. We will describe every question by explaining the purpose of it and what kind of information we want to have from it. The complete questionnaire is enclosed in the Appendix.

The questionnaire was designed to be simple in order to be concise for the respondents. The simplicity should have prevented any misunderstandings, which could bias the analysis. At the beginning, before the questionnaire itself, we asked passengers what was their final destination. If the answer was not Košice/Prague we did not continue. The second selective question was if they or any of their relatives worked for any transportation company. That could bias the analysis because, for instance, ČD/ZSSK offer its employees special cards; they pay annual fee and then can travel for free. Also, employees are usually loyal to their company. It is interesting to note here that we did not encounter any employee of RJ or LE travelling privately on their trains, but we did meet three people travelling with ČD/ZSSK that had an employees' annual card. The next questions were chosen with regard to the *Methodology of defining the relevant market in the rail transportation industry* (Kvizda et al. 2013) and modified for our purposes.

Question 1

We started with easier questions. The first was about the frequency of passengers᾽ journeys between Prague and Košice. This information is important for determining the weight coefficients of the answers for computation of the price elasticity of demand. Information from a passenger who only travels occasionally on the route will have a lower weight than information from a passenger who travels regularly. The question was asked as an open-ended and the respondents had to write down the number of her/his journeys between Prague and Košice in the last 12 months.[34] Afterwards, we divided the answers into five groups. The first group comprised people who were traveling for the first time, and the second group are occasional passengers who travel one to four times a year. Passengers who travel more often, but not every month, are in the third group, and regular passengers who travel approximately once a month are in the fourth group. The fifth group is made of passengers travelling more than once a month. The following figure shows the frequency of passengers᾽ journeys:

Figure 4: Frequency of passengers' journeys
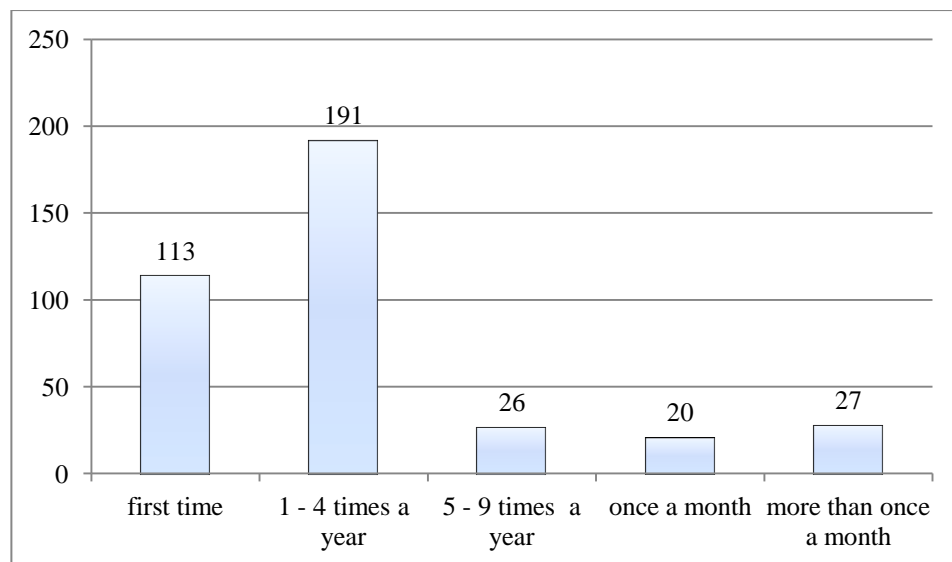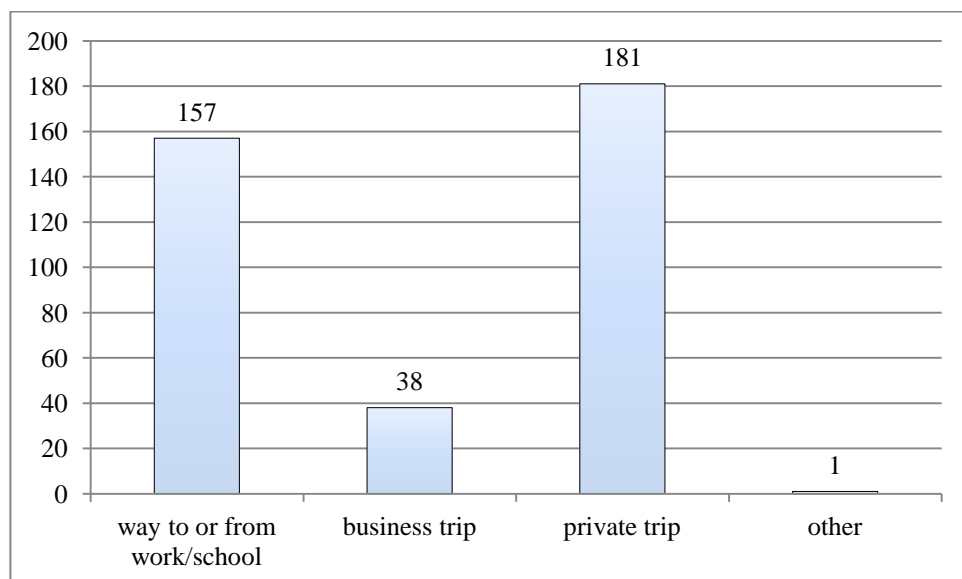

