



Benefits and Pitfalls of Deregulating Taxi Markets: Can Contrasted Case Studies Help Inform the Debate?

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1 **THE BENEFITS AND PITFALLS OF DEREGULATING TAXI MARKETS.**
2 **CAN CONTRASTED CASE STUDIES HELP INFORM THE DEBATE?**
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1 **ABSTRACT**

2 Taxi and for-hire markets have traditionally been heavily regulated and public policymakers
3 have been quite imaginative in regulating these markets, discriminating among market segments
4 (hail, rank and pre-booked), using different types of instruments (quantitative, qualitative,
5 economic), and targeting different subjects (company, driver, vehicle). Cities and countries have
6 experimented with the deregulation of taxi and for-hire services since the 1970s, aiming at
7 raising the efficiency and competition in the service supply, lowering the prices, or both.
8 Analyses of deregulated markets have often focused on the broad effects of deregulation at
9 national level and paid limited attention to comparisons between regulated and deregulated
10 markets.

11 This paper discusses the effects of taxi deregulation in Stockholm (in terms of market size and
12 structure, as well as pricing of services) in light of two contrasted case studies of regulated taxi
13 markets in Helsinki (Finland) and Lyon (France). Original findings include observations as to
14 some counterintuitive effects of deregulation, including high prices in both absolute (i.e., for the
15 local context) and relative terms (i.e., compared with other cities).

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20 *Keywords:* Taxi, For-Hire Services, (De)regulation, Comparative Analysis, Contrasted Case
21 Studies, Public Policies, Market Structure, Pricing Analysis

1 INTRODUCTION

2 Urban transportation systems in developed countries have traditionally been divided between
3 public transit and individual transport. Each mode has its own features; for example, individual
4 transport is known to offer comfort, flexibility and door-to-door service, whereas public transit
5 focuses on regular services, generally provided at a lower cost than individual transport (in some
6 cases through governmental subsidies) and free of the hassles associated with parking private
7 transport means (1). Generally considered to work in close connection with public transit (as an
8 integral part of paratransit services), taxi and for-hire services have become a valuable
9 complement to the portfolio of traditional public transit services to the extent that they provide
10 door-to-door services that come close to the flexibility of individual transport by making a
11 vehicle with driver available for hire by the general public (2).

12 The taxi and for-hire industry usually encompasses three distinct markets known as
13 “rank”, “hail” and “pre-booked”. Ranks are designated places where drivers can wait for new
14 customers and vice versa. The hail market refers to the situations in which drivers are allowed to
15 cruise on the street while looking for new customers. In the case of the pre-booked market,
16 customers contact a driver, a company, or a dispatch center to order a ride (whether immediately
17 or at a later time) (3).

18 This market segmentation (or similar ones) has underlain the design of public policies
19 regulating the taxi and for-hire industry in a wide range of countries, allowing for differences in
20 the way the different markets are regulated. According to Aarhaug (4), the hail and rank markets
21 are in many cases more strictly regulated than the pre-booked market.

22 Generally speaking, the taxi and for-hire industry operates within one of two regulatory
23 systems, known as the one-tier system and the two-tier (or multi-tier) system. Under a one-tier
24 regulatory system, all markets –hail, rank and pre-booked– are regulated identically under a
25 unique taxi regulation. On the other hand, under a two-tier regulatory system, the hail and rank
26 markets are usually subject to a separate set of regulations from those that apply to the pre-
27 booked market. In the latter case, differentiated services tend to specialize on each market
28 category: taxi services on the rank and hail markets, and for-hire services on the pre-booked
29 market (4). Under both one-tier and two-tier regulatory systems, the taxi and for-hire industry
30 has traditionally been a heavily regulated market.

31 Prior research focusing on the regulation of taxi and for-hire services has highlighted the
32 coexistence of three main types of regulation, labeled as quantitative, qualitative and economic
33 (4, 5). Quantitative and qualitative regulations can make requirements on companies, drivers, or
34 vehicles. Quantitative regulations may, for instance, limit market entry by restricting the number
35 of licenses (for companies, drivers, or vehicles). Qualitative regulations may make market entry
36 conditional upon meeting, for example, financial requirements for companies, professional
37 requirements for drivers, or technical requirements for vehicles. Economic regulations mostly
38 focus on fares (4).

39 Public policies can set up very different frameworks for taxi and for-hire markets,
40 through regulating or deregulating either category of markets (hail, rank, and pre-booked) and
41 regulation groups (quantitative, qualitative, economic). Sweden in 1990 opted for complete
42 deregulation (all market categories and regulation groups), whereas France only partially
43 deregulated the for-hire industry in 2009 (for pre-booked market and quantitative and economic
44 regulations).

45 Deregulation of taxi and for-hire services may be undertaken in the pursuit of various
46 types of objectives, including improving the service to customers, achieving more competitive
47 prices for the service, allowing the entry of new players, and so forth (6). Numerous cities in the
48 U.S. and the EU have experimented with the deregulation of taxi and for-hire services since the

1970s (7, 8). Sweden offers one of the best documented cases of taxi deregulation. The rationale for deregulation that took place in 1990 is known to have been “that the taxi industry was believed to be inefficient because of a mismatch of supply and demand and a lack of price competition” (8). Swedish public policymakers therefore endeavored to deregulate the taxi market in order to increase the availability, efficiency, competitiveness, and affordability of taxi services (9). The deregulation of Dutch taxis in 2000 aimed to strengthen the role of taxis in the transportation system, improve market mechanisms, and increase competition (9). The rationale for taxi deregulation in Ireland in 2001 was to make taxi regulation sustainable and reinforce market efficiency (8).

Since taxi deregulation was enacted in Sweden, many studies have been dedicated to assessing its effects (10, 11, 12, 13). Mainly, these studies had a national scope and involved comparisons (if any) with other deregulated markets. The objective of this paper is to inform the debate on the effects of deregulation on the taxi market size and structure, and on the pricing of services at city and regional level, compared with regulated markets.

