The Deregulation of the Swedish Railway - On Track or Derailed?

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Abstract

Since 2010, the Swedish railway has been open to competition for passenger train traffic. Despite extensive deregulations, the state-owned enterprise and previous monopoly Statens Järnvägar has managed to retain its previous position as the reigning actor of the Swedish railway. This thesis aims to analyse an incumbent firm's effect on an industry, targeted with regulatory interventions. It will be done by examining the current competition on Sweden's two most heavily burdened routes. The Structure-Conduct-Performance approach of the studies in industrial organisations is used to determine the effectiveness of the competitive industry. The core of the research is based on data regarding different departures on the routes examined in tables, charts and with regression following the Ordinary Least Squares method. These are further analysed with the theoretical approach to demonstrate how factors such as price and quantity are linked to the strategic behaviour of firms. According to the results, SJ has successfully preserved its previous monopoly market power despite deregulation and increased competition. This may result from incorrectly implemented regulatory reforms or SJ strategically preventing rival firms from properly establishing themselves.

Keywords: Deregulation, Swedish railway, The Structure-Conduct-Performance approach, Strategic interaction, Entry barriers

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1 Introduction

It has been thirteen years since the Swedish railway opened up for competition. This was realised with extensive deregulations to secure sustainable prices for travellers, improve competition conditions, and expand the railroads to relieve the pressure of more unsustainable means of travelling. It is considered one of the most liberalised railroads in Europe. Nevertheless, the previous monopoly state-owned enterprise Statens Järnvägar (SJ) has barely been exposed to competition. Despite the extensive regulatory interventions, SJ is the reigning actor in the industry with significant market power.

Deregulation, sometimes referred to as liberalisation, is an action done by public policymakers or legislators to simplify a regulatory framework. The aim is often to facilitate and improve conditions for actors to enter the industry and to improve its overall efficiency and productivity. It can also be done with additional rules and policies to restrict a dominant actor or level the industry to ensure that all firms face the same conditions (Alexandersson 2009, pp.32-33).

According to Brandborn (2008, p.57), the main motives behind deregulation have been decentralisation, privatisation, horizontal competition, and vertical division of the Swedish railway traffic. The vertical division has occurred mainly by reallocating SJs functions to Trafikverket and the previous Banverket. It has contributed to competition-neutral terms and conditions for firms other than SJ. The horizontal competition has improved since the rail authorities procured rail services (DNR N2006/12020/TR). The corporatisation of SJ in 2001 enabled the privatisation of the Swedish railway industry and contributed to the decentralisation of SJs previous power.

The implementation of the reforms has been called into question. Even if the passenger railway is officially open to competition, entering firms have a considerably hard time establishing themselves. Is this a result of an incorrect approach, or is it the current dynamics of the industry that inhibits competition? Alexandersson (2009) even refers to the Swedish passenger railway market opening as *"The Unintended Deregulation"*(p.270). He believed that the reforms accidentally set off a chain of events that ultimately led to an inevitable decision to liberalise the market thoroughly.

1.1 Purpose

The thesis aims to analyse firms' current and prior strategic interactions at the railroad routes from Stockholm to Malmö and Stockholm to Gothenburg. The main objective is to showcase the aggravation for effective deregulation from having one incumbent firm with significant market power. The current competitive environment will be examined with the Structure-Conduct-Performance approach of industrial organisation that provides a theoretical framework for analysing an industry.

1.2 Thesis Outline

First and foremost, the reader will be introduced to the earlier events and the conditions that underlie the current situation. This will be done by showcasing the wide-ranging liberalisation process of the railways in the EU and delving into the deregulation and current competition in Sweden.

Secondly, the Structure-Conduct-Performance approach of industrial organisation will be explained and work as the theoretical framework for the thesis. The three interconnected concepts will be the foundation for analysing the industry dynamics of the targeted routes.

Thirdly, the methodology for collecting data and its process will be presented. Then, the field of application of the examined variables will be explained. Tables, charts or ordinary least squares regressions will evaluate the results.

Lastly, an analysis of the current competition and the results will be conducted with the theoretical approach. This is followed by a discussion which will finally be intertwined with some concluding remarks.

2 Background

2.1 Liberalisation in the EU – The Railway Packages

Over the last thirty years, there has been a joint effort from the members of the European Union to develop a common transport policy for railways. The increased liberalisation of the rail transport markets in the EU has mainly been obtained with four legislative railway packages entered into force between 2001 and 2016. This is the basis for the long-term goal of creating a transnational railway system shared and redefined by all the members. Since the first railway package, there have been interventions to open up and restructure the railway industry with the aim of increasing the competitiveness of firms by creating equal conditions, ensuring fair pricing for train travellers, and developing as well as enhancing the infrastructure of the railways (European Council, 2022). The purpose of the fourth and most recent railway package has been to achieve a single European railway area. It contains six legislative texts that are divided into two pillars. The technical pillar targets cost reduction and administrative burden for railway firms that wish to operate across Europe to increase the competitiveness of the railway sector. It also aims to reduce the remaining inhibiting national rules, which may create entry barriers for new firms. The market pillar aims to complete the process of market opening that started with the first package. Railway undertakings with the ambition to operate in other EU member states now have the unrestricted right to do so. In addition, the pillar aims to ensure that these firms do not face discrimination laws or national rules that inhibit competition from their services (European Commission, 2016). Member states still have the right to limit commercial transport if it harms publicly funded railway services. The fourth railway package was fully incorporated from the 1st of June 2022 in Sweden (Transportstyrelsen, 2022).

2.1.1 The UK and Norway

Liberalising the railway systems has had various outcomes. In the UK, extensive privatisation has led to a highly deregulated industry. In 1993 the publicly owned British Rail was divided into 100 companies sold to the public. The purpose was to introduce competition to improve the efficiency of the railways. Before the privatisation, British Rail owned and operated almost all of the country's railway infrastructure. The decision to vertically separate the railway was partly inspired by Sweden, which introduced competition on their railroad and was later embodied by the Railway Act 1993 (House of Commons, 2022). The privatisation is considered a failure in many aspects. Political interventions on railways had never been tested

on such complex and large railways as in the UK. The transition from a state-owned monopoly to accomplished liberalisation occurred in three years. There are still implications and issues that limit the UK railway's effectiveness. Since 1993, public spending on railroad subsidies has doubled and infrastructural innovation has been little to none, with increasing ticket prices and many safety issues (Amadeus, 2018).

In 2015, Norwegian passenger train traffic opened to competition. The state-owned company Vy, earlier NSB, operated most of the traffic before this (Jarnvägsnyheter, 2021). Since 2018, the railway has been divided into six geographical areas called *Pakker*. Out of these six areas, three different firms have won the negotiations for three of the areas. SJ operates in the northern part, the UK-based firm Go-Ahead the south, and Vy in the western area, including the capital Oslo. The agreement allows the firms to have a time-limited monopoly in the area for 8-10 years (Infrastrukturdepartementet, 2020). Therefore, the competition in the Norwegian railways only concerns the procurement negotiations for the areas. The railway within these areas is free from competition. Further tendering of their railway was stopped by the Norwegian Ministry of Transport and Communication in 2021. The decision also removed the prerequisites for competition (Jernbanedirektoratet, 2021).

The Norwegian state-owned company Entur has created a competitive neutral, national digital platform for railway tickets. Established in 2016, it functions as a travel planner and a ticket-selling system for all the commercial railway firms operating in the country. Entur has resulted in cost-efficiency, where the individual operators do not need to develop and maintain their individual systems. It also limits the possibility for individual firms not to permit other firms to sell tickets on their channels to inhibit competition (Infrastrukturdepartementet, 2020).

2.2 Deregulation in Sweden

Since 2010, the Swedish passenger traffic industry has been open to competition. Sweden has been at the forefront of liberalising the railway sector with extensive deregulation reforms. The underlying rationale for the market opening has mainly been to ensure the efficiency and sustainability of the railway network. The aim has been enabling more travellers by train than other, less sustainable means of travel. This was also done to increase the railway sector's competitiveness, benefiting the consumers. The increased number of competing operators was expected to expand the range of offered trains. Additionally, firms were expected to lower their prices while increasing the quality of their services to stay competitive (Prop. 2008/09:176).

The initial actions for the liberalisation process began as early as 1988 with the Swedish political transport proposition *The Transport Policy for the 1990s* (Prop.1987/88:50). The decision resulted in a vertical separation of the previous rail department of SJ that became the separate authority *Banverket*. This was done to manage SJs lacking financial performance and to enable larger investments into the rail infrastructure without cross-subsidizing operations. Thus, SJ was still in charge of the railway traffic but no longer of the infrastructure now managed by Banverket. Before 1988, the Swedish railway network had been a monopoly controlled by SJ since 1939 and had been in charge of more or less all the railway operations and the complementary services (Brandborn 2008, p.56).