Source: own realization

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[34] In the questionnaire we asked the respondents to count every single way so that we have consistent answers. Hereinafter for the sake of brevity and simplicity if we say e. g. once a month, we mean once a month there and back.

The most of respondents (50.7%) travel 1 - 4 times a year, 30% of respondents travelled for the first time, regular passengers who travel once a month or more than once a month constituted 5.3% and 7.2% of respondents, respectively and 6.9% of respondents travel 5 - 9 times a year.

Question 2

The second question regarded the purpose of the respondent's journey. It is important supplementary information and verification of the characteristics of the particular transport line and computed price elasticity of demand. It was multiple-choice; there were four options to choose from because a more detailed overview was not needed for our analysis. The next figure shows the distribution of the passengers according to the purpose of their journey:

Figure 5: Distribution of passengers according to the purpose of their journey

Source: own realization

Contrary to what was expected, the biggest group of respondents (48%) stated that the purpose of their journey was a private trip, so that almost a half of them were occasional passengers like tourists or people visiting friends or family. That could have been caused by the fact that the survey was taken in late May and early June, which is the start of tourist season. However, the group that we thought would form the majority, students and workers, was the second biggest (41%). Business trips constituted 10.1% and only one respondent chose the "other" option. We can conclude about this line that most of the respondents were travelling for recreational

or visiting reasons. But the group of students and workers is almost as big as the first one, so our assumptions were not that far from the truth.

Question 3

The third question asked about the reason why the respondent chose that particular train or company. The answers can also be an additional indicator for the characteristics of the transport line and for specification of possible substitutes. We can find out if the respondents that chose the option "price" are really more price sensitive than others. In addition, the answers give us interesting information about passengers' preferences. There were eight options and respondents were told that it was possible to choose multiple answers, so the answers and percentages do not sum up to 377 and 100%, respectively.

Figure 6: Reasons of the respondents' journeys
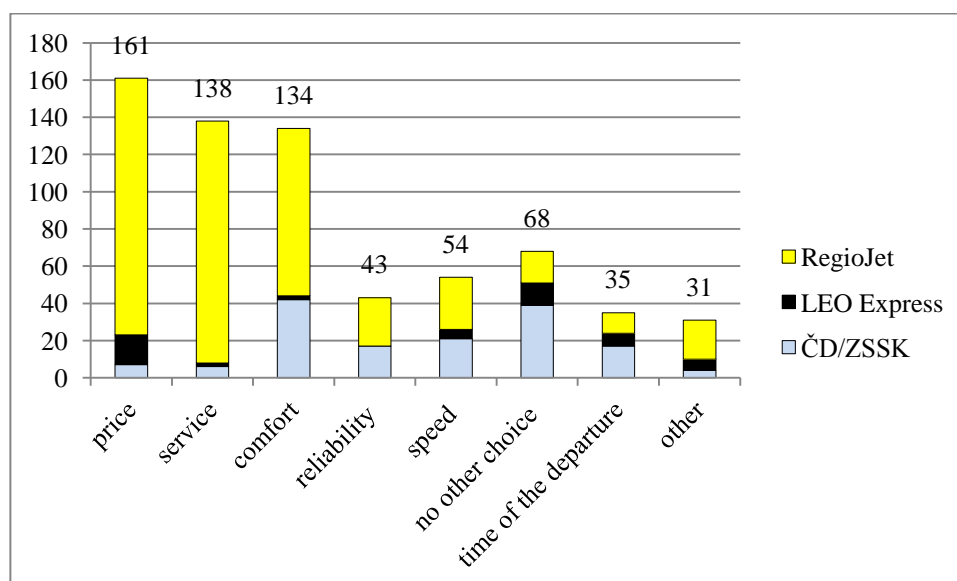
Source: own realization