This paper is organized into four sections. First, the authors introduce the research approach and data collection method. The second section presents the analysis of the Stockholm (Sweden) case study with a focus on the diachronic analysis of public policies, market structure and service pricing since the 1990 deregulation. The third section presents a comparison of the current situation in Stockholm with two contrasted case studies of regulated markets: Helsinki (Finland) and Lyon (France). A final section discusses the results of the comparative analysis and draws out some perspectives for future investigations.

METHODOLOGICAL APPROACH

Approach by Case Studies and Choice of Cities

The authors based their initial case study of taxi deregulation on the method documented by Lijphart for the intensive examination of a single case study with a view to establishing general hypotheses and building theories (14). The authors chose to place their case study in the Swedish context in view of the time elapsed since taxi deregulation (28 years) and of the extensive literature (9, 10, 11, 12) which has resulted from said deregulation. They focused on the capital, Stockholm, in view of the high density of taxi services in the city relative to the whole country (respectively 3.7 and 1.7 vehicles per thousand inhabitants, according to the Swedish statistics - SCB). The effects of deregulation on the taxi industry in Stockholm were analyzed over a 28-year period of time (1990-2018) and along various dimensions, focusing inter alia on the industry's size and structure, and on the pricing of services.

To confirm the results of this initial analysis, the authors used a comparative analysis based on the method of contrasted cases documented inter alia by Mills (15). The authors therefore chose to compare the Stockholm case (deregulated taxi market) with two cases where taxi markets are strictly regulated, namely Lyon, France, and Helsinki, Finland (this analysis does not consider the changes triggered by the deregulation of taxi services enacted on July 1, 2018 in Finland). The three cities present some similarities (which is a requirement to allow a relevant comparison): they all are medium-sized cities with under 1M inhabitants at city scale, and between 1.5M and 2.5M inhabitants at metropolitan scale (see Table 1) (16). However, Lyon has a higher population density than both Helsinki and Stockholm, which may have an influence on the relative performance of public transport services, including taxi. On the other hand, all three cities display high household vehicle ownership rates. In relation to regulatory systems, the taxi and for-hire industry operates under a one-tier system in Stockholm and Helsinki (i.e., unified taxi regulation) and under a two-tier system in Lyon (i.e., distinct regulations for taxi and

for-hire services). For lack of data on market structure, these cases were compared on the basis of market size and pricing strategies.

TABLE 1 General Information on Case Studies

TERRITORY	STOCKHOLM		HELSINKI		LYON	
	City	Stockholm County	City	Greater Helsinki	City	Lyon Metropolis
Administrative division						
Area (sq.km)	187	6,524	214	3,698	48	538
Number of municipalities	1	26	1	14	1	59
Population (M inh.)	0.9	2.3	0.6	1.5	0.5	1.4
Population density (inh. per sq.km)	5,075	354	3,002	399	10,879	2,584
Household motor vehicle fleet (M veh.)	0.4	0.9	0.2	0.6	0.2	0.6
Vehicle ownership rate (per 000 inh.)	375	403	329	408	354	453
Regulatory system	One-tier Taxi		One-tier Taxi		Two-tier Taxi For-hire	
Regulation status	Deregulated (since 1990)		Regulated (until 2018)		Regulated Deregulated (since 2009)	

Construction of an Analytical Framework for Public Policies

The authors constructed an analytical framework based on regulation groups (quantitative, qualitative, and economic) and regulation targets (companies, drivers, and vehicles). Because of the rise in congestion-related concerns in cities and the importance of access to public space for taxi and for-hire services, the authors isolated a dedicated group of regulations (e.g., parking, bus lanes, major transport hubs). This information allowed construction of a timeline of public policies in the cities studied.

Construction of a Grid of Indicators to Analyze Industry Features

The authors constructed a grid of indicators to compare two main categories of industry features across case studies. The first group of indicators refers to the size of the industry on a given territory (e.g., service fleet size in the administrative area, number of service vehicles per thousand inhabitants and number of service vehicles per thousand household motor vehicles). The second group of indicators refers to the pricing of services. The authors estimated the price for a reference ride (5 km traveled at an average speed of 17 km.h⁻¹) and compared it to the price of a single-ride on local public transit as well as with the median daily disposable monetary income of local households. The distance of 5 km was chosen for the reference ride as the area of Stockholm (respectively, Helsinki and Lyon) can be contained in a 7.7 km radius disc (respectively, 8.3 km and 3.9 km). The sensitivity of the comparison results was tested using an alternate 10 km reference ride.

Data Collection

The authors collected data from a wide range of sources. For general information about territory and market size (e.g., territory area, population, household motor vehicle fleet, and service fleet by category) governmental sources were used (official documentation, reportings, and statistics). Information about the services was collected from professional (company websites), governmental (reportings), academic (reports, articles) and media sources (local newspapers).

Information regarding the evolution of public policies was retrieved from governmental (regulations) and academic sources. Cross-referenced analysis was used to fill some information gaps.

Limitations

The comparative analysis of public policies and taxi/for-hire services over time was limited by data availability, especially regarding interrupted services. Besides, some comparisons could not be made for lack of appropriate data at city/metropolitan scale (e.g., taxi fleet in Stockholm, for-hire fleet in Lyon) because the scientific and official literature has mostly analyzed the effects of public policies (e.g., on prices) at the national level. Another limitation stems from the differences in the official definition of territory units (city vs. metropolis), which do not cover the same realities in the three cases studied. This leads to differences in terms of geographical areas and population densities. Moreover, the taxi and for-hire markets are structured and influenced by many kinds of contextual factors (e.g., institutional, regulatory, economic, geographical). Therefore, market evolutions cannot be entirely explained by evolutions in public policies. The present analysis does not aim at identifying direct causal relations between regulatory changes and market evolutions, but rather at formulating hypotheses as to the possible influential factors emanating from (de)regulation.

STOCKHOLM: LESSONS LEARNED FROM 28 YEARS OF TAXI DEREGULATION

This section provides a diachronic analysis of Swedish public policies for taxi services since 1990 and discusses their effects through the size of the taxi industry, the structure of the taxi industry and the pricing of taxi services.