In 1990, SJs monopoly was revoked. BK Tåg obtained a four-year contract for the right to operate in Småland. A governmental proposition (Prop.1993/94:166) was the first step in deregulating the monopoly. It regarded the railway deregulation and new policies for SJs operation for 1994-1996. The Swedish parliament enabled firms with the proper financial prerequisites to be granted authorisation for operating railway traffic. The motive was that the routes of the railway system where competition prevailed had decreased prices. However, the decision for the deregulation was terminated with a change of government. They argued that the intervention was carried out on a weak basis for decision-making. Additionally, it lacked a profound analysis of future impacts on railway traffic.

In the subsequent years, the regulatory change in the railway slowed down. A contributing factor was the former government which was unwilling to allow competitors at the profitable lines operated by SJ. The introduction of the EU´s railway packages has been a determining and driving force for the deregulation in Sweden. The deregulation of domestic commercial transport services began in 2007. This was done by lifting SJs monopoly on charter- and night traffic. In 2009 the previously government-run rail network opened to competition for long-distance and weekend traffic. The final decision to liberalise commercial railway traffic was enforced in October 2010. However, since the extensive planning period for traffic authorisations and train paths, the process was not considered completed until 2012.

One aim of the deregulation was to facilitate the emergence of a national system for all train tickets. In 2019, the government assigned *Samtrafiken I Sverige* to coordinate a common system for all railroad undertakers in Sweden (Konkurrensverket, 2019). They have since 2006 had a national travel planning platform named *Reserobot* (Samtrafiken, 2023), but SJs digital platforms still account for most of the ticket sales. The choice of being available on

Reserobot is voluntary for the railroad firms. Furthermore, the platform is not commercialised, contributing to its inability to compete with SJ (Konkurrensverket, 2019).

In April 2022, *Transportstyrelsen* was commissioned by the government to analyse and propose a design for the necessary financial funding to develop the regional ticket systems for more widespread use for public transport ticket services. They received 100 million SEK in 2022 and 100 million in 2023 from the government to cover the costs of developing the system (Trafikverket, 2022).

2.3 The Examined Routes - Stockholm to Malmö and Stockholm to Gothenburg

The market power of the previous monopoly SJ has not changed significantly despite the market opening. Hong Kong-based MTRX, previously MTR Express, has been the only entrant able to compete significantly with the prior incumbent state-owned firm. They began to operate the train route between Stockholm and Gothenburg in 2015, which made SJ decrease their ticket prices by 12.8 per cent on average between March 2015 and June 2016 (Vigren, 2017).

In 2018, SJ was notified by the Swedish competition authority for abuse of its dominant position by MTRX and Saga Rails. This company operated between Stockholm and Linköping only from January until June 2018 (Lokman, 2020). Both companies were denied authorisation to sell their tickets through SJs digital booking platform, which they claimed to be at a severe competitive disadvantage. The digital ticket distribution channel was already in place before the deregulation, which today still stands for the absolute majority of all train ticket sales in Sweden. SJ only allows certain railroad operators who are considered to enhance their ticket sales to cultivate their channels. SJ may reevaluate its prior permission and exclude the company to reduce competition if the allowed firm reduces the demand for SJs tickets. MTRX and Saga Rails were both not considered to be able to enhance SJs ticket sales and were therefore denied access to their digital channels.

Since SJ, from a legal standpoint, had the right to choose whom they wanted to cooperate with and had no legal bindings with either MTRX or Saga Rail, the case was closed. Additionally, the Swedish Competition Authority argued that there are better solutions to the problem than by regulations of SJ. They stated that one way forward was to regulate how commercial person train tickets are sold due to the unthreatened position of SJs distribution channels. Saga Rail only operated for a few months in 2018 as they could not attract enough customers to stay financially viable (Konkurrensverket, 2019).

The only other company operating between Stockholm and Malmö is Snälltåget, a small-scale train firm part of Transdev. They have been on the route since the 3rd of July 2009, the first day the deregulation made it possible for firms to compete with SJ. In 2010 the average price decreased by 50 SEK on the stretch. Snälltåget was awarded the 2023 Grand Travel´s Sustainability award with the motivation that they offer sustainable travelling services despite the competitive industry and without subsidised financial support (Snälltåget, 2023).

The Alliance of Passenger Rail New Entrants (ALLRAIL), a non-profit association of independent passenger rail companies, published a press release demanding the Swedish government and Trafikverket to stop financing SJ´s current offensive actions against Snälltåget. According to the association, they are violating the regulations for Public Service Obligations fundings for railway traffic by illegal cross-subsidization (Allrail, 2023). The allegations are based on SJs plans to extend their night-train traffic from Stockholm-Hamburg to Berlin in April 2023. The Swedish and Danish part of the route is publicly procured, while the traffic in Germany is commercial. Snälltåget is operating between Stockholm and Berlin without subsidies and claims that SJ competes on unfair terms. SJs government subsidies allow them a high level of risk-taking where they have been undercutting Snälltågets prices by charging half the amount for tickets on the distance. Snälltåget is dependent on the income from ticket sales, whereas SJ, on the other hand, can compensate for the losses from the commercial traffic in Germany with state aid from the procured Swedish and Danish part of the route (Järnvägsnyheter, 2023).

The current state of the railways is questioned. Monica Lingegård, SJ's CEO, says that the Swedish people have a love-hate relationship with SJ. Recently, major systematic failures of the ticket sales for the Christmas trains, dirty night trains, and the decision to cancel all trains between Gothenburg and Malmö during the summer of 2023 have further strengthened the negative side of this relationship. The love side is, according to Lingegård, related to SJs role as the old, reliable foundation of Swedish railways. Nevertheless, SJ presented increasingly positive financial results in Q1 2023 with a profit of 129 million SEK. A contributing factor is that travelling has increased by 33% compared to the same period in 2022 (Österberg, 2023). Yet, the Swedish Quality Index 2023 for passenger transport firms ranked SJ the lowest of all travelling companies, scoring 59,3 out of 100, 5,6 units lower than in 2022. MTRX scored 71,3 and Snälltåget 64,5. The Index is based on the travel opinion of the companies in the Swedish transport industry. Including their perceptions of the firm's level of service,

punctuality, and price of the tickets. SJ has the lowest score of all transport firms in Sweden, and MTRX is the second best after the bus operator *Vy Bus4you* (SKI, 2023).

While evaluating the current strategic interaction between the operators, there are external factors that limit the potential for more operating firms that must be considered. First of all, the railway capacity is limited. There are only several possible slots to access with negotiations between the current firms. Secondly, the railway operators do not only compete with each other. Other means of transport, i.e. flights and buses, freight trains compete for the travelling customers. However, in accordance with the efforts for a sustainable future, there is an increasing burden on the railway system as it is considered the most sustainable mode of travel. Lastly, commercial rail companies compete with freight trains that use the same railways.

2.4 Earlier Studies on Regulatory Reforms

Stigler (1971) changed the general perception of the effects of political interventions on regulation. Before his work, there was a consensus that regulation was the tool to manage market failures. He argued that regulatory interventions systematically fail and harm the targeted industries. Stigler believed that regulatory reforms serve the interest of dominant incumbent firms where they turn their intended constraint into their advantage. Their vast experience and reputation in the industry allow them to use regulatory intervention as a tool to control the demand, price, and quantity of the provided goods or services. His work was path-breaking, given his view of the effects of regulations. Nevertheless, it has faced much criticism. Stigler's belief that regulatory failure is inevitable has been greatly resisted. His “rule” that any regulatory intervention was deemed to fail was based on bold claims with limited empirical evidence (Carrigan & Cogliansese, 2016).

According to Chari & David (2012), there is a negative relationship between market reforms and the sustainability of firm performance. Their study is in line with Muukas (1997) beliefs that reforms in terms of market openings are vulnerable for domestic firms. A premature and rushed market opening inhibits the firms from developing the necessary capabilities to withstand competition from foreign firms. Therefore, reforms should be carefully implemented concerning domestic firms' current strength and competitiveness level.

3 Theory of Industrial Organisation

This thesis's foundation is based on studies in the field of industrial organisation. Several names know the concept, but there seems to be a general consensus over the scope, including firms, markets, and industries. One appropriate and intrusive definition is Cabral's (2000): *"Industrial organisation is concerned with the workings of markets and industries and in particular the way firms compete with each other."* (p.3). The strategic interactions of firms are assumed to be a determining factor of the various market structures. These structures are associated with different levels of market power that may change due to factors such as competition and regulations (Pepall, Richards & Norman 2014, p.213).

3.1 The Structure-Conduct-Performance Approach

The Structure-Conduct-Performance approach belongs to the traditional approach in industrial organisation, first introduced by Mason (1939) and later epitomised by Bain (1959). It is considered a pillar in the field and serves as an analytical framework for studies of industries.

The model is used to examine the assumed causal, one-way relationship between the structure of an industry, firm conduct, and market performance. Additionally, there is a basic idea that society strives for every sector to be socio-economically efficient. Market structure can be measured in the number of competitors and the entry and exit conditions. Conduct refers to the strategic action of firms and their interactions, e.g., pricing strategies, product differentiation, and exploitation of market power. Both of these factors then determine the performance of the firms, which can be measured in terms of product efficiency, allocative efficiency, and profitability.