The most important determinant to respondents was price, 42.7% of them selected that they chose the company or the train because of a better price. The next most important factors for them are services provided (36.6%) and the comfort of the journey that the train offers (35.5%). Because of no alternative options, 18% of respondents chose their particular train. Speed is an influential factor for 14.3% of respondents. Only 11.4% of respondents travelled with their train because they thought that the company was more reliable. For 9.3% of respondents' time of the

departure played a crucial role in the decision about how they would travel. The last option, "other", was picked by 8.2% of respondents. Only ten of them also stated their reason. Online purchase is important for six respondents, and the possibility of cancelling the ticket for four. It is also interesting to see how the distribution among reasons differs with each company.

For the customers of RegioJet the most important factors that influence their decision to take the particular train are price (60.5%), better service (57%) and more comfort (39.5%). This should not be surprising, as the company really offers low prices with exceptional services and comfortable trains. The price (41%) is also the most determining factor for the customers of LEO Express. But the second most important reason was unavailability of other choices (30.8%). It is also logical that 17.9% of respondents chose the train of LE because of the time it departs. As can be seen from the Table in Chapter 4, the schedule of LE trains differs from the two other companies. Comfort is the first biggest reason for 38.2% of customers of ČD/ZSSK. These were probably the respondents travelling in sleeping cars. Not having any other option is the second most important reason for the respondents that chose to take the ČD/ZSSK train (35.5%). Also, convenient departure time and the reliability of the operator play an important role for the customers of ČD/ZSSK (both 15.5%).

Question 4

The aim of the fourth question was to divide the respondents according to the category of the ticket they were using. Specifically, it was desirable to distinguish between adult passengers who bought regular tickets, students and seniors who use a discount, and passengers who use other promotional fares. This information is also useful for checking if the respondents really know the price of the ticket they bought, which was the subject of the next question.

Table 26: Numbers of respondents for each fare

Fare	Number of respondents	Percentage of all respondents
Adult	220	58.4%
Student	80	21.2%
Senior	8	2.1%
Disabled	1	0.3%
Companion	1	0.3%
Other	67	17.8%

Source: own realization

The majority of respondents were travelling at regular fare (58.4%). The next biggest group was students (21.2%). There were eight respondents using discounts for seniors (2.1%) and we also met one disabled person with his companion. The last option, "other", was chosen only by customers of ČD/ZSSK (17.8%). This is caused by the fact that the other two companies at the time of the survey did not have any special offers and ČD/ZSSK sells First Minute tickets. It is interesting to see that 60.9% of all respondents travelling with ČD/ZSSK used this offer. But the remaining group of respondents is quite big, almost 40%, which is surprising, considering that the regular fare tickets can be as much as two times more expensive than First Minute tickets. The first explanation can be that half of them were passengers travelling for the first time, so they might not have known about the possibility of buying the First Minute ticket. Some of them were students or seniors who could have bought the ticket for a discounted price (only one of them stated the price). And the simplest explanation is that they bought the regular fare ticket because the First Minute offer was not available anymore.

Question 5

The fifth question is aimed at finding out the price sensitivity of the passengers to verify the previous answer. The knowledge of the price indicates higher sensitivity and vice versa. The real price will be identified with the help of the ticket category used by the respondent. It follows from the answers that the majority of the respondents know the price of the ticket they bought. Only 16.4% stated that they did

not know, they wrote a wrong price or they did not write anything. If we look at the companies separately, it is a bit different. Almost a third of customers of ČD/ZSSK did not know the price. On the other hand, more customers of RegioJet and LEO Express knew the price, 88.2% and 92.3%, respectively. From this observation we could say that customers of RJ and LE are more price sensitive than customers of ČD/ZSSK.

Table 27: Responses to Question 5

Knowledge about price	ČD/ZSSK		LE		RJ		ALL	
	Number of respondents	% of ČD/ZSSK customers	Number of respondents	% of LE customers	Number of respondents	% of RJ customers	Number of respondents	% of all respondents
Yes	78	70.9%	36	92.3%	201	88.2%	315	83.6%
No	32	29.1%	3	7.7%	27	11.8%	62	16.4%

Source: own realization

Regarding the prices that respondents stated, we encountered a great variability among them. The prices differ not only with respect to the operator but also with respect to each company's range of fares. There are 20 possible combinations of the ticket and reservation prices that ČD/ZSSK offers, and an even greater range of prices for LE tickets. In total, we recognized 39 different relevant prices.