Public Policies Before and After Deregulation (July 1990)

Strict Quantitative Regulations until July 1, 1990

Before July 1, 1990 the Swedish taxi industry was regulated under the Occupational Traffic Act (1979:559 and 1988:263) and the Occupational Traffic Regulation (1979:871 and 1988:1503) which gave county or city authorities jurisdiction over freight, bus and taxi traffic. Taxi traffic was (and remains to this day) defined as such professional traffic for passenger transport by passenger car or light truck that is not a regular service (1988:263). Authorities were responsible for providing citizens with a satisfactory transport system. Authorizations for taxi services could be delivered if the resulting traffic was expected to enhance the overall performance of the transport system (1988:263).

Companies were required to hold operating licenses (1988:1503). Requirements to obtain such license were few (e.g., compliance with law). Operating licenses indicated the maximum number of taxi vehicles in traffic, the maximum number of passengers allowed in each vehicle, and the command plan (e.g., operating areas, schedules for vehicles). License transfers was allowed only under special circumstances.

Few requirements were made on taxi drivers (1988:1503), but they had to belong to one operator when they were not themselves operators.

Each company and driver was to be attached to only one dispatch center within the operating area (1988:1503). In most cases there was only one dispatch center in each municipality or airport (SOU 1999:60).

Taxi vehicles were registered with the County Administrative Board (to obtain a certificate) and tied to an operating license. They had to meet certain qualitative technical

requirements, for example, regarding taximeter (with some exemptions), vehicle size or periodic checkup.

Furthermore, maximum taxi fares were regulated by the government on a national level.

July 1, 1990 to June 1, 2012: Growing Economic Competition Following the Removal of Quantitative Regulations

After July 1, 1990 the Swedish taxi industry was no longer regulated for the following: number of operating licenses, number of taxi vehicles in traffic, size of taxi vehicles, operating areas, and maximum fares (Prop. 1987/88:50). The aim of such deregulation was to promote economic competition in order to increase efficiency and achieve diversity in the service offer (e.g., quantity of taxi companies, drivers and taxi vehicles, increased price competition) (17,18).

Most of the special provisions for taxi services were repealed from both the Occupational Traffic Act (1988:263) and the Occupational Traffic Regulation (1988:1503) as a result of deregulation. Only the few qualitative requirements aforementioned remained in the original regulations. Consequently, for-hire services were merged into the category of taxi traffic (12,19). Taxi vehicles could now be attached to either an operating license (operator) or a driver license.

Many qualitative requirements were added or tightened during the 1990s. Starting January 1, 1994 a new certificate of professional competence (written examination) and minimum financial capital (SEK 30,000 per vehicle and SEK 1,500 per seat in vehicle) were required to apply for an operating license (1988:1503). On January 1, 1995 a special taxi driver license (with unlimited duration) was introduced with a view to improving the quality of taxi services. New requirements included written examinations, a test of professional competence (regarding road safety, vehicle technical requirements) and a criminal record check (1988:1503) (10). On October 1, 1996 additional requirements were made for better information for customers on prices (1988:1503).

In parallel, in 1995, an exemption of taxi services from the most restrictive clauses of the Competition Act (1982:729) allowed cooperations among licensed taxi companies or between them and dispatch centers if they did not involve more than 30 vehicles or 35% of the relevant market (3). Maximum vehicle threshold was raised to 40 vehicles in 2000 (7).

On October 1, 1998 the new Occupational Traffic Act (1998:490) and Occupational Traffic Regulation (1998:779) were introduced aiming to harmonize Swedish laws with European directives and to strengthen qualitative requirements on the taxi industry (11).

Financial capital requirements for companies were raised (SEK 100,000 for the first car and SEK 50,000 for each additional car). A few qualitative requirements for taxi drivers were added to those previously mentioned, such as a medical examination, and renewal of the taxi driver license every 10 years.

Since 2000, drivers and companies have been required to display the prices inside and outside the vehicle according to a template (reference prices for comparison among operators are calculated for a 10 km, 15 min ride).

On November 1, 2008 the new Competition Act (2008:579) entered into force and a special law for the exemption of certain cooperations in the taxi industry from anti-competitive clauses was enacted (2008:580). The same threshold as aforementioned still applied.

June 1, 2012 to 2020: Overcoming Historical Market Failures through Qualitative Regulations

From June 1, 2012 onwards taxi regulations were isolated from both the Occupational Traffic Act (2012:210) and the Occupational Traffic Regulation (2012:237). The Taxi Traffic Act (2012:211) and Taxi Traffic Regulation (2012:238) were enacted with the same requirements as before for companies, drivers and vehicles. On January 1, 2015 drivers and companies were

1 required to inform the customer prior to the journey if the ride should cost more than SEK 500 to
2 overcome previous problems of unsatisfactory customer information on prices (12).

3 To better monitor the taxi industry (following frauds) the Swedish government ordered in
4 2014 the creation of “reporting centers” (12) to centralize taximetric data (journey length,
5 number of hours worked, prices, etc.). The Reporting Centers Act (2014:1020) and the Reporting
6 Centers Regulation (2016:623) were enacted. Reporting centers were supposed to be operational
7 as of January 1, 2017. Starting May 1, 2017 taximetric data of each vehicle was to be transferred
8 at least once a week to a reporting center.

9 The government public inquiries in 2018 (20) confirmed the need to modernize taxi
10 legislation in order to keep pace with market developments (e.g., introducing the possibility of
11 taximeter exemptions). New laws are expected in the early 2020s that may create a new category
12 of taxi drivers (20).

13 14 **Following Taxi Deregulation: A Diversified Market Juggling Between Monopoly and** 15 **Market Saturation**

16 17 *Evolution of the Taxi Fleet*

18 From 1990 to 2017 the number of taxi vehicles increased by 83% and 55% respectively for
19 Stockholm City and Stockholm County (Figure 1). Because statistics on the number of taxi
20 vehicles are reported as of December 31, date for 1990 actually date from after the deregulation.
21 Some sources (7, 12, 18, 19) state that the number of taxi vehicles increased sharply in large
22 cities just following the deregulation. Decreases in the number of taxi vehicles in 2002 and 2012-
23 2013 could be explained, respectively, by a decrease in the number of taxi companies (21), with
24 the entry into force of the Taxi Act (2012:210), and by bankruptcies (22).