Industries characterised by higher levels of competition inhibit the range of options and constraints firms from acting freely. This enables more social welfare since the firms are restricted to serving for their profit maximisation. On the other hand, an industry with a low level of competition is less constrained, enabling a more comprehensive range of conduct options. Firms may use their market power to set prices for competitive advantage. However, the competitive advantage of these firms is determined by the existence of entry barriers. If other firms enter, the competitive advantage might disappear.

The main critique against the SCP model is that it fails to explain the importance of strategic action in the middle link of conduct. According to the Chicago School, the argument that structures are exogenous and not affected by firm behaviour is an inaccurate assumption.

They belong to the “new” school of industrial organisation and highlight an entrant firm's potential competitive advantage in controlling the incumbent firm by undercutting its prices. The ability to measure the variables has also been criticised. Especially the possibilities of measuring entry barriers and the extent of vertical integration have raised serious doubts.

Despite its flaws and critiques, the SPC model is one of the most enduring tools for analysing competitive industries. Taking the deficiencies of the approach into account, the interconnections between structure, conduct, and performance are not viewed as linear. Instead, the analysis will be based on the revisited, dynamic approach of the SCP model. Since this thesis examines the strategic interactions and actions taken by the operating railway firms, the central analysis area will be the conduct. It will be assumed that conduct may determine structure and performance and not necessarily only a result of the industry's structure.

3.1.1 Structure

To analyse an industry, it is necessary first to delineate it. The market structure, the number of firms, and the distribution of market shares are required to declare further the existing dynamics and interactions within the targeted industry.

An appropriate measurement for the concentration and competitiveness of an industry is the Herfindahl-Hirschman index. It accounts for the size of the firms in relation to their industry. The index is calculated by the formula:

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

Every firms market share is squared and summed with a value between 0 and 10 000. s_i^2 is the squared market share. A low score indicates a lower concentration with many firms in the industry of equal market shares in a scenario closer to perfect competition. On the other hand, a high value indicates an industry with few or only one firm with high degrees of market power. A score of 10 000 demonstrates an industry with one firm with absolute monopoly power which serves the whole market (Eurostat, 2021).

Monopoly and Natural Monopoly

A monopoly is defined as an industry with only one firm operating. When there are high entry barriers, firms may use their unthreatened position to set higher prices than if there were other firms in the industry. Regulation may inhibit the incentives for firms to set unjustified prices.

This phenomenon is also regulated by Swedish competition law. A monopoly is not per se negative for the consumers and the welfare of society, where sector-specific regulations often take place to avoid monopolistic firms exploiting their favourable position (Konkurrensverket, 2023).

A natural monopoly may occur in an industry with high entry costs and where one firm is more efficient in providing a good or service than multiple firms. The high start-up costs create high entry barriers, keeping other firms out of the industry. These are allowed as long as they can keep prices lower than their potential rivals and can serve the entire industry. Natural monopolies are often subject to demanding governmental regulations where they should operate for the public, not the firm's profit (Pepall et al., 2014, p.71).

Oligopoly and Duopoly

An industry with only a few operating firms is defined as an oligopoly. The risk of illegal collaborations that may inhibit competition may occur in an oligopolistic setting. Additionally, the structure enables firms to follow the agreements closely, which forces others either stay in line or react to the behaviours of others. Firms that abuse their dominant position in an oligopoly often hinder entrants from entering the industry to keep their market power (Konkurrensverket, 2023).

The most basic form of an oligopoly is the duopoly, with only two firms in an industry. If these firms decide to collude, may it have the same effects as with a monopoly with higher prices. Firms choosing not to cooperate may lead to fierce competition, which can lower consumer prices (Church & Ware 2000, p.755).

Entry Barriers and Strategic Entry Deterrence

Some structural characteristics of an industry can allow the incumbent firm to maintain its market power and profits. Entry barriers protect the already sitting firm and may make entering unprofitable. Suppose a new firm enters successfully. In that case, the incumbent firm may react aggressively, even to increase the exclusionary conditions to stop further entering to preserve its market power. The purpose of strategic entry deterrence is for a firm to secure its stream of monopoly profits in the long run. The main action from the incumbent firm is an investment in, for example, a low-cost technology or vertical integration before entry to create a disadvantage for the entrant in the post-entry industry (Church & Ware 2000, pp.536-537).

Bain (1956) defined an entry barrier as anything that allows incumbent firms to earn above-normal profits without inducing entry. According to him, the barriers to entry are a crucial element in the structure-conduct-performance approach. He identified three potential barriers enabling this condition:

- *Economies of scale*
- *Absolute-cost advantage of established firms*
- *Product differentiation*

Economies of scale occur where a firm's increased efficiency in production becomes a cost advantage where the increased production decreases the cost. An absolute cost advantage occurs when an established firm has a lower average cost than an entrant at any potential scale of operations. It may arise from lower prices for raw materials, patents, superior techniques or even control of the supply of necessary materials. Product differentiation is an indirect entry barrier since it may reinforce scale economies. The differences in goods or services can give a firm a degree of control over the price and increase its market power. This may result in a narrowing of the industry with fewer firms and a more concentrated market.

His theory has been criticised by Stigler (1968), who argued that scale economies are not an entry barrier. He defined an entry barrier as *a cost of production that must be borne by a firm which seeks to enter an industry but is not borne by firms already in an industry.* Therefore, he believed that all firms in a given industry would enjoy the same economies as they expand their output.

An incumbent firm may act to deter new entrants from the industry. This can be done both intentionally but also unintentionally. A *strategic* entry barrier is done to reduce the potential competition with purposely deterring actions. An *innocent* entry barrier has two different types. Firstly, a *post-entry absolute advantage* is when the entering firm faces an established firm with a profit advantage from patents, lower marginal costs or superior technology. Secondly, a *pre-entry asymmetry advantage* occurs if the incumbent firm has a first-mover advantage from already committed resources (Salop, 1979).

3.1.2 Conduct

As the model predicts that the industrial structure drives the conduct, the subsequent stage is to analyse the organisational behaviour of the present firms. The strategic and tactical interactions are crucial in industries with few firms where every decision a firm makes will significantly impact the others. Firms are well aware of their current rivals and will base their strategies on the anticipated action of others. Therefore, analysing the conduct is intended to display the different strategies done by the firms. It will be done with theories of price and quantity competition. Other pricing strategies railroad operators may use to either attract customers or inhibit their rivals from achieving profits will also be presented.

Price and Quantity Competition

Game theory is the fundamental framework for analysing these interactions. It is divided into either noncooperative or cooperative games where we will use the noncooperative models of Cournot, Bertrand and Stackelberg. These will be applied to evaluate these interactions in a static and or dynamic setting in industries with oligopolistic market structures. There are two fundamental assumptions. Firstly, firms are rational in their decision-making, intending to maximise profit. Secondly, firms are assumed to use all their knowledge with strategic reasoning to determine the expected behaviours of other firms. Threats and promises are critical in games where one firm strategically tries to obstruct another from entering. If these are credible, the incumbent firm may be able to maintain a dominant position and become less threatened by other entrants.One important caution when analysing oligopolistic structures is that there is no single standard model, unlike in the case of a monopoly. There are more differences in the oligopoly setting with various amounts of firms, the amount of available information and if the decision-making is sequential or simultaneous. Hence, these models will be more suitable for cases where another case requires another. In addition, these models are oversimplifications of abstract real-life interactions of firms (Pepall et al., 2014, p.216).

Augustin Cournot (1836) presented his model for simultaneous quantity competition in an oligopoly market. Firms are assumed to produce identical products at the same cost and be rational in their strategic behaviour. It is also assumed that there are only two actors, the incumbent and the entrant. The industry structure changes from a monopoly to a duopoly, forcing the incumbent firm to act. The entrant firm chooses its output level to the anticipated level of the incumbent. This leads to a response from the incumbent firm that chooses the same output level that lowers its previous monopoly profit. The market outcome is improved from one of the monopolies, but not as in a perfect competition equilibrium.

Cournot's model was questioned and revisited by Joseph Bertrand (1883). Ceteris paribus, he believed that firms competed in price rather than quantities. In his model, the firm that offers the lowest price clears the whole market and obtains all the consumer demand. The outcome is that the price will equal the marginal cost in equilibrium, which is the same outcome as in perfect competition.

Stackelberg's (1934) model has the same assumptions as Cournots, with the difference that firms compete sequentially in either price or quantities. The sequential setting makes the model dynamic where there is a leading firm and a following firm. The leader firm enjoys a first-mover advantage when competing in quantity since it considers the followers´ response in choosing its initial output level. On the other hand, the leader may be restricted by a first-mover disadvantage when competing in price where the following firm can always undercut its prices.

Price Discrimination

A firm with different levels of information about its consumer's preferences can practise three different degrees of price discrimination. 1st degree is conditioned on perfect information on consumers' willingness to pay for their goods or services and can extract all the surplus. 2nd-degree price discrimination is when a firm can disunite individual demands and charges different prices based on different quantities. 3rd-degree price discrimination is when a firm can identify different segments of consumers and charges different prices for the same good depending on the group. The consumers in one distinct segment face the same price, and every individual consumer pays a constant price for all units or services of output purchased (Varian 2010, pp.462-470).

