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Taxi Market Deregulation: Effects on Market Outcomes, Tax Evasion and Crime

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CENTRES OF EXCELLENCE IN RESEARCH

Taxi Market Deregulation: Effects on Market Outcomes, Tax Evasion and Crime*

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Abstract

We study the effects of taxi market deregulation in Finland, which removed price controls and lowered barriers to entry. The reform led to a surge in firm entry and a modest increase in exit, indicating substantial changes in market structure. Average taxi prices increased slightly according to price indices, while monthly firm-level reported sales and VAT declined by over 10 percent. Operating costs and mileage remained largely unchanged, suggesting limited demand responses. These findings point to increased tax evasion following deregulation. Consistent with this interpretation, we document a small rise in property crime, with no effects on other criminal offenses.

Keywords: taxi market, deregulation, prices, sales, mileage, exit, entry, tax evasion, crime

JEL Codes: L52, L91, L98, H26

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1 Introduction

Technological developments over the past decades have revolutionized various traditional service sectors by connecting businesses and customers in a digital market space. These so-called platform economies have challenged old service providers and created opportunities for new market entrants. Their estimated revenues have been quickly growing: In the EU, for example, the revenues increased from 3 to 14 billion euros between 2016 and 2020, and in 2022, the approximated number of people operating through platforms was 28 million (European Commission, 2024). Simultaneously, this development has caused a quandary for policy makers: how to regulate new platform markets and those old markets where the changes have been most drastic?

The platform economy has alleviated challenges that customers may face in observing key characteristics of the commodities or services purchased. One such example is the taxi market where informational asymmetries traditionally rendered comparisons of both prices and quality difficult for consumers, and conditions for perfect competition were unlikely to be met (see e.g. Balafoutas et al., 2013). Accordingly, the taxi industry has traditionally been subject to extensive regulation in many countries and cities. However, recent decades have seen a wave of deregulation. Comprehensive evidence of what are the impacts of such deregulatory policies on key market outcomes is however limited.

We study the effects of taxi market deregulation in Finland. We exploit an extensive reform, implemented in July 2018, which liberalized market entry and removed price controls with the aims of promoting competition and increasing service supply, and also loosened certain forms of quality control and monitoring. Due to the special features of the industry, it is unclear a priori however, whether liberalization will lead to effective competition. We apply a standard difference-in-differences approach to estimate the effects of the reform. In our empirical setting, we use firms in bus transportation as controls for firms in the taxi industry. These industries share common cost and demand drivers, and our data verify that the development of key outcomes is comparable for the treated and control firms before

the reform. We use comprehensive firm-level tax record data to estimate the effects on entry and exit rates, reported sales, operating costs, VAT-payments and profits in the taxi sector. These data are supplemented by data on prices from Statistics Finland's consumer price indices for taxi rides, and taxi vehicle-level mileage driven. Motivated by more lenient entry requirements for new taxi drivers and anecdotal evidence that insecurity experienced by customers would have increased after the reform, we also use novel data on suspected crimes of employees and entrepreneurs in taxi and bus industries to examine whether criminal offenses increased after the reform.

Extensive margin responses (entry and exit) and effects on prices and mileage are of major interest in themselves, providing first-hand information on how deregulation affects key market outcomes. They also provide insights into the mechanisms driving the observed changes in reported sales values and VAT payments. The reform combined liberalization of entry and pricing with a loosening of certain forms of quality control and monitoring. The purpose of the latter was to further reduce the costs of entry, but such measures may also lead to side effects such as increased tax evasion, which may show up as a decline, e.g., in reported value added even in the absence of changes in real market behavior. Our data and empirical setting allow us to pin down and separate all these effects.

We find a surge of new entry into the taxi market after the reform. We also observe that some incumbents exit the market at a faster rate in comparison to the previous regime, but net entry into the market is still markedly positive after deregulation, which implies extensive market structure effects. The reform led to a decline in average reported sales and VAT payments, and the decline is both statistically and economically significant. The reduction in sales is not explained by a reduction in prices or in proxies for two separate demand measures, firm-level variable costs or taxi vehicle-level mileage. Rather, we observe an increase in prices after the reform. We also observe only a very slight decline in payroll and variable costs (indicative of service volume), but this decline is much smaller than the reduction in reported sales. These findings together suggest that the decline in sales is more

likely attributable to changes in the reporting behavior of taxi companies rather than a real response. The sharp and immediate decline in reported sales implies a corresponding reduction in tax revenues, and our findings therefore point to increased tax evasion following deregulation, a mechanism we discuss in detail in Section 6. Overall, instead of leading to efficiency gains from intense competition, in the short run deregulation led to adverse effects both for consumers in the form of higher prices, and for public finances in the form of lower tax revenue. While tax evasion appears to have increased, we do not find clear effects on other types of criminal activity despite more lenient regulation towards new entrants.