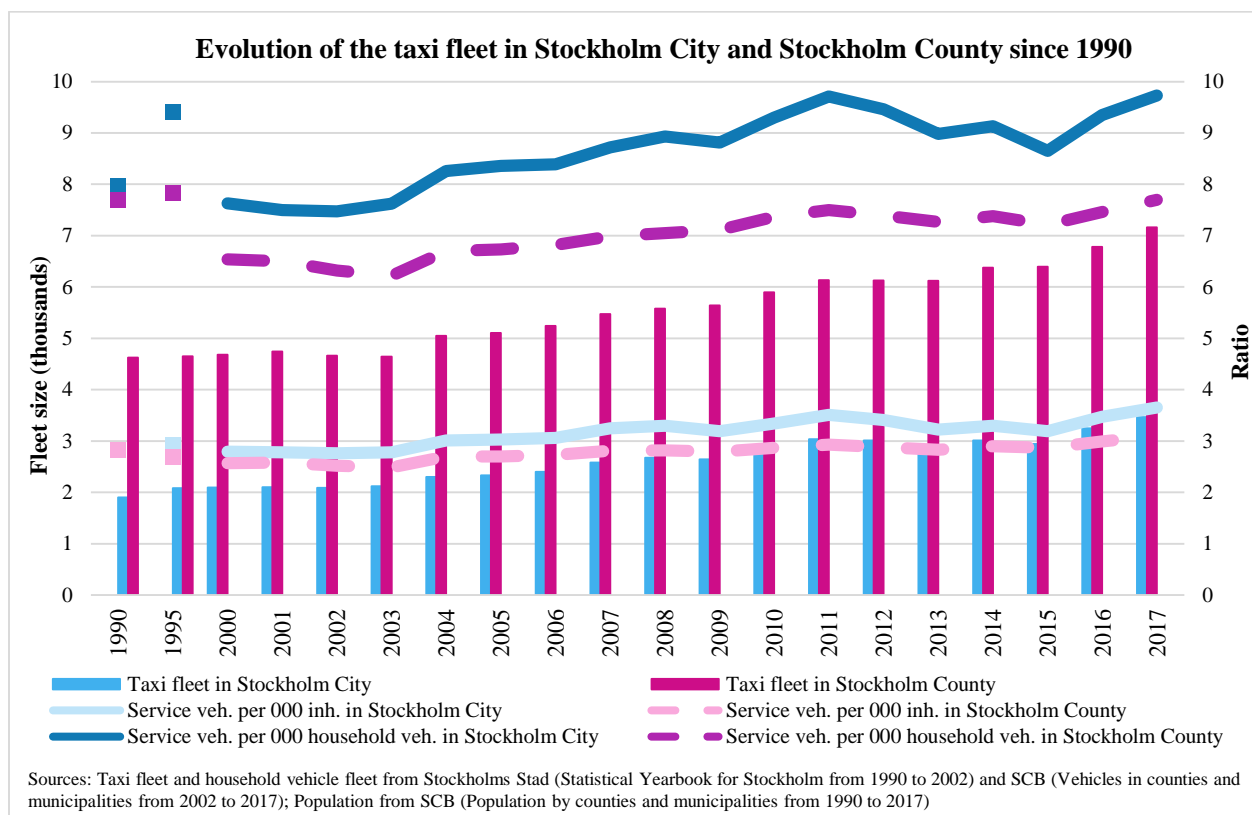


FIGURE 1 A continuous increase in the taxi fleet in Stockholm since 1990

The average annual growth rates of taxi fleets were lower from 1990 to 2000 than from 2000 to 2017 for both Stockholm City (respectively 0.1% and 0.9%) and Stockholm County (respectively 2.4% and 2.8%). After 2000, the taxi fleet grew faster than both the population and the household motor vehicle fleet (Figure 1).

The number of service vehicles per thousand inhabitants also increased from 1990 to 2017, although modestly. In 1990 there were 2.8 taxi vehicles per thousand inhabitants in both Stockholm City and Stockholm County, whereas in 2017 there were respectively 3.7 and 3.1 taxi vehicles per thousand inhabitants in Stockholm City and Stockholm County. These figures illustrate a densification of the taxi fleet in Stockholm City relative to the County.

Market Structure

From 1990 to 2000, the number of taxi companies, drivers, and dispatch centers increased in Sweden and in Stockholm (7, 12, 13, 18, 19, 21, 22). At the end of 1989, the number of taxi companies in Sweden was around 6,700, then it rose to 7,300 in 1990 and 8,600 in 2002, before it was back to around 6,700 in 2015 (12, 23, 24, 25). Most of them were unipersonal companies with one vehicle. From 1999 to 2013, the number of taxi Swedish driver licenses in Sweden increased by 74%, up from 49,652 to 86,000 (12, 26). The number of taxi dispatch centers in Sweden remained constant between 1999 and 2015, at around 350 (12, 26).

Today major players in Sweden are dispatch centers coming from Stockholm County (12,18). Before July 1, 1990 Taxi Stockholm 15 00 00 AB and Taxi Kurir AB, an association founded in 1899, were the only dispatch centers in Stockholm City (18). After deregulation opened the possibility to operate throughout Sweden, companies and dispatch centers restructured their operating areas to better face competition:

- Taxi Stockholm 15 00 00 AB, founded in 1899 in Stockholm City, expanded operations to Stockholm County;
- Taxi Kurir AB, which was formed in 1987 in Stockholm City, extended operations to several locations across Sweden and Nordic Countries (18);
- Taxi 020 AB, founded in 1993 by the merger of two dispatch centers (i.e., Sigtunaortens Taxi AB of Sigtuna municipality, and Taxi Norr Berghamravn AB of Solna and Lidingö municipalities), extended operations from Stockholm County to several locations across Sweden (e.g., Linköping in 2003 and Uppsala in 2004) (18, 21, 26);
- Sverigetaxi Stockholm, founded in the early 1990s in Stockholm City, extended operations across Stockholm County, before merging with Taxi 020 AB in 2016.