Peak-load pricing is a variation of price discrimination, but instead of a segment of consumers, it is concerned with the various demands for different times for the service. Consider the case of a public service offered at a few different times at the same price. The demand for the different times may differ. If the firm identifies these variations, peak-load pricing can be implemented to either regulate the demand or to obtain increased profit. Increases or decreases in price can control demand peaks and off-peaks (Church & Ware 2000, p. 802-807).

Product Differentiation

Firms that offer a product or service with particular characteristics that stand out from their competitors use the product differentiation strategy to attract a certain segment of consumers.

This may allow the firms to increase their market share and market power. Furthermore, this strategy can enable higher profits where product differentiation allows firms to charge higher prices for improved appearance, customer service or durability. In addition, it may improve the firm's ability to define its target segment and understand its customers. Horizontal product differentiation refers to, given equal prices, people's consumption of different goods based on their preferences. Vertical product differentiation, on the other hand, is how consumers prefer one product over the other due to the varying qualities of a good or service (Pepall et al., 2014, pp.238-239).

Predatory Pricing

An incumbent firm can use this aggressive pricing strategy to induce the exit of a rival firm. Ordover and Willig (1981) defined predatory pricing as "*the response to a rival that sacrifices part of the profit that could be earned under competitive circumstances, where the rival to remain viable, in order to induce exit and gain consequent additional monopoly profit"* (p.9). The predatory firm can, over a period of time, lower its prices to drive out a competitor. It can also be used to deter new firms from entering the industry since they will not be able to be profitable at low prices. If the incumbent firm succeeds with the strategy, the price may rise again.

3.1.3 Performance

Lastly, the relationship between the structure and the conduct of the industry is assumed to determine its performance ultimately. This is measured by how the goods or service contributes to society's overall well-being. According to Bressler and King (1970), performance is also related to the functioning of the market, measured in terms of price, volume and costs of products.

Since this thesis aims to examine the competitive environment and the interactions in the Swedish passenger railway industry, its performance will be evaluated in terms of the number of departures, the price of tickets in second class and the overall efficiency of the industry. With the theoretical foundations of the industry's structure and conduct, the obtained results will be intertwined into the performance part of the analysis. The aim is to determine the industry's performance with either structure or conduct or possibly as a combination.

4 Methodology

This thesis is done with a two-stage methodology of two data sets. Public available data regarding Swedish passenger transportation by train is unfavourable regarding quality, extent and availability. Therefore, the available information about 397 direct departures from Stockholm to Gothenburg and 183 from Stockholm to Malmö has been gathered. These are the most heavily burdened train routes in Sweden. The railway line between Stockholm and Gothenburg is considered the busiest train route in Scandinavia and the second most busy in Europe (Sydsvenskan, 2020). This was done in two stages, with an aggregated collection of all the direct departures at specific dates, followed by a more profound gathering of specific elements for every departure.

Excel was used to structure the data and to create tables. It was also used as a tool for evaluating the targeted variables. This is done with Pivot Tables, an analysing tool that creates structured tables for variables. The aim is to provide tables and charts of numerical findings from the data sets.

To understand how these variables have a significant effect and how they are an explanatory variable of price in the second class, two different Ordinary Least Squares regressions were performed on the variables. The objective is to demonstrate how these variables either have a positive, negative or insignificant impact on price. This was done with the econometric Tool Gretl.

The tables, charts and outputs of the regression will be presented in *Chapter 5*. These will then be further analysed with the empirical events in *Chapter 6* and discussed in *Chapter 7*.

4.1 Data

The initial data collection stage was to clarify the number of direct departures and operators at a specific date at the two train routes. The internet-based public transport planner *Reserobot* (2023) was used to gather the data. It is a competition-neutral platform that gathers all the operating firms' tickets simultaneously. The data consist of all departures of four Tuesdays, Wednesdays and Thursdays. The delineation was done to reduce the anticipated weekend, Monday and Friday effects on both prices and departures. In addition, no holidays are included due to increased demand due to their potential impacts on price and quantity.

Table 1. The number of direct departures and trains at the routes Stockholm-Malmö & Stockholm-Gothenburg from twelve different dates (Resrobot,2023).

Stockholm-Malmö	***Accessed:***	***27/3-2023, 11/4-2023***	***Stockholm-Gothenburg***	***Accessed:***	***28/3-2023, 11/4-2023***
Departure date	***Departures***	***Trains***	***Departure date***	***Departures***	***Trains***
18/4–2023	*15*	*2*	*18/4–2023*	*30*	*3*
19/4–2023	*14*	*2*	*19/4–2023*	*30*	*3*
20/4–2023	*11*	*2*	*20/4–2023*	*31*	*3*
25/4–2023	*15*	*2*	*25/4–2023*	*34*	*3*
26/4–2023	*16*	*2*	*26/4–2023*	*34*	*3*
27/4–2023	*16*	*2*	*27/4–2023*	*35*	*3*
3/5–2023	*16*	*2*	*3/5–2023*	*34*	*3*
4/5–2023	*16*	*2*	*4/5–2023*	*34*	*3*
5/5–2023	*17*	*2*	*5/5–2023*	*34*	*3*
9/5–2023	*15*	*2*	*9/5–2023*	*34*	*3*
10/5–2023	*16*	*2*	*10/5–2023*	*34*	*3*
11/5-2023	*16*	*2*	*11/5-2023*	*33*	*3*
Total	***183***		***Total***	***397***	

The gathering in the initial phase was subsequently used as the foundation for obtaining information about every specific departure. The train operator, time of departure, total travelling time and the prices of the different price categories have been collected from the individual operators' websites.To perform regressions, incomplete variables and totally sold-out departures were excluded. The definite data was divided into two sets. The first one consists of all 580 departures accessed on March 27th and 28th of March 2023. The second set consists of the same 580 departures but is accessed on the 11th of April 2023, one week from the first departure date. These sets will hereafter be referred to as *Data-set 1* and *Data-set 2*.

4.2 Variables

Since the results will be presented in both tables and with regressions, the following variables will be used with some discrepancies. This section will present the examined variables in their initial form for both the pivot tables, charts and regressions. In *Section 4.3*, some of them will be redefined to some extent to function in a regression.

Price of 2nd Class Tickets:

Since the examined operators differ in many aspects, there is a need for a common denominator. The price offered by the different operators in the second-class tickets is the only variable for all operating firms regarding different available ticket categories. The price is in the Swedish currency SEK.

Operators and Trains:

There is an anticipated effect on price in second class related to which operator is offering the ticket. They will be examined in the pivot tables by which train they operate. SJ, MTRX and Snälltåget are referred to as *operators*. Since SJ operates two different types of trains, SJ High-Speed and SJ Regional will be referred to as *trains.*

Number of Ticket Classes:

The operators offer different types of ticket classes. This variable is related to price discrimination, where a more extensive selection of offered ticket classes enables the operators to attract customers with different willingness to pay and preferences. *Table 2* contains the different types of ticket classes.

Table 2. The Ticket Classes Offered by the Operators (SJ, 2023), (MTRX,2023), (Snälltåget, 2023).

Ticket categories/operators	***SJ High-Speed***	***SJ Regional***	***MTRX***	***Snälltåget***
2nd Class	*X*	*X*	-	*X*
Fix	-	-	*X*	-
2nd Class (Calm carriage)	-	-	-	-
Flex	-	-	*X*	-
Plus	-	-	*X*	-
1st Class	*X*	*X*	-	-
1st Class Plus	-	-	*X*	-

Time To Peak:

To determine how the different departure times are related to the fluctuations in price, the variable time to peak is included. Since the pressure on demand for train tickets for weekdays is highest in the morning and the afternoon, two peaks are definite as 8:30 and 16:30. The departure times are therefore remodelled in the sense that they take values in minutes to the closest peak. 12:30 is the fixed limit that marks 240 minutes to each peak, determining whether the departure is counted towards the morning or afternoon peak.

Travel Time:

The total travel times vary between operators and the individual departures on the same routes. It is measured in the total of minutes from departure to arrival. The anticipated effect is that a faster train is more expensive since the customers' willingness to pay should be higher for shorter travel times.

Distance:

Since the routes vary in length, the distance in terms of kilometres is included. It is also included to calculate the following variable, price per kilometre.

Price/Km:

Price per kilometre will be used in the pivot table to showcase how the differences in the total distance of the train routes may affect the price. The following formula will calculate it:

$$Price/Km = \frac{Price\ 2nd\ class}{Total\ distance}$$

Since price in second class is used as the numerator will it not be used in the regression.

The Herfindahl-Hirschman Index:

The HHI (see *Section 3.1.1*) will first be summarised in a pivot table and later implemented in the regression. Firstly, the total frequency of 580 departures will be summarised. Secondly, the frequency value will be remodelled into its total percentage representing the operator's market share. Lastly, the market shares will be squared and summarised in one HHI value. It will demonstrate how an operator's market power may be an explanation for their price setting.

Sold Out Ticket Classes:

Table 2 contains all the operators' ticket classes. What happens with the remaining variables if any of these are sold out? This will be examined in *Section 5.1* and *5.2*.