Question 6

Now we come to the most important question of our analysis. The sixth question is designed to find out a passenger's sensitivity to price increase. It asked how the respondent would react in case of a permanent 10% increase of the price of the ticket of that particular train. Because there are three rail companies operating on the route, i.e. the competition is high, we do not have to limit our analysis only to find out if the rail and bus transportation form one relevant market. We can choose one rail operator that would form a candidate market and extend the market with possible substitutes. Therefore, there were two answers with the option to travel by train; to travel with the same or with a different operator.

It was important to stress that the 10% increase would be permanent and only on the particular train, i.e. only the particular product that the passenger is using would become permanently more expensive. These products can differ (in speed,

services, comfort of the train), and therefore constitute substitutes for each other. The answers will be used to verify the candidate market and thus it is important for the definition of the relevant market that the respondents consider only the product they are using at the time and not any other similar product or the rail transportation in general.

The options for the reaction were:
a) I would travel by the same train
b) I would travel by train but with another operator
    do you know the price that you would pay:
c) I would travel by bus
    do you know the price that you would pay:
d) I would travel by my own car or rideshare
    do you know the price that it would cost you:
e) I would travel by plane
    do you know the price that you would pay:
f) I would not travel at all/ I would travel somewhere else
g) I do not know/other (please, specify):

The following table shows the absolute numbers of all reactions for each operator and the relative values with respect to the total number of its customers, and also for all of them together.

Table 28: Reactions to the 10% price increase with respect to operators

| | Operator | | | | | | | |
| | ČD/ZSSK | | LE | | RJ | | all | |
Reaction	absolute	%	absolute	%	absolute	%	absolute	%
a	80	72.7	24	61.5	184	80.7	288	76.4
b	18	16.4	12	30.8	29	12.7	59	15.6
c	4	3.6	0	0.0	1	0.4	5	1.3
d	0	0.0	0	0.0	6	2.6	6	1.6
e	1	0.9	0	0.0	0	0.0	1	0.3
f	0	0.0	0	0.0	1	0.4	1	0.3
g	0	0.0	0	0.0	5	2.2	5	1.3

Source: own realization

From the table we can see that in the case of a 10% price increase, 76.3% of all respondents would not react anyway and would use the same train and 15.6%

would use a different rail operator. Only 5 respondents would choose bus instead and 6 would travel by car. Twelve respondents did not answer this question. These results are very interesting for our next analysis because it seems that bus transportation is not a relevant substitute for respondents travelling by train.

Question 7

The seventh question asked about the particular preferences of respondents about the operators on the route. It purposely did not specify the means of transport so that the respondent could choose between bus, train or any other operators. The following table shows the preferences of all the respondents and also for each operator separately, in absolute numbers and also relatively to the number of all the customers of the particular operator.

Table 29: Preferences about transport providers

Respondent's preference	Operator							
	ČD/ZSSK		LEO Express		RegioJet		all	
	absolute	%	absolute	%	absolute	%	absolute	% of all respondents
RJ	27	24.5	14	35.9	75	32.9	116	30.8
ČD/ZSSK	15	13.6	1	2.6	12	5.3	28	7.4
LE	2	1.8	5	12.8	18	7.9	25	6.6
Student Agency	0	0.0	0	0.0	3	1.3	3	0.8
Eurobus	0	0.0	0	0.0	2	0.9	2	0.5
no preference	66	60.0	19	48.7	118	51.8	203	53.8

Source: own realization

Out of all the respondents, 203, which is more than a half, did not state anything or answered negatively, i.e. they do not have any preference. From the respondents that do have a preference, 66.7% prefer RegioJet, 16.1% prefer ČD/ZSSK, 14.4% prefer LEO Express and only a 2.9% prefer a bus company.

RegioJet is the most preferred operator not only among its own customers but also among the passengers that were at the time travelling with its competitors. The explanation is that RegioJet still offers better prices for the services it provides. The trains are modern, air-conditioned with free Wi-Fi and have comfortable sleeping cars; and there are always nice and polite stewardesses or stewards that are ready to help and offer a free beverage or daily press.