Since 2010 new important players have emerged. Uber and mytaxi launched in Stockholm in 2013 and 2016, as a dispatch center via digital platform (12).

In addition, two major taxi groups have dominated the market since the 2010s, which were created to improve connection between customers and taxi drivers from multiple companies in Sweden through a mobile application. The first is Cabonline Group which was formed in 1989 and has developed several brands across Nordic countries including Sverigetaxi AB and Taxi Kurir AB since the 2010s (18). The second group is Svea Taxi Allians, formed in 2009 with Taxi Stockholm AB, which is in partnership with various brands across Sweden. Dominant positions are sought after by major groups in order to circumvent the Competition Act which prevents cooperation among licensed taxi companies or between them and dispatch centers beyond a total fleet of 40 vehicles.

Pricing Analysis Over Time

Just following deregulation taxi prices increased significantly across Sweden (3, 7, 19). Trafik Analysis showed that from 1990 to 2007 taxi prices increased by about 4% per year, whereas consumer price indexes (CPI) increased by about 2% per year (21). According to the Swedish Statistic Agency (SCB) taxi prices increased by 86% from 1997 to 2017, which is about twice the price increase for transport prices in general over the period (21).

Kukkonen reports that according to the Swedish Transport Agency (Transportstyrelsen) the price for a reference taxi journey (10 km in 15 min) in 2014 ranged from SEK 299 to SEK 1,499 (27). All evidence therefore points to the fact that taxi deregulation in Sweden has led to a significant, though unintended, increase in prices.

COMPARISON WITH TWO CASE STUDIES OF REGULATED MARKETS

This section provides a comparison of the deregulated market in Stockholm with two contrasted case studies of regulated taxi/for-hire markets, namely: Helsinki, Finland and Lyon, France.

Evolution of Public Policies in Contrasted Case Studies

Taxi/for-hire policies in Stockholm, Helsinki and Lyon are compared here over the period 1990-2018, distinguishing among regulation groups (quantitative, qualitative, fares, public space) and among regulation targets (company, driver, vehicle). Because of the different regulatory systems (one-tier for Stockholm and Helsinki, and two-tier for Lyon), the authors differentiated markets by category, taxi and for-hire. Figure 2 summarizes the results of this analysis.

Quantitative Regulations

1 Since deregulation in 1990, Stockholm has not had quantity limits for vehicle or company
2 licenses. In Helsinki (until the 2018 deregulation) and in Lyon the number of taxi vehicle
3 licenses has been limited by municipal authorities. Regarding for-hire services in Lyon, before
4 they were deregulated in 2009, the number of vehicle licenses was also limited by municipal
5 authorities. Since 2009, there has no longer been any quantity limits for company, driver or
6 vehicle licenses in the for-hire industry. The number of driver licenses was never limited. This
7 analysis reveals some similarities between the quantitative regulations of the taxi industries in
8 Helsinki and in Lyon, contrasted to those of the for-hire industry in Lyon and the taxi industry in
9 Stockholm.

10 11 *Qualitative Regulations*

12 **Company** There are many similarities in the qualitative requirements for taxi and for-hire
13 companies in the three cities, for example, compliance, company or driver license, professional
14 and financial requirements. Most qualitative requirements for taxi and for-hire companies in all
15 three cities were enacted before 1995. Yet some differences persist: in Helsinki each taxi
16 company have to be affiliated to a dispatch center, whereas in Lyon taxi companies have to
17 obtain a medical certificate and for-hire companies have to employ qualified staff and register in
18 a dedicated registry. Both types of services in Lyon have to meet certain vehicle requirements.

19
20 **Driver** The requirements for taxi and for-hire drivers are quite similar to those for companies
21 and were also regulated before 1995 for the most part: license, lawfulness, check of criminal
22 record, certificate of professional competence, and medical certificate. In Helsinki drivers are
23 required to attend an entrepreneurial course followed by an exam. In Lyon both for-hire and taxi

Types of regulation	QUANTITY	QUALITY	FARES	PUBLIC SPACE
Targets of regulation	C – company	D – driver	V – vehicle	

Taxi-related policies in Stockholm, Helsinki and Lyon (1990-2018)