4.3 Regression Framework

The regression aims to identify what factors affect the price of the dependent variable price of second-class tickets. The above-presented variables have been adapted to fit and show results from which conclusions can be drawn. *Table 3* contains the descriptives of variables used in the regressions. The implemented dummy variables are presented in *Table 4*.

Table 3. Descriptives of regression variables.

Data-set 1					*Data-set 2*			
Variable	*Mean*	*Median*	*Minimum*	*Maximum*	*Mean*	*Median*	*Minimum*	*Maximum*
Price2ndClass	*457.89*	*439*	*185*	*1295*	*503.88*	*445*	*185*	*1475*
TimeToPeak	*113.04*	*116*	*2*	*293*	*113.04*	*116*	*2*	*293*
TotalTime	*232.59*	*203*	*174*	*297*	*232.59*	*232,59*	*174*	*297*
Distance	*433.97*	*398*	*398*	*512*	*433.97*	*398*	*398*	*512*
HHI	*0.63*	*0.77*	*0.04*	*0.77*	*0.63*	*0.77*	*0.04*	*0.77*

Further explanations of the above variables are available in *Section 4.2*. The full descriptive tables, including the dummy variables, are available in *Appendix A*.

Table 4. Dummy variables and their reference categories.

Dummy variable	*Reference category*
OtherOperator_D	*SJ High-Speed*
SJRegional_D	*SJ High-Speed*
SoldOut_D	*All Available*

Since the variables of operator, train and sold-out tickets are not ratio scale variables but categorial, three dummy variables have been included. This allows the variables to be incorporated into the regression as 1, where their reference category is coded as 0. They differ not in numbers but in their attributes. The reference categories do not possess the targeted

attribute and are therefore not included (Gujarati & Porter 2008, pp. 277-281). The following further explains the implemented dummy variables:

OtherOperator_D:

The dummy variable for other operators refers to MTRX and Snälltåget. SJ is the most prominent firm in the data set and therefore has the most effect on the mean of the dependent variable.OtherOperator_D aims to catch the impact of the other operators on price in the second class.

SoldOut_D:

SJ and MTRX offer more price classes than just the second-class options. Therefore, the occasions of a sold-out class, other than in the second class, will be treated as a dummy variable. The anticipated effect on second-class tickets is high since it creates scarcity for already heavily demanded departures.

SJRegional_D:

Since SJ offers two types of trains, High Speed and Regional, the regional option is coded as a dummy variable. The regional train operates on the Stockholm – Gothenburg route as a slower but cheaper option. In addition, it only offers second-class and first-class tickets. This dummy variable is included to capture the Regional option's impact on price in the second class for SJ.

4.3.1 Ordinary Least Squares

In order to analyse the effects of the independent variables on the price of second-class tickets, two Ordinary Least Squares (OLS) regressions were performed on the cross-sectional data sets by the following equation:

$$Price2ndClass_i = \beta_1 + \beta_2(TimeToPeak) + \beta_3(TravelTime) + \beta_4(Distance) + \beta_5(HII) + \beta_6(OtherOperator_D) + \beta_7(SJRegional_D) + \beta_2(SoldOut_D) + \varepsilon_i$$

Where $Price2ndClass_i$ is the dependent variable. The OLS method minimises the sum of the squared residuals where it identifies the linear relationship that best explains the interplay of the variables. An essential condition for OLS regressions, since it is a linear model, is that the equation is linear. This means the dependent variable must be related to the explanatory variables and the error term to satisfy the assumption of linearity. Each independent variable is multiplied and summed up as a prediction of the dependent variable. One appropriate

method to determine linearity is using scatter plots of the explanatory variables plotted against the dependent variable. If the observed pattern is linear, the assumption is fulfilled.

While performing the regressions, some common errors are essential to manage for achieving reliable results. During the process, the selected data encountered problems with multicollinearity and heteroscedasticity. An explanation of their implication and how it has been handled is presented as follows:

Multicollinearity:

When performing an equation with multiple explanatory variables, there is the risk of multicollinearity. It occurs when two or more explanatory variables depend on each other in a linear relationship. If the variables have a perfect linear relationship, will it be unable to perform the regression due to perfect multicollinearity (Carter Hill 2011, pp.240-242). The previous issues with multicollinearity were handled by excluding certain variables that disrupted the OLS regression. Additionally, some dummy variables were excluded to avoid the so-called dummy trap. This is the phenomenon of having multicollinearity in the independent variables with duplicated categories (Gujarati & Porter 2008, p.642).

Heteroscedasticity:

When performing OLS regression, the variables should fulfil the assumption of homoscedasticity. This requires that the mean of the error term is normally distributed and its expected value of error 0. Therefore, the regressions are expected to have no errors on average. If the assumption is violated, heteroscedasticity is present, and the regression result becomes unreliable. Two White´s tests were conducted in Gretl to determine the state of the error term (see *Appendix B*). The null hypothesis of homoscedasticity is rejected if there is heteroscedasticity present. Additionally, robust standard errors were included to prevent heteroscedasticity (Gujarati & Porter 2008, pp.365-371).

5 Results

5.1 Evaluation of Pivot Tables and Charts

Table 5. The Herfindahl-Hirschman Index.

Operator	***Frequency***	***Firm Rank***	***Market Share (%)*** s_i	***Squared Market Share*** s_i^2
MTRX	*111*	*2*	*19,14*	*366,34*
SJ	*448*	*1*	*77,24*	*5966,02*
Snälltåget	*21*	*3*	*3,62*	*13,1*
Grand Total	***580***		***100***	***6345,46***

Since the market delineation is all the departures on the routes of Stockholm - Gothenburg and Stockholm – Malmö for 12 weekdays, the table does not show the entire competitive industry of the Swedish railroad companies. Yet, it reveals the distribution of market power on the most heavily burdened routes. SJ is by far the actor with the largest number of departures, with them offering both their high-speed option and their slower option of SJ Regional. This result also approximates the current competition on all rail routes in Sweden. 2021 SJ accounted for 84 per cent of the commercial passenger train industry. MTRX and Snälltåget accounted for 4 per cent each (Transportstyrelsen, 2022). Since MTRX is only present in Gothenburg, its market share is significantly higher in this thesis. Comparing the two routes, SJ accounts for almost 90 per cent of all departures between Stockholm and Malmö and 70 per cent between Stockholm and Gothenburg on these dates.

Table 6. Data-set 1: Stockholm to Malmö.

Train	***Departures***	***Offered Ticket Classes***	***Average Price 2nd Class***	***Average Price/km***
SJ High-Speed	*162*	*3*	*677*	*1,32*
Snälltåget	*21*	*1*	*278*	*0,56*
Grand Total	***183***	***4***	***631***	***1,23***

Table 7. Data-set 2: Stockholm to Malmö.

Train	***Departures***	***Offered Ticket Classes***	***Average Price 2nd Class***	***Average Price/km***
SJ High-Speed	*162*	*3*	*723*	*1,40*
Snälltåget	*21*	*1*	*385*	*0,78*

Grand Total	***183***	***4***	***684***	***1,33***

Table 8. Data-set 1: Stockholm to Gothenburg.

Train	***Departures***	***Offered Ticket Classes***	***Average Price 2nd Class***	***Average Price/km***
MTRX	*111*	*4*	*347*	*0,87*
SJ High-Speed	*190*	*3*	*450*	*1,13*
SJ Regional	*96*	*2*	*273*	*0,68*
Grand Total	***397***	***9***	***378***	***0,95***

Table 9. Data-set 2: Stockholm to Gothenburg.

Train	***Departures***	***Offered Ticket Classes***	***Average Price 2nd Class***	***Average Price/km***
MTRX	*111*	*4*	*393*	*0,99*
SJ High-Speed	*190*	*3*	*497474*	*1,25*
SJ Regional	*96*	*2*	*302*	*0,76*
Grand Total	***397***	***9***	***421***	***1,05***

The train route between Stockholm and Malmö is only operated by SJ and Snälltåget. The distribution of departures is clearly in SJs favour since it accounts for approximately 90 per cent of the total. There is an increase in the average price between the two data sets, where Snälltåget has increased their price by 107 SEK and SJ BY 46 SEK. The 14-day period between the access dates has therefore contributed to increasing prices.

The route between Stockholm and Gothenburg is also operated by two firms, SJ and MTRX. SJ offers two types with their High-Speed option and the slower, Regional trains. The average price of MTRX is lower than that of SJ High-Speed, but the average price/km is slightly higher than the SJ Regional trains. There is also a markup in price between the data sets where MTRX tickets have increased by 46 SEK, SJ High-Speed by 47 SEK, and SJ Regional by 29 SEK.

Splitting the data sets into four sets for the different routes and access dates allows for a clear comparison. SJ is significantly more dominant on the Stockholm to Malmö route and accounts for almost all departures. As shown in *Table 1*, the total daily departures range from 15-17. Stockholm to Gothenburg has between 31 to 36 departures. In addition, SJ is not as dominant here as on the Stockholm to Malmö route, where MTRX accounts for approximately a third of all daily departures.