8.4   Application of the critical loss analysis

As described in the theoretical part of the thesis, the next step in SSNIP test is to compute the actual and critical loss. For that we need to compute from the given data the coefficient of the price elasticity of demand. We will use the formula:

$$\varepsilon_{own} = \left| \frac{\%\Delta Q}{\%\Delta P} \right|$$

where ΔQ is the percentage change in the quantity demanded and ΔP is the percentage change in price, our chosen 10%. We obtain ΔQ from the answers to the Question 6. From Table 5 we can sum up the respondents that answered C, D, E, and F. We excluded respondents that picked the G option because it does not give us any relevant information. So, in the end we have only 13 out of 360 respondents (whose answer is relevant for us) that would use other alternatives to the train in case of a price increase.

$$\varepsilon_{own} = \frac{\frac{13}{360} * 100}{10} \cong 0.36$$

Hence, the computed own price elasticity is 0.36, which is less than 1. This means that the demand is highly inelastic. This elasticity, of course, does not reflect any other characteristics of the respondents and we cannot say which category of customers is more or less price sensitive. Therefore, we created the following Table 13 that shows the numbers of answers for each category and also for each operator. We computed values of responses C, D, E, and F relative to the total relevant answers for each category as well. This information tells us what percentage of the passengers using a particular type of ticket would not travel by train anymore if the price of the ticket increased by 10%. This is the actual loss.

The categories are numbered as follows: 1 - adult, 2 - student, and 3 - senior, 4 and 5 were excluded because there were no relevant answers, and 6 is the "other" category which is represented by First Minute ticket offered by ČD/ZSSK.

Table 30: Answers C, D, E, F on Question 6

Category	ČD/ZSSK			LE			RJ			All operators		
	Total relevant answers	Answers C, D, E, F	%	Total relevant answers	Answers C, D, E, F	%	Total relevant answers	Answers C, D, E, F	%	Total relevant answers	Answers C, D, E, F	%
1	31	1	3.2	26	0	0	156	5	3.2	213	6	2.8
2	7	4	57.1	8	0	0	62	3	4.8	77	7	9.1
3	2	0	0	1	0	0	3	0	0	6	0	0
6	63	0	0	0	0	0	0	0	0	63	0	0
ALL	103	5	4.9	36	0	0	221	8	3.6	360	13	3.6

Source: own realization

Because we do not have enough responses from the passengers of each operator, it would not make sense to analyze it separately, and therefore we will continue working with the aggregated data. However, there are only 13 responses that we can work with, so we have to stress that it decreases the validity of the results.

The most price sensitive are passengers using student discounts. This fact is logical, as mostly students do not have their own income and are more flexible with other options of travelling, so in the case of a price increase they would switch from the train. Nonetheless, it is just 9.2% of them that would stop travelling by train. The second group that would choose another means of transport in the case of a 10% increase in the price of their ticket are adults not using any kind of discount. This fact also corresponds with the typical behavior of consumers. But again, there were only 6 respondents using adult fare that chose not to travel by train, which is 2.8% of all respondents from this category; so it is hard to conclude if they are very price sensitive.

According to the formula given above and using the Table 13, we can also compute the price elasticity for each category.

Table 31:Actual loss and actual elasticity for different ticket categories

Category	Actual loss	Actual elasticity
1	2.8%	0.28
2	9.1%	0.91
3	0	0
6	0	0
ALL	3.6%	0.36

Source: own realization

The last problem to deal with is the fact that we have two different elasticities that we have to aggregate into one for the application of the SSNIP test. Here we have to note that it is just a theoretical step that will serve for comparison of computed values with critical values. In reality, we cannot assume that all the operators would increase the prices of all the tickets by exactly 10% at the same time. However, for the sake of this thesis, we will assume a 10% increase in all prices. We have computed the elasticities, but they have different weights. We will use a formula for weighted average in the way as was described in the diploma theses of Rederer (2012), Pečinka (2013) and Kleinova (2014). The computed elasticity should then reflect two influencing factors; frequency of the journeys and price paid for the ticket. According to this, more weight will have passengers that travel more often than just occasional passengers. The same is true about the higher prices of the tickets.

For the weighted average we use the formula:

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

where w_i is the weight. The coefficient w will be computed as follows. First, we will compute according to the answers from the questionnaire regarding the amount that the respondent paid on the route for a year (in one way)[35]. Then we will sum those amounts for all the categories of the ticket fares that we use. The weight then will be the ratio of the amount paid by one group for a year and the total amount paid (see Rederer 2012 for more detail).