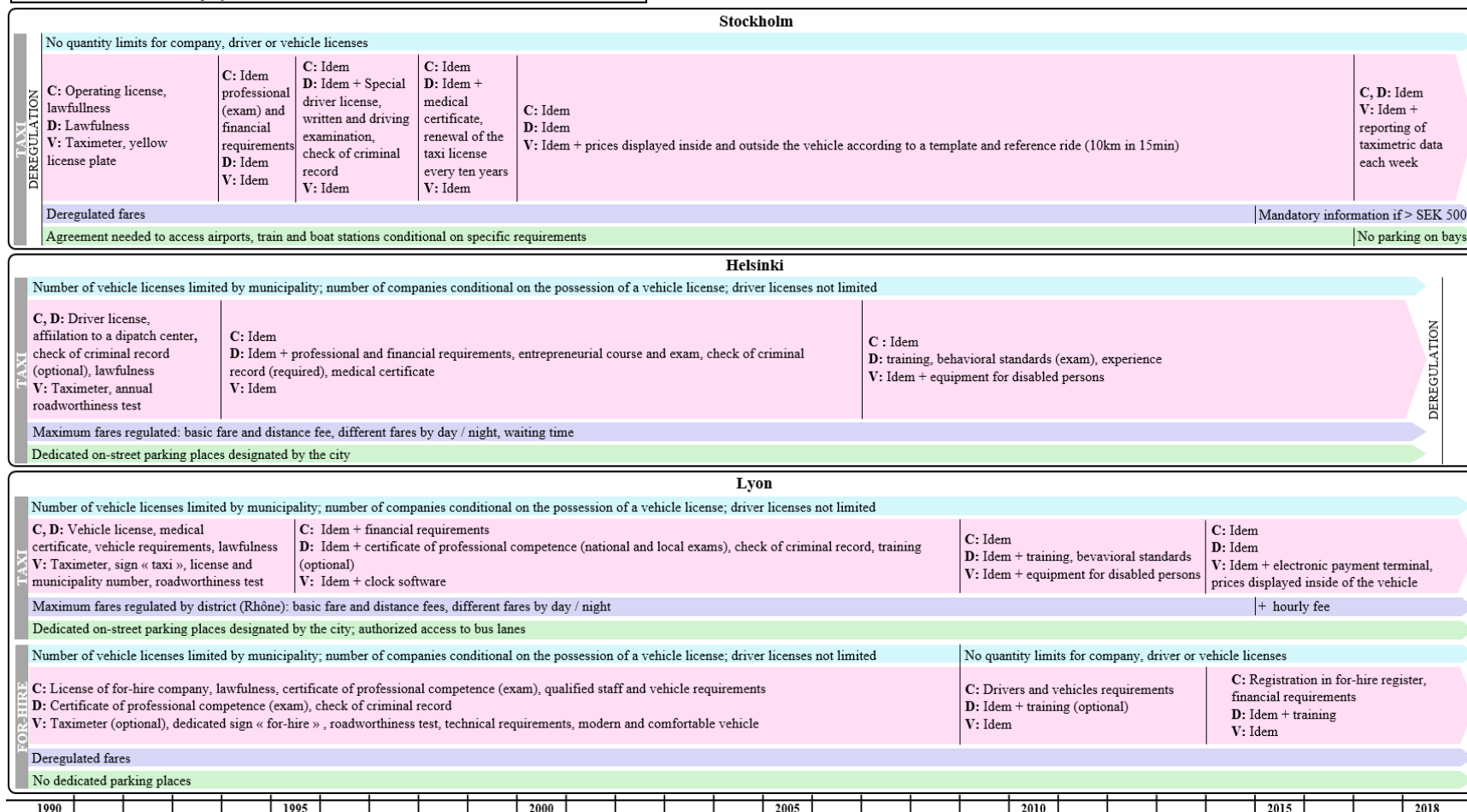


FIGURE 2 Taxi-related policies in Stockholm, Helsinki and Lyon (1990-2018)

drivers need to hold a certificate of training (renewal every 5 years). Also, requirements on behavioral standards for taxi drivers have been enacted in Helsinki and Lyon.

Vehicle For most types of services annual roadworthiness tests and taximeters are required; only for-hire services in Lyon could be exempted of the use of taximeters. There are also some external signs that should enable to differentiate taxi/for-hire vehicles from other cars on the street: in Stockholm taxi vehicles must have a yellow license plate; in Lyon for-hire and taxi vehicles display external “taxi” or “for-hire” signs. Also, in Lyon the taxi license number and reference to the municipality must be apparent from outside the vehicle. Other requirement for taxi vehicles in Lyon have included: use of a time clock software (since 1995) and availability of an electronic payment terminal (since 2014). In Stockholm service prices have had to be displayed inside and outside the vehicle, but only inside the vehicle in Lyon. Only in Stockholm taxis have been required to report taximetric data weekly since 2017. For-hire vehicles in Lyon face further qualitative requirements (on vehicle size, modernity, and comfort) as a result of their status as a luxury service. Since 2007 in Helsinki and 2009 in Lyon, taxi vehicles have been required to be accessible for disabled persons.

Fare Regulation

In Helsinki and Lyon taxi fares vary according to the time of day, and are regulated in relation to basic fare and distance fee. In Helsinki, an additional fare for the waiting time exists; a similar regulation was adopted in Lyon in 2015. There have been no changes in fare regulations for taxi services in Stockholm and for-hire services in Lyon since 1990 (both industries face no maximum fare, no basic fare). Only customer information requirements about the price of the ride have been tightened in Stockholm over recent years. As in the case of quantitative regulations, this analysis reveals some similarities between the fare regulations that apply to the taxi industries in Helsinki and in Lyon, contrasted to those that apply to the for-hire industry in Lyon and the taxi industry in Stockholm.

Public Space Regulations

Public space regulations for taxi/for-hire services can take the form of dedicated parking places in the city, authorized access to bus lanes, or authorized operations in transport hubs (e.g., airports). In Stockholm, there are no dedicated parking places for taxi services in the city. However, subject to an agreement taxi services can have access to the airports, train and boat stations. Also, since 2017, taxis have not been allowed to park on delivery bays. In Helsinki and Lyon, taxis can use parking places dedicated to their activity that are designated by the city. In Lyon, they are also authorized to access bus lanes. For-hire services, however, have never been granted dedicated places for parking on the public space in Lyon.

Current Situation of Taxi/For-hire Markets in Contrasted Case Studies

Industry Size

The three case studies present contrasted situations in relation to density, regulatory systems and regulation status. This section displays the results of the comparative analysis of current market size for taxi and for-hire industries in all three cases at city and metropolitan levels (Table 2).

The taxi fleet in Stockholm (City and County) is between 2.0 and 3.5 times larger than in other cities. Taxi fleets in Lyon and Helsinki are similar at the city level, about 1,000 vehicles, although at the metropolitan level Helsinki has 50% more taxis than Lyon. Yet, the two-tier system in Lyon allows factoring in of fleet of for-hire services, which brings the total service fleet at the metropolitan level to a level of 2,500 vehicles similar to Helsinki's.

TABLE 2 Fleet Size of Taxi/For-hire Industry in Stockholm, Helsinki and Lyon

TERRITORY	STOCKHOLM		HELSINKI		LYON	
Administrative division	City	Stockholm County	City	Greater Helsinki	City	Lyon Metropolis
Taxi fleet (2017)	3,467	7,159	1,032	2,558	1,002	1,415
For-hire fleet (2018)	-	-	-	-	789 (est.)*	1,114 (est.)*
Total service veh. fleet per 000 inh.	3.7	3.1	1.6**	1.7**	3.4	1.8
Total service veh. fleet per 000 household veh.***	9.7	7.7	4.9	4.3	9.7	4.0

Note: - = not applicable; est. = estimated.