When comparing and calculating the difference in percentage between SJ High-Speed average price per kilometre of the routes, a recognisable observation appears. In *Data-set 1* there is a difference of 16 per cent. In *Data-set 2,* there is a 12 per cent difference. As mentioned in *Section 2.3*, SJs average ticket price decreased by 12,8 per cent after MTRX entry. With external effects in mind, this may show how an incumbent firm's monopoly prices drop when an entrant firm significantly affects the market dynamics.

Table 10. Peak and off-peak departures at the Stockholm to Malmö route.

Peak Departures	***Train***	***Average Price 2nd Class***	***Off-Peak Departures***	***Train***	***Average Price 2nd Class***
16.11	*SJ High-Speed*	*955*	*09.28*	*Snälltåget*	*318*
15.22	*SJ High-Speed*	*940*	*16.23*	*Snälltåget*	*349*
08.21	*SJ High-Speed*	*887*	*19.21*	*SJ High-Speed*	*359*
12.20	*SJ High-Speed*	*806*	*20.28*	*SJ High-Speed*	*400*
14.22	*SJ High-Speed*	*800*	*05.21*	*SJ High-Speed*	*428*
Average Total		***878***			***371***

Table 11. Peak and off-peak departures at the Stockholm to Gothenburg route.

Peak Departures	***Train***	***Average Price 2nd Class***	***Off-Peak Departure***	***Train***	***Average Price 2nd Class***
16.32	*SJ High-Speed*	*696*	*21.23*	*MTRX*	*202*
17.16	*SJ High-Speed*	*583*	*19.52*	*MTRX*	*205*
15.27	*SJ High-Speed*	*574*	*20.34*	*SJ High-Speed*	*218*
17.28	*SJ High-Speed*	*533*	*10.14*	*SJ Regional*	*221*
13.29	*SJ High-Speed*	*515*	*06.14*	*SJ Regional*	*224*
Average Total		***580***			***214***

When comparing the tables above, there is gravitation against both the same peak and off-peak hours. The afternoon peak is the most distinct in terms of spiking prices, where the majority of the most expensive departures are between or close to the interval between 15:00

and 17:00. The morning peak is only noticeable on the route from Stockholm to Malmö with the 08.21 departure. The off-peak hours are more difficult to discern, partly because the average price of both Snälltåget and SJ Regional is considerably lower than the other. Still, travelling early in the morning and evening is, according to the tables, the least expensive and can be considered the off-peak hours.

SJ High-Speed accounts exclusively for the five departures with the highest average price in second-class tickets at both routes. It is also observed 4 out of 10 possible times in the off-peak tables. SJ accounts for 16 out of 20 possible peak or off-peak departures with both regional and High-Speed trains.

Chart 1. Data-set 1- Sold Out Ticket Classes.

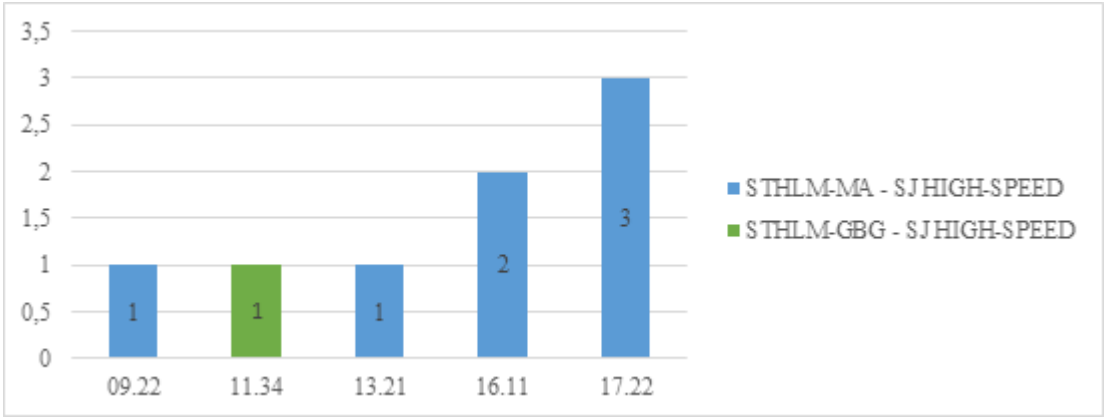
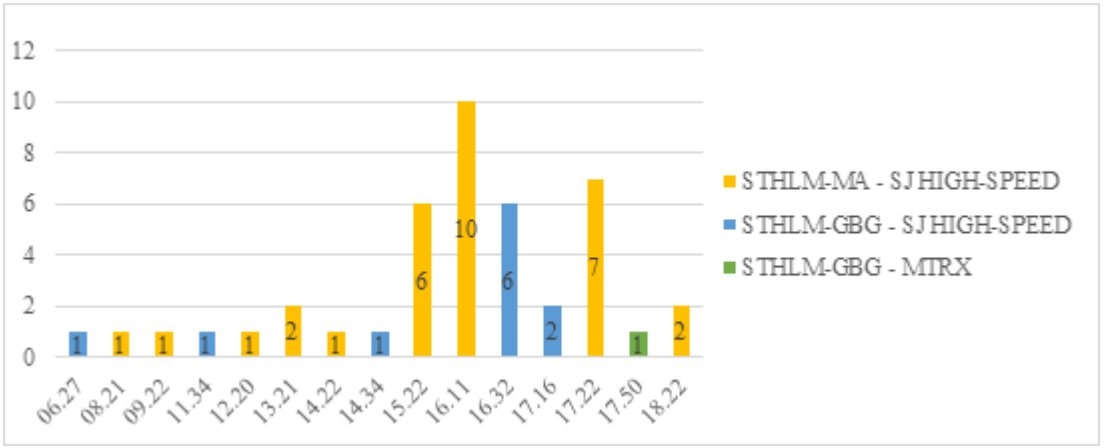


Chart 2. Data-set 2 - Sold Out Ticket Classes.



There is a clear difference between the two data sets regarding the number of sold-out ticket classes. In *Chart 1,* all the sold-out ticket classes are on the SJ High-Speed departures, whereas 7 out of 8 sold-out ticket classes are on the Stockholm to Malmö route. In *Chart 2*, SJ High-Speed accounts for 42 out of 43 observations, and 31 are on the Stockholm to Malmö route. The only exception is the 17.50 departure from Stockholm to Gothenburg, where

MTRX operates. The number of sold-out observations increased by 35 units from *Data-set 1* to *Data-set 2*. Most sold-out classes are centred around the afternoon peak, where 77 per cent of the total ranges in the interval from 15.22 until 17.22. Another salient observation is that the SJ High-Speed train accounts for all the sold-out ticket classes except one of MTRX.

5.2. Evaluation of regressions

Table 12. Regression output 1: OLS, using observations 1-580
Dependent variable: Price2ndClass

	Coefficient	*Std. Error*	*t-ratio*	*p-value*			
Constant	−910.355	131.789	−6.908	<0.0001	***	Mean dependent var	457.8914
TimeToPeak	−0.884443	0.0950448	−9.306	<0.0001	***	S.D. dependent var	222.6813
TravelTime	−3.82761	1.04399	−3.666	0.0003	***	R-squared	0.517478
Distance	4.36486	0.760075	5.743	<0.0001	***	Adjusted R-squared	0.511573
HHI	597.442	130.043	4.594	<0.0001	***	Significance level:	Confidence %
OtherOperator_D	236.713	75.9903	3.115	0.0019	***	***	1%
SJRegional_D	187.595	106.685	1.758	0.0792	*	**	5%
SoldOut_D	140.022	56.1789	2.492	0.0130	**	*	10%

Table 13. Regression output 2: OLS, using observations 1-580
Dependent variable: Price2ndClass

	Coefficient	*Std. Error*	*t-ratio*	*p-value*			
Constant	−663.786	125.789	−5.277	<0.0001	***	Mean dependent var	503.8845
TimeToPeak	−0.893832	0.0987024	−9.056	<0.0001	***	S.D. dependent var	236.5516
TravelTime	−1.83442	0.692035	−2.651	0.0083	***	R-squared	0.547662
Distance	2.90606	0.510891	5.688	<0.0001	***	Adjusted R-squared	0.542126
HHI	587.206	127.633	4.601	<0.0001	***	Significance level:	Confidence %
OtherOperator_D	233.084	76.7625	3.036	0.0025	***	***	1%
SJRegional_D	−14.5767	71.6717	−0.2034	0.8389		**	5%
SoldOut_D	262.074	31.0892	8.430	<0.0001	***	*	10%

At first glance, it is clear that the tables are consistent in their results. Still, there are some observed differences due to the time difference between their points for data collection. This results from the OLS regressions being done on data from the departures but from different points in time.

The negative marginal effect of time to peak shows the significant impact a value in terms of minutes to the set peak hours has on price. There is a significant price difference depending on when the departure is during the day. This yields the negative relationship of the fewer minutes to the peak, the higher the price is.

Total travel time in terms of minutes also negatively affects the price. This effect results from the shorter travel time and length of the Stockholm-Gothenburg route with, on average, significantly lower prices.

On the other hand, the total distance travelled has an increasing effect on price. This effect may result from the variation in the total distance where the route from Stockholm to Malmö is longer. In addition, the average price on the route is significantly higher than on the Stockholm to Gothenburg route, which impacts the result of the variable.