Our paper fills a gap in the literature on taxi markets and the regulation of service industries characterized by asymmetric information, by providing an exceptionally comprehensive analysis of the effects of deregulation on key market outcomes (entry, exit, sales and demand, prices), tax reporting, as well as tax evasion and other crimes, using unique data and a credible quasi-experimental research design. There has been recent interest in the functioning of taxi markets per se, in particular the supply side of the market (e.g. Camerer et al., 1997; Farber, 2015; Thakral and To, 2021). Another strand of literature examines taxi markets from the viewpoint of the credence goods nature of taxi services. While this literature focuses on market failure due to the unobservability of quality which may lead to both overcharging and overtreatment (riding suboptimally long routes), this literature does not extensively discuss regulation (e.g. Balafoutas et al., 2013; Dulleck and Kerschbamer, 2006). On the other hand, there is a separate literature focusing on the principles of taxi market regulation highlighting both the need for regulation (Cairns and Liston-Heyes, 1996; Douglas, 1972), and potential caveats with poorly designed regulation leading to inefficiency (Buchholz, 2022). Numerous previous empirical studies have examined the implications of deregulation in different countries on various aspects of market outcomes; the evidence is summarized in Moore and Balaker, 2006.[1]

Regarding the development of the platform economy, and the fundamental changes

[1] Jääskeläinen et al. (2023) examine the Finnish reform, with a focus on documenting price dispersion after the reform and estimating effects on entry.

brought about by these new types of operators to traditional service industries, the Finnish reform is of interest as it allowed the entry of platform service providers such as Uber into the taxi market. Earlier research has highlighted that platform operators may reduce the informational asymmetries and associated inefficiencies in the taxi market (Liu et al., 2021), improve quality (Athey et al., 2024) and productivity (Cramer and Krueger, 2016). On the other hand, it has been argued that an increase in the number of independent contractors (vs. employees) in the market makes tax enforcement more difficult (Alm, 2021). Further, platform services have been found to be associated with higher prices especially at peak times (e.g. Hall et al., 2023), but the negative effects of higher prices on consumer welfare may be partially compensated by shorter wait times induced both by better matching of drivers to passengers, and increased labor supply (Castillo and Knoepfle, 2024; Hall et al., 2023). Our findings highlight that tax evasion increased after liberalization, and we further find that despite the large increase in net entry, prices increased i.e. the new competition was not successful in driving prices down at least in the short run. These findings are consistent with the earlier evidence, though we cannot separate the role of each type of firm (traditional taxi operators vs. platform operators) in these developments. A caveat in our analysis is that we do not have good data on waiting times or other dimensions of service quality. Our evidence suggests at least potential improvements in service availability in urban areas where entry increased the most, even though surveys carried out by the regulatory agency suggest that customer satisfaction with access to services did not improve at the time of the reform (Traficom (2020)).

Finally, we also contribute to the literature on tax evasion, highlighting yet another context in which better evasion opportunities – due to less intense monitoring – lead to higher levels of evasion (e.g. Kleven et al., 2011). Tax evasion and other types of criminal activity may be of particular interest in credence goods markets, such as the taxi industry, as the functioning of these markets is to an important extent based on trust, and evasion and crime may have repercussions on market efficiency (Balafoutas et al., 2015). Adhikari

et al. (2022) provides an analysis of taxi markets focusing solely on the implications of more intense monitoring, in the form of third-party reporting, on tax evasion.

2 Taxi Market

2.1 Taxi market characteristics

Taxi markets are characterized by various informational asymmetries. Taxi services are an example of so called credence goods, meaning that important aspects of service quality are not observable to the customer even after purchase. In the context of taxi rides, this means, for example, that a customer is often not fully informed about the optimal route, or the local tariff system. This likely applies especially to less frequent customers such as tourists. Customers therefore rely on the driver to provide an expert service in the sense of choosing the best possible route, and charging the appropriate price for that route. However, drivers may respond along margins such as route length or pricing per route, creating incentives for overtreatment or overcharging (e.g., Balafoutas et al., 2013). More generally, complex tariff structures and the nature of the service have made price comparisons difficult and burdensome for customers. Further, the difficulty associated with observing quality may also lead to market concentration (related to building reputation).

Taxi markets consist of several submarkets, which may partially overlap. In the hailing taxi market, direct entry costs are low (absent regulation), but because the service is tied to time and place, a monopolistic market is possible and there is uncertainty about waiting times and quality. Reputational factors are likely to have a limited effect on customer's choice. In the taxi stand, taxis are often taken from the queue by the "first in, first out" principle, which leaves little or no space for price comparison and for competition to emerge. In dispatch markets instead, taxis are usually pre-booked and reputation affects customer's choice. This type of a market may be closer to a competitive market, and firms can compete with quality and price.