The weight coefficient for each fare category looks as follows:

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[35] Where it was possible, we added ex post the prices of tickets for respondents that did not know them. It was not a problem for RegioJet and ČD/ZSSK customers that used regular tickets. We knew the day, class and the fare they used. A problem arose with passengers of LEO Express and those of ČD/ZSSK that bought First Minute ticket because the prices of those tickets vary too widely to be able to determine them. Therefore, 7 respondents were excluded from the analysis.

Table 32: Weights for computation of aggregated elasticity

Category	Sum of payments	w
1	441631	0.55
2	265085	0.33
3	6020	0.01
6	91765	0.11
ALL	804640	1

Source: own realization

Thus, in the final computation, the biggest weight will be put on adult customers travelling at the regular fare. On the contrary, passengers using a discount for seniors will have almost no weight in the computation. After substituting the values into the formula for weighted average we get the final value of elasticity 0.45. This value is just 0.09 more than the original elasticity but it is more accurate. The actual loss in case of a 10% price increase is therefore 4.5%. This means that if there were 1000 people travelling by train, after a 10% price increase, 45 of them would choose another alternative.

In the last part of the critical loss analysis we compare the critical values with the actual values. Because we do not have data about margins available, we will use a model situation illustrated in Table 1 in Chapter 5. It follows that the margins would have to be more than 220% in order for the actual loss to be higher than the critical loss. In that case, the 10% price increase would not be profitable and we would have to add the closest substitute to the candidate market and start the analysis again. Assuming that the margins in the railway industry are not that high, with respect to our analysis, we can state that the rail transportation on the line between Prague and Košice forms a separate relevant market.

8.5 The definition of the relevant market for the company RegioJet

The consumer survey allows us at least to outline the definition of the relevant market separately for RegioJet. According to the results of the survey, the company seems to be the most frequently used operator on the route between Prague and Košice, and it is also the most preferred company on this route.

There are 228 respondents in the sample of RegioJet customers, which, according to our methodology, is not enough. However, for an illustration it will be satisfactory. The other operators have an even smaller sample, so we cannot include them in the analysis.

From Table 5 we constructed a new table that sums up the results only for RegioJet.

Table 33: Absolute and relative values of all reactions to a 10% price increase for RegioJet

Reaction	Absolute	%
a	184	80.7
b	29	12.7
c	1	0.4
d	6	2.6
e	0	0.0
f	1	0.4

Source: own realization

After substituting the values of reaction B to F (we now consider also a shift to another train operator) into the formula we get:

$$\varepsilon_{own} = \frac{\frac{37}{221} * 100}{10} \cong 1.67$$

Own price elasticity is therefore 1.67, which is more than 1 so that the demand is elastic. The actual loss is then 16.7%. In other words, in case of a 10% price increase, more than 16% of RegioJet's customers would switch to another operator or would change the means of transport.

We will now also compute the aggregated elasticity using the weights for each category of the ticket fare as we did previously. The Table 17 shows the number of reactions B to F for the ticket categories used by the customers of RegioJet. We computed all the values in the table using the same method as above.

Table 34:Actual loss and elasticity, weights for RJ

Category	Total relevant answers	Answers B, C, D, E, F	Actual loss	Actual elasticity	Sum of payments	w	Weighted elasticity
1	156	22	14.1	1.4	224230	0.495	0.69
2	62	13	21.0	2.1	224425	0.496	1.04
3	3	2	66.7	6.7	3920	0.009	0.06

Source: own realization

We can now compute the aggregated weighted elasticity, which is 1.79 (actual loss is therefore 17.9%). If we compare this final loss with the critical loss, the margin of RegioJet would have to be more than 50% for the actual loss to be higher than the critical loss. In that case, the price increase would not be profitable for the company. On the contrary, if RegioJet had margins lower than 50%, a 10% increase would be profitable for the company. This would mean that RegioJet would form a separate relevant market on the route between Prague and Košice.