Market power has a significant impact on price. SJ scored 5966,02 out of 6345,46, which accounts for 77,24 per cent of all the observations. It was interpreted as the total number of departures in the HHI, conducted in *Section 5.1*. One may also view the HHI as a dummy variable of SJ High-Speed since it accounts for most observations. With this approach of the variable is its significant positive effect on price an interpretation of SJs market power.

The other operator dummy representing Snälltåget and MTRX is significant with a positive marginal effect. There is an observed slightly decreasing effect of approximately four units on the dependent variable between the tables. Simultaneously, the mean price in the second class increased by 46 units. This may be an effect of the observed increase in both these operators' average prices in 2nd class is showcased in *Table 6-9*. Therefore, their increase in the average price in 2nd class for all observations may explain the decreasing effect in the regression.

A dummy variable for the slower SJ Regional train was included to capture its eventual effect on the dependent variable. Its outcome was just on the 1 per cent significance level in *Table 12* with a positive marginal effect. In *Table 13, it* is not significant. Therefore, it is unreliable to ascertain the dummy's possible effects. Variations in other variables have likely disrupted its previous impact.

The most noticeable change is observed in the dummy variable for sold-out ticket classes. There is an increase of 115 units between the points of data collection, where it also has an increased significance level in *Table 13*. As shown in *Chart 2,* the number of sold-out tickets increased from 8 to 43 in 14 days. Sold-out tickets have an additional positive effect on price and are increasingly significant the closer the departure date.

6 Analysis

In this chapter, the Structure-Conduct-Performance approach will be applied to analyse the obtained results from *Chapter* 5 and the empirical findings from *Chapter 2*.

6.1 Structure

First and foremost, explaining how the current structure emerged is important. Prior to the deregulation, SJ could be considered a natural monopoly. The Swedish government allowed SJ as the only firm operating unthreatened, believing that they could serve the whole market better than having more firms operating passenger trains. The vertical split with authority Banverket in 1988 separated its power to some degree where SJ was no longer in charge of the infrastructure. Nevertheless, SJ was still in a monopoly until the market opened with the temporary exemption of the local competition with BK Tåg in Småland.

The score of 6345,46 out of 10 000 on the Herfindahl-Hirschman index indicates that the targeted days and routes are considerably concentrated. SJ accounts for 77,24 per cent of the departures with their High-Speed and Regional trains. When delineating the routes, they are both defined as duopolies. As shown in *Table 6* and *7*, the route between Stockholm and Malmö is less burdened with a lower average of daily departures. SJ almost has a monopoly on the route. On the other hand, the route between Stockholm and Gothenburg is more competitive, with a higher number of average daily departures despite its only two firms operating.

SJs ticket channel is the most prominent entry barrier and by far the most used platform to plan trips and buy tickets for Swedish passenger trains. It can be argued to be a strategic entry barrier aiming to protect its market power and control the demand for the other firms. Even though MTRX has notified SJ to the Swedish competition authority for abuse of its dominant position, they are still not authorised to have their tickets on the platform. On the other hand, Snälltåget is granted. This may result from SJ not considering Snälltåget a real threat, where MTRX has proven to reduce ticket prices after they entered the route between Stockholm and Gothenburg. Therefore, the ticket platform can be considered a deterring strategy since it reduces competition. Additionally, it limits the potential exposure of MTRX tickets.

Another entry barrier is the railway itself. With SJ already established long before the market opening, they have a pre-entry asymmetry advantage of already committed resources. The railway is limited in the number of trains that can operate simultaneously. Entering is

associated with high costs with investment in train carriages, personnel, digital platforms and marketing to attract customers. SJ already has these foundations in place, and their deterring actions might keep possible entrants from trying to enter since it is not considered profitable or even possible.

6.2 Conduct

Since the routes are defined as duopolies, the models for price and quantity competition are suitable for analysing the strategic interactions of the firms. Prior the deregulation, SJs position as a monopoly was unthreatened. The entrance of MTRX has proven to force SJ to adapt and react. Their average ticket prices fell by 12 per cent and have acted, among other things, with not permitting them to use their dominant ticket sales channel. That decision stands despite the fact that the Swedish Competition Authority has been investigating their deterrent actions on behalf of MTRX and the now out-of-business Saga Rail.

The firms compete both in quantities and price. Quantity competition is done with the negotiations for train slots during the railway capacity allocation processes. Since these occur months before the actual department, they can be viewed in the sequential setting of the Cournot model. The outcome has been higher quantities and lower prices than in the previous monopoly case. This is especially prominent on the Stockholm to Gothenburg route, with many departures at lower prices than the one between Stockholm and Malmö.

Price competition of the Bertrand model may not be an appropriate explanatory framework for the competition of the Swedish railway. He argued that the firm that offers the lowest price in a duopoly setting clears the whole market. *Table 6-9* shows that SJ High-Speed is consistently the most expensive train. If this assumption were to hold, would Snälltåget or MTRX be the only firms operating since they attracted all the consumers. On the other hand, the sequential setting of the Stackelberg model for price situations may be observed. If SJ is the leading firm, they have a first-mover advantage when setting their prices. MTRX and Snälltåget use their position as followers to their advantage and can adapt their prices to SJs. It may explain why their average prices increased significantly more than SJs from *Data-set 1* to *Data-set 2*.

Some determining price drivers are noticeable when observing the tables and charts in *Chapter 5*. The peak load pricing strategy has a significant impact on price. To state an example, the average price of the 16.11 departure is almost 600 SEK more expensive than the 19.21 departure on the Stockholm-Malmö route (see *Table 10*). Both departures are operated by SJ High-Speed but with a time difference of 3 hours. Peak-load pricing can be viewed as

price discrimination since the firm identification of periods with increased demands allows them to increase their prices. On the other hand, firms decrease their prices during periods with lower demand to still attract consumers. This may also be a result of the number of sold-out ticket classes, where the 16.11 departure is the departure with the highest number of sold-out ticket classes (See *Chart 2*). Therefore, a firm that can offer more than one ticket class can use sold-out tickets to increase the price of the remaining classes.

As shown in *Table 2,* the operators offer a variety of ticket classes. 2nd class is offered on all trains, where MTRX refers to it as *Fix*. Snälltåget is the only train that only offers 2nd class tickets. Both MTRX and SJ have different ticket classes for different prices. They use the product differentiation strategy to target segments of train passengers with different preferences and willingness to pay for exceptional comfort levels. Offering different ticket classes in vertical product differentiation makes the consumers choose according to their desired level of quality. Horizontal product differentiation targets different consumer preferences, e.g. by offering different departure times.

One prominent result that may catch the monopoly pricing of SJ is one of the different average prices per kilometre between the routes. As previously mentioned in *Section 5.1*, the difference came out as 16 per cent for *Data-set 1* and 12 per cent *Data-set 2,* similar to the 12,8 per cent decrease in SJs ticket price after MTRX entered. This might be an effect of, e.g. higher operating costs of the longer Stockholm to Malmö that justifies higher ticket prices. Nevertheless, the observation is interesting since it may catch the closer to monopolistic prices on the route. The route from Stockholm to Gothenburg has been proven to be more competitive, where SJ have to face more challenging competition and therefore have been forced to lower their prices to stay competitive.

Even though the situation between SJ and Snälltåget regarding the German extension of the route is not taking place in Sweden, it is nevertheless an interesting aspect. One can argue that this is predatory pricing. SJ can cover the potential losses from the under-priced tickets on the route's commercial railroad with the procured part's aid. Snälltåget, who only operates commercially, does not have this financial assistance and is dependent on ticket revenues. This interference may be a long-term strategic action to weaken or eliminate Snälltåget from the route.

6.3 Performance

From a competition point of view, the current performance is not optimal. The previous monopoly SJ still charges significantly higher prices for their High-Speed trains, and the firm generates high profit even though it is a state-owned enterprise. The range of possible choices at the examined routes is limited, with only two actors operating on each.

When comparing the different routes, Stockholm to Gothenburg is performing better in terms of price and quantities. The average daily departures are twice as many as on the route between Stockholm and Malmö, and the prices are significantly lower. MTRX has proven to put pressure on SJ, which now faces a competitive actor at Sweden's most highly burdened route. According to the Quality Index, MTRX is considered significantly better. Since the index is based on the train travellers, which train companies rely on, their perceived level of the offered service is essential for the firms. Dissatisfied and angry customers may choose to switch between operators if one can ensure a higher standard of service and punctuality of the train. Therefore, according to the actual train travellers, SJ is not performing properly. As SJ is responsible for most of the departures, it could be argued that they contribute to a less well-functioning industry.

The current performance can be regarded as suboptimal for societal welfare. Travelling by train is an essential social function, regarded as the most sustainable means of transportation. With increasing prices in the prevailing period of inflation and overall economic uncertainty, it may be considered contradictory that SJ presents such a clear upward trend of positive results. This occurs despite the increasing dissatisfaction of their train travellers. Suppose SJ continues to increase its profit while not offering up-to-par service, having repeated errors with its ticket platform and exploiting its market power. In that case, the trend of deteriorating train travel may continue.