* Due to the availability of data on for-hire fleet size only at regional level, the authors estimated the number of for-hire vehicles in Lyon Metropolis using the ratio of the metropolitan population to the total population of large cities in the region (including two metropolitan areas and ten municipalities with >100,000 inh.). Then the authors estimated pro rata the fleet of for-hire services in the City of Lyon using the ratio of the number of city taxis to the number of metropolitan taxis.

** For Helsinki before deregulation.

***2016 for Stockholm; 2017 for Helsinki; 2015 for Lyon.

The indicator of total service vehicles per thousand inhabitants at the city level is similar in Stockholm and Lyon, which is twice as high as it is in Helsinki. When shifting to the metropolitan level, this indicator remains stable in Helsinki, whereas it decreases by 16% in Stockholm. This echoes prior results highlighting the higher density of supply of taxi services in the denser, central areas of Stockholm following deregulation. Results for Lyon (where the density indicator is calculated to be twice as high at the city scale than at the metropolitan scale) are too dependent on the assumptions made by the authors to enable proper comparison.

Prices

Taxi prices in both Helsinki and Lyon are regulated, whereas taxi prices in Stockholm are not regulated, and neither are for-hire prices in Lyon. To compare taxi/for-hire services across cities (Table 3), references are made to the price of a single-trip transport ticket and to the household median daily income (as a proxy for purchasing power parity).

The price ratios of a single-trip transport ticket (STTT) to local household median daily disposable monetary income (MDDMI) are similar in all three cities, 2% or slightly higher. However, the relative prices of taxi/for-hire services differ widely across the cities. In Stockholm, taxi services are more expensive than local UberX service although operating under the same regulations for both distances (by 48% for a 5 km ride and 52% for 10 km ride). On the contrary, in Lyon UberX services (for-hire) are more expensive than local taxi services (by 50% for a 5 km ride and 95% for a 10 km ride). No comparison could be made for Helsinki because UberX did not operate before deregulation in 2018.

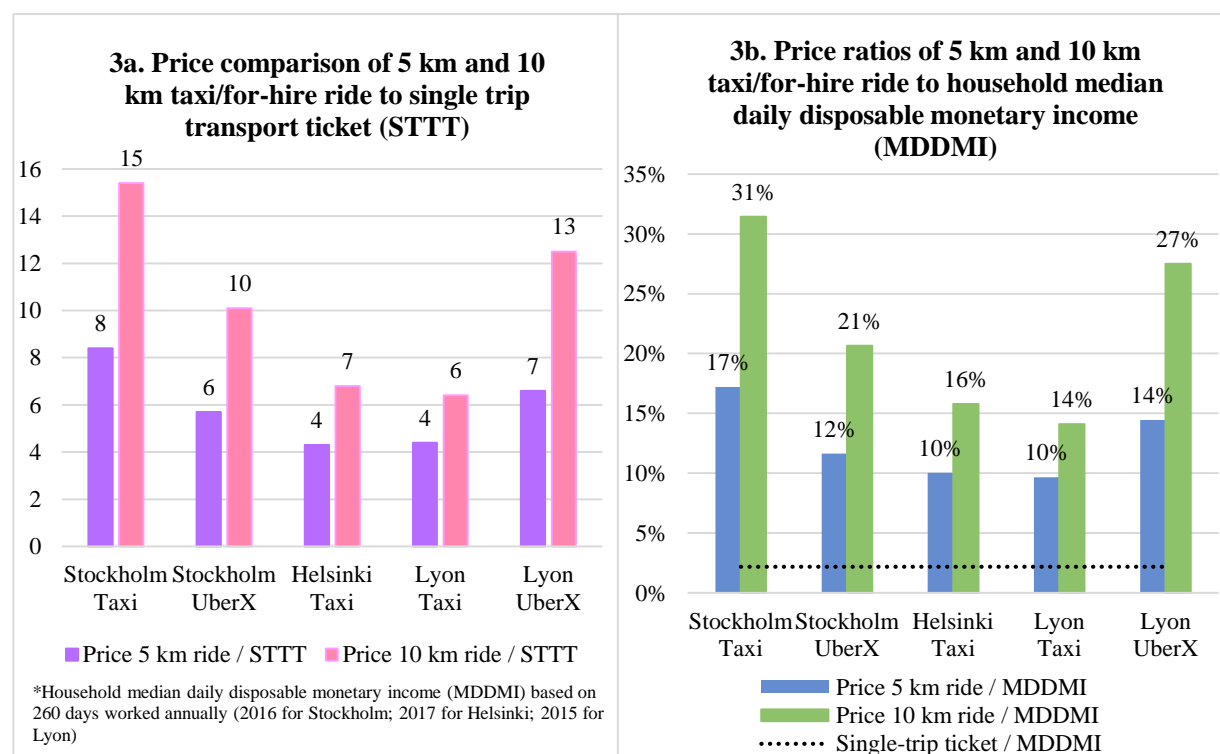
Besides, the price of a 5 km taxi ride (respectively 10 km) could buy four local STTTs in both Helsinki and Lyon, and eight in Stockholm (respectively 7, 6 and 15) (Figure 3a). The ratios for for-hire services (UberX in Stockholm and Lyon) seem to be more similar across cities, although slightly higher in Lyon (6 and 7, respectively, for 5 km, 10 and 13, respectively, for 10 km). Comparing the price of taxi/for-hire rides to household income (MDDMI) brings similar results (Figure 3b). A 5 km taxi ride (respectively 10 km) amounts to 10% of the median household income in Helsinki and Lyon (respectively 16% and 14%), as compared with 17% in Stockholm (31% for a 10 km ride). Once again, the ratios for for-hire services (UberX in Stockholm and Lyon) are more similar across cities (12% and 14% respectively for 5 km, 21% and 27% respectively for 10 km).