If we assumed that it has margins lower than 50%, it would mean that the company does not maximize its profits because it could profitably rise the price by 10% but sets it at lower levels. This conclusion is controversial but not rare. Jičinský (2015) came to similar conclusions for Student Agency in his thesis in which he focused on bus transport on the route Brno - Prague. Also Lajkepová (2015) analysed Student Agency on the route Brno - Bratislava and Kleinová (2014) on the route Prague - Most. All the findings were similar. So the question is why the company SA/RJ sets the prices at lower levels when it could raise them profitably. A possible explanation could be that the company focuses on long-term objective which is to drive the competitors out of the market. Once there are no other competitors, it could rise the price to a level which would generate higher profits and offset the losses from the period of lower prices. It could be assumed that if the prices were at the profit-maximizing level, the results of the analysis would be different.

In addition, we should note that at the start of its operation the prices were incomparably lower than prices of any other operator regardless of the mode of transport and because of this higher competition some other connections were cancelled. Now, after a year and a half of its operation, RegioJet started to increase the prices. This might be seen as an abuse of dominant position in the form of

predatory pricing. Nonetheless, this assumption is based on the survey with too small of a sample, and therefore we have to look at it with a great care.

Conclusion

The aim of the thesis was to define the relevant market for rail transportation on the route Prague - Košice. In the theoretical part we explained the importance of market definition for competition policy and described the methods how relevant market can be defined. From the different concepts of market definition, for the empirical part of the thesis was chosen a method based on the demand-side substitution. We used SSNIP test that is currently the most common test used by competition authorities. We conducted consumer survey and based on the results of it we computed price elasticity of demand and performed critical loss analysis.

We encountered several problems with the application of SSNIP test. The biggest problem was the unavailability of data on margins of the operators. Because we do not know the margins, we could not define the relevant market precisely, we could only determine the critical margin. If a firm has higher margins than this critical value, actual loss for a hypothetical monopolist is higher than critical loss and increasing price would not be profitable.

At the end of the thesis we analyzed relevant market on the route Prague - Košice for operator RegioJet. The computed weighted elasticity was 1.79 which means that the demand is elastic. We found out that the critical margin would have to be more than 50% for the actual loss to be higher than the critical loss. In that case, the price increase would not be profitable for the company.

We came to the conclusion that defining relevant market in the railway industry is a very complex task and we need to use more methods to overcome problems that arise. The application of the SSNIP test showed that the test could be used as one of possible methods for assessing market power of operators on the railway market.

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Appendix A: Questionnaire

Hello! Excuse me, can I interrupt you for a moment? [if YES, continue] Are you travelling to Prague/Košice? [if YES, continue] Are you or any of your relatives an employee of [the particular company]? [if NO, continue] My name is Zuzana Juhasova and I am a student of Charles University in Prague. I am writing my diploma thesis about competition in the railway industry. I would like to ask you to fill this questionnaire which would help me do my research. Would you be willing to do it, please?

Question 1: How many times have you travelled on the route between Prague and Košice in the last year? (count every single way, there or back)

Question 2: What is the purpose of your journey?

   a) way to or from work/school
   b) business trip
   c) private trip (hiking, tourism, cultural/sport event, visiting friends/relatives)
   d) other (please, specify):

Question 3: Why did you choose this train? (multiple answers are possible)

   a) better price
   b) better services
   c) better comfort
   d) the operator is more reliable
   e) it is faster
   f) I did not have any other choice
   g) the time is convenient for me
   h) I do not know/ other (please, specify):

Question 4: What kind of ticket are you using? (in case of First Minute ticket/group ticket/any special offer, please specify)

   a) adult
   b) student/ISIC/Euro 26/Alive
   c) senior
   d) disabled
   e) accompanying person of a disabled
   f) other (please, specify):

Question 5: Do you know how much you paid for the ticket?

 a) yes (please, specify):
 b) no

Question 6: Imagine that the price of the ticket in this train would permanently rise by 10%, [in case of 500 CZK ticket, it is 50 CZK][36] while prices of all other tickets remained the same. How would you react to such a change?

 a) I would travel with the same train
 b) I would travel by train but with another operator
 c) I would travel by bus
 d) I would travel by car/rideshare
 e) I would travel by plane
 f) I would not travel at all/ I would travel elsewhere
 g) I do not know/other (please, specify):

Question 8: Do you prefer any particular means of transport or operator on this route? Please, specify:

Question 9: What is your gender?

 a) male
 b) female

Question 10: How old are you?

 a) under 26
 b) 27 - 39
 c) 40 - 62
 d) over 62

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[36] We modified the questionnaire for each operator according to the prices offered. In the case of too many price offers, we approximated the most common values and stated some of them.