7 Discussion

With the above analysis, one could argue that the conduct of firms may determine the structure. SJs unwillingness to authorise certain firms to sell their ticket on their digital platform and reputation as a powerful actor may have created such high entry barriers that possible entrants are deterred from the industry. This may be reasonable behaviour from SJs perspective since they are defending its operation and do not necessarily want to allow more firms on the already heavily burdened railway. However, the quality index indicates that the train travellers are not satisfied with their current level of service, punctuality and prices. Reducing SJs position as the master of puppets and allowing for more competitors can theoretically benefit them in the long run. This would pressure SJ to increase its quality of service, boost innovation, and decrease its prices to withstand its rivalry, and possibly entering, firms.

Even though Stigler's beliefs about regulatory failures have been critiqued, it is hard to disregard its main argument when examining the Swedish passenger train industry. According to the government and policymakers, enabling deregulation was one essential purpose of introducing competition against SJ to improve the industry's efficiency. With its profound experience in the industry and its former position as a monopoly created an advantage. As a matter of fact, SJ is not excessively confined by the market opening. Alexanderssons beliefs of the accidental deregulation may be considered accurate. All the interventions since 1988 can have resulted in the inevitable market opening of 2010.

This raises the question of whether the Swedish government does what it can to limit the current power of SJ or whether they benefit from the current situation. If that is the case, the question is whether the current competition model and a declared free-entry market are the correct way to move forward. Take Norway as an example. They initiated a similar process of market opening as Sweden but have changed their approach.Their geographical breakdown of procured railway areas has allowed railway operators to compete for the permit of the areas, not to compete with each other in the same area. In addition, have they successfully incorporated a national ticket system that a dominant actor does not use as a power tool. It might be time for Swedish policymakers to consider a reorganisation of the current competitive model. It could facilitate smaller operators and new entrants to establish themselves since they would not have to compete with SJ. However, Sweden should not follow the same approach of privatisation as the one of the UK railways. Still, their situation

can serve as a leading example of regulatory failures for Swedish policymakers for future regulatory intervention.

An important aspect that should be given more attention is the importance of the Swedish railways for the future. With the prevailing circumstances of climate change and an increased influx of individuals who choose trains over planes and cars, its effectiveness must be ensured. Today the price of train tickets is considerably high, and it is sometimes cheaper to fly than to travel by train. An increased governmental focus on improving the infrastructure, the conditions for competition, and reducing the ticket prices for passenger trains is of utmost importance to ensure a sustainable future.

7.1 Further Research

Since the sample size of the data is considerably small, the provided results of this thesis are not entirely sufficient to explain the whole industry. The limited access to data has been an aggravating factor that also affects reliability. Numerous factors have not been taken into account that might affect the current situation. Thus, many aspects remain to be investigated.

When and if the time comes for a national ticket system, further research on its effect would be beneficial to determine whether SJs platform has been an entry barrier or not. An analysis that would catch its potential impact on price, quantity, number of competitors and the redistribution of power in the industry would be a clear argument in favour of more interventions to reduce unjustified behaviour by powerful actors.

Since this thesis only concerns departures from Tuesday until Thursday on two routes over a limited period, does it not show the whole industry. A possible extension and research area would be to have the same approach but investigate the weekend, Monday and Friday departures instead. Additionally, the anticipated effect of holidays can be analysed.

Yet, another aspect that might be difficult to assess is distinguishing and evaluating potential political incitements to protect SJ's position. As previously mentioned, the market opening may have been accidental, realised by a set of political interventions that ultimately resulted in unavoidable deregulations. It may be that Swedish authorities are acting behind closed doors to preserve the profitability of their cash cow. This is a bold claim, but further delving into the relationship between the previous monopoly SJ and the Swedish state might be considered to understand the current events truly.

8 Concluding remarks

The narrow approach to a highly complex situation may only be able to explain some underlying factors and events successfully. Nevertheless, when breaking it down and targeting specific operators and events on certain rail routes, it is clear how they all contributed to the current situation. The Structure-Conduct-Performance approach of industrial organisation has provided an appropriate framework to analyse certain aspects of the Swedish passenger train industry. A more profound analysis of the strategic interactions was possible by relaxing its assumption of the one-way causal relationship. Ultimately, the conduct of the industry may be considered the driving factor of its current performance.

The results from the data sets are unequivocal. SJ is in a position where, in many ways, it can control the industry. Its experience and reputation as the previous monopoly remarkably affect other firms. The unwillingness to allow MTRX on their ticket platform is considered the most apparent deterring action, demonstrating their current market power. However, the small sample size and the fact that it only targets a fragment of the whole industry make it unreliable to make sweeping conclusions from the results.

Nevertheless, an increased effort by Swedish policymakers to limit SJ's current dominance and ensure improved conditions for all operators should be considered. EUs railway packages executive force will be unavoidable. If a transnational railway network with the same legislative framework becomes a reality, it may be unavoidable for the Swedish government not to restrict SJ further. Despite the market opening and the long deregulation process, it is difficult to circumvent that the deregulation may have caused a derailment of the Swedish passenger railway industry from its intended track.

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10 Appendix

Appendix A

Summary Statistics, using the observations 1 - 580

Table 12:					Table 13:			
Variable	Mean	Median	Minimum	Maximum	Mean	Median	Minimum	Maximum
Price2ndClass	457.89	439.00	185.00	1295.0	503.88	445.00	185.00	1475.0
TimeToPeak	113.04	116.00	2.0000	293.00	113.04	116.00	2.0000	293.00
TotalTime	232.59	203.00	174.00	297.00	232.90	232,59	174.00	297
Distance	433.97	398.00	398.00	512.00	433.97	398.00	398.00	512.00
HHI	0.63257	0.77000	0.040000	0.77000	0.63257	0.77000	0.040000	0.77000
OtherOperator_D	0.22414	0.0000	0.0000	1.0000	0.22414	0.0000	0.0000	1.0000
SJRegional_D	0.16724	0.0000	0.0000	1.0000	0.16724	0.0000	0.0000	1.0000
SoldOut_D	0.013793	0.0000	0.0000	1.0000	0.051724	0.0000	0.0000	1.0000
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Price2ndClass	222.68	0.48632	1.0152	0.85812	236.55	0.46946	1.0356	0.91561
TimeToPeak	69.124	0.61152	0.23270	-0.90809	69.124	0.61152	0.23270	-0.90809
TotalTime	44.029	0.18930	0.15044	-1.7976	44.029	0.18930	0.15044	-1.7976
Distance	53.024	0.12218	0.79395	-1.3696	53.024	0.12218	0.79395	-1.3696
HHI	0.25475	0.40273	-1.3413	-0.12159	0.25475	0.40273	-1.3413	-0.12159
OtherOperator_D	0.41737	1.8621	1.3230	-0.24957	0.41737	1.8621	1.3230	-0.24957
SJRegional_D	0.37351	2.2334	1.7833	1.1802	0.37351	2.2334	1.7833	1.1802
SoldOut_D	0.11673	8.4631	8.3375	67.514	0.22166	4.2854	4.0482	14.388
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.	5% Perc.	95% Perc.	IQ range	Missing obs.
Price2ndClass	195.00	951.40	294.00	0	199.00	955.00	260.00	0
TimeToPeak	7.0000	238.00	115.00	0	7.0000	238.00	115.00	0
TotalTime	185.00	291.00	78.000	0	185.00	291.00	78.000	0
Distance	398.00	512.00	114.00	0	398.00	512.00	114.00	0
HHI	0.19000	0.77000	0.0000	0	0.19000	0.77000	0.0000	0
OtherOperator_D	0.0000	1.0000	0.0000	0	0.0000	1.0000	0.0000	0
SJRegional_D	0.0000	1.0000	0.0000	0	0.0000	1.0000	0.0000	0
SoldOut_D	0.0000	0.0000	0.0000	0	0.0000	1.0000	0.0000	0

Appendix B

Table 11. Regression 1:

Mean dependent var	457.8914	S.D. dependent var	222.6813
Sum squared resid	13853610	S.E. of regression	155.6265
R-squared	0.517478	Adjusted R-squared	0.511573
F(7, 572)	87.63416	P-value(F)	2.51e-86
Log-likelihood	−3746.483	Akaike criterion	7508.965
Schwarz criterion	7543.869	Hannan-Quinn	7522.573

White's test for heteroskedasticity -
Null hypothesis: heteroskedasticity not present
Test statistic: LM = 94.004
with p-value = P(Chi-square(25) > 94.004) = 6.28904e-10

Table 12. Regression 2:

Mean dependent var	503.8845	S.D. dependent var	236.5516
Sum squared resid	14655267	S.E. of regression	160.0659
R-squared	0.547662	Adjusted R-squared	0.542126
F(7, 572)	98.93436	P-value(F)	2.74e-94
Log-likelihood	−3762.796	Akaike criterion	7541.592
Schwarz criterion	7576.497	Hannan-Quinn	7555.200

White's test for heteroskedasticity -
Null hypothesis: heteroskedasticity not present
Test statistic: LM = 73.9653
with p-value = P(Chi-square(26) > 73.9653) = 1.72652e-06