TABLE 3 Pricing of Taxi/For-hire Services in Stockholm, Helsinki and Lyon

TERRITORY	STOCKHOLM		HELSINKI	LYON	
Administrative division	City		City	City	
Currency	SEK		EUR	EUR	
Household median daily disposable monetary income (MDDMI)*	1,521		126	87	
Price of a single-trip transport ticket (2018)	31		2.90	1.90	
Price of a single-trip transport ticket per MDDMI (%)	2.0		2.3	2.2	
Category of service	Taxi	UberX	Taxi	Taxi	UberX (For-hire)
Price for a 5 km taxi/for-hire ride with average speed of 17 km.h ⁻¹ **	261.6	176.6	12.6	8.4	12.5
Price for a 10 km taxi/for-hire ride with average speed of 17 km.h ⁻¹ **	478.3	313.9	19.9	12.2	23.8

*Based on 260 days worked annually (2016 for Stockholm; 2017 for Helsinki; 2015 for Lyon)
 ** For Helsinki before deregulation; for Stockholm average price among the three largest companies (<1% difference among them), which also happened to be three of the least expensive taxi companies (26)

Thus, taxi services would appear to meet different categories of demand (or to fill different “gaps” in supply) in the three cities considering their relative prices compared to public transit rides and average income. For-hire services in Lyon are closer in pricing to (deregulated) taxi services in Stockholm, whereas for-hire services in Stockholm are closer in pricing to (regulated) taxi services in Lyon and Helsinki. These observations confirmed that under certain circumstances prices on a deregulated market (taxi in Stockholm, for-hire in Lyon) could be higher than on a similar regulated market.

**FIGURE 3 Pricing of taxi/for-hire rides relative to public transit rides (3a) and average income (3b) in Stockholm, Helsinki and Lyon**

(Note: Household median daily disposable monetary income (MDDMI) is derived from household median annual disposable monetary income based on an assumption of 260 days worked annually (2016 data for Stockholm; 2017 data for Helsinki; 2015 data for Lyon))

DISCUSSION

This section aims at putting the previous analysis into perspective by discussing the effects of taxi deregulation in Stockholm and more generally the causal relation between taxi-related public policies and taxi market evolutions in light of contrasted case studies.

The analysis of the features of Stockholm's taxi industry has confirmed some intuitive effects of deregulation, including increased diversity in service offer (number of taxi vehicles, companies, drivers and dispatch centers) and increased differentiation of service prices. In addition, through deregulation the Swedish government achieved regulatory simplification by moving from a two-tier regulatory system to a single-tier system.

However, the analysis also revealed some counterintuitive (or unexpected) effects of taxi deregulation in Stockholm. First, increased competition resulted, in the short term, in numerous bankruptcies and in the longer term in the consolidation of the taxi industry and the emergence of a few dominant players.

Yet another, even more spectacular, counterintuitive effect was an overall increase in taxi prices, as attested by many official reports. As a result of such, the Swedish government endeavored to tighten the requirements regarding customer information on prices.

The deregulation of taxi services was also followed by the concentration of services in denser areas. Both price and distribution effects may be associated with taxi services targeting high-income market segments. Further research would, however, be needed to assess the accessibility and affordability of taxi services in the Stockholm County more precisely. Further research would also be needed as to the role (and effectiveness) of qualitative re-regulations as palliative measures for some of the counterintuitive effects of deregulation.

The comparison with two regulated taxi markets, Lyon (France) and Helsinki (Finland), has produced some promising results in exploring the causal relation between changes in public policies and evolutions in the taxi market. The case of Lyon has illustrated how a two-tier regulatory scheme can result in a diversified range of prices and service offers (with regulated taxis providing more affordable services than deregulated for-hire services). Although available data was insufficient to reach a conclusion on whether for-hire services have become more concentrated in the denser areas following their deregulation in 2009, this hypothesis would deserve further investigation. So would the question of whether regulated taxi services have helped maintain a balance in service density at metropolitan level.

Contrary to Lyon, Helsinki features a one-tier regulatory system (with heavily regulated taxi services). Such regulation has allowed maintenance of low taxi prices and a homogeneous service distribution at metropolitan level. Seeking to boost the taxi market, Finland deregulated (quantitatively) the industry as of July, 1 2018 with a view to promoting the creation of new types of services, facilitating market entry, and fostering competition. The effects of this most recent taxi deregulation will be worth monitoring over the coming years and decades.

Fare regulations are a very sensitive, very complex issue when considering the influence of public policies on market developments. As taxi fare regulations have historically set both minimum and maximum fares, they have been considered to look after the interests of both the operators and the customers. This, however, raises several issues, for example, as to the adequate level of fares that would optimize complementarity with other regulated transport services (i.e., public transit), or as to the adequate set of skills (and data) required from the regulating authority to set said fares. According to the analysis, transit

services across all three cities are priced at very similar levels when compared with local household income (approximately 2% of the median daily income for a single-trip transit ticket), whereas no such clear pricing position could be established for taxi/for-hire services across case studies. The experience of fare deregulation for taxi in Stockholm and for-hire in Lyon showed higher prices of deregulated services than for regulated services (taxis in Lyon and Helsinki), which fairly raises the question of goals setting and achievement in deregulation processes, also in relation to targeted markets, spatial distribution, and schedules. Whether the deregulation of taxi services is likely to alienate them from the wider public transport system and make them less affordable to large portions of the population is an issue for public policymakers that would require further comparisons across diversified case studies.

Following such detailed comparative study, it also appears that the range of taxi regulations is wide, and their possible combinations quite diverse, although taxi markets are often inappropriately addressed as either regulated or deregulated. More accuracy would be needed in the definition of terms and description of situations. Can “deregulation” refer to quantitative deregulation only? Could a taxi market be completely deregulated without any compensatory policies to avoid some counterintuitive, negative effects?

Finally, further research would be needed to analyze the performance of taxi/for-hire services from the perspective of customer satisfaction as well as from the perspective of workforce welfare to reach a more comprehensive understanding of the trade-offs offered by different balances stricken in terms of quantitative and qualitative regulations.

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AUTHOR CONTRIBUTION STATEMENT

The authors confirm contribution to the paper as follows: study conception and design: V. Boutueil; data collection: T. Quillerier, A. Voskoboynikova; analysis and interpretation of results: V. Boutueil, T. Quillerier, A. Voskoboynikova; draft manuscript preparation: V. Boutueil, T. Quillerier, A. Voskoboynikova. All authors reviewed the results and approved the final version of the manuscript.

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