The special features of taxi markets provide a rationale for regulation. Difficulty of price comparisons due to low salience of fares especially under complicated pricing structures, incentives for overcharging, and potential market concentration all point to a tendency of market outcomes to be characterized by prices that may be higher than social optimum. This may call for price regulation.

Perhaps surprisingly, there is very little general discussion of the principles of regulation in the credence goods literature. Instead, there are separate fields of literature which discuss regulation in different markets (often without explicit reference to credence goods characteristics).[2] Cairns and Liston-Heyes (1996) provide a search model of the taxi industry, showing that search costs lead to market failure, and price regulation is necessary. Further, the expert nature of taxi services imply that some kind of licensing and monitoring are likely needed. Some of this necessarily translates into entry barriers. Thus, Cairns and Liston-Heyes (1996) argue that regulation of entry may be a useful tool in the taxi industry.

Indeed, taxi markets have traditionally been subject to extensive regulation in many countries. Regulation with similar features as in the Finnish case (discussed below in detail) has been widely applied. On the other hand, starting in the 1980s, deregulatory reforms have been implemented, e.g. in multiple cities in the US by 1985, New Zealand in 1989, Sweden in 1990, and the Netherlands and Ireland in 2000. The effects of the reforms have been mixed, and in many cases prices have increased after deregulation. (Moore and Balaker, 2006; Teal and Berglund, 1987.)

The development of the platform economy implies that many of the key market characteristics described above may be changing fundamentally. Uber entered the transportation market in the USA in 2010. Their new digital platform, matching supply and demand of transportation services with an app, revolutionized the industry by potentially alleviating many of the informational asymmetries highlighted above (Cramer and Krueger, 2016; Liu

[2]In practice different markets with credence goods characteristics are subject to very different types of government intervention, ranging from direct government provision (healthcare) to no regulation beyond general consumer protection (e.g. repair services).

et al., 2021.) In Finland this development was delayed until June 2018 due to the strict market regulation that we describe below in detail.

2.2 Finnish taxi market regulation prior to 2018

Price regulation. Before July 2018, the maximum prices of taxi rides were annually set by a Government Act. The Act contained maximum kilometer-based fees and maximum additional fees including, for example, waiting- and starting, assistance and airport fees.[3] Although this regulation essentially set a price cap, the maximum price was applied by most taxi companies, leading to, in practice, no price variation between service providers. The price cap was reviewed annually, and according to the old Taxi Law, the maximum prices set in the Act had to be cost-oriented such that they included a reasonable profit. The annual increases in the maximum prices were based on a cost index of taxi transportation. The Finnish Taxi Alliance was also heard in the decision process.[4] (Taxi Traffic Law 217/2007, 2007)

Entry regulation. The Taxi Law prior to July 2018 set multiple requirements for the admission of a taxi license. Each license was subject to discretion by local authorities and the authorities assessed demand and existing taxi service supply on a case by case basis. To hold a taxi license, the service provider had to commit to 24/7 service.To obtain a taxi license, the applicant was required to obtain at least 120 hours of education on entrepreneurship and pass a test after completing the education program. Eligibility for obtaining a license also depended heavily on the applicant's criminal record.[5] (Taxi Traffic Law 217/2007, 2007.)

[3]One example of such price regulation starting from July 1st 2013 is available as an English translation here: https://www.finlex.fi/fi/laki/kaannokset/2013/en20130460_20130460.pdf

[4]Another dimension of public sector involvement is that a sizable proportion of taxi service usage is publicly subsidized. The costs of using a taxi for healthcare visits can be covered from social insurance if other means of transport are not feasible. In 2017, for example, approximately 40 percent of the taxi industry's turnover was from publicly supported services (Traficom, 2020).

[5]The old Taxi Law required that the applicant must not have had been convicted for over two year's imprisonment during the past ten years, or for any imprisonment during the past five years. In addition, the applicant must not have been imposed a fine penalty for a crime against a customer, drunk driving or practicing taxi business without a license during the past three years. Lastly, the applicant must not have

Other quality control. In addition to the requirements set for entry of service providers, as outlined above, the Law set specific requirements for individual taxi drivers. A driver was required to pass a course with at least 30 hours of training.[6] The taxi driver's test was in Finnish or Swedish, which implies that drivers were in practice required to have adequate knowledge of one of the two official languages in Finland. One additional requirement was that the driver should have adequate regional knowledge of the area of operation, and these skills were also tested. There was also regulation pertaining to the applicant's criminal record[7] (Act 695/2009, 2009.)

Finally, each taxi vehicle was required to have a taximeter, a device showing the real time distance and price of the journey to the passenger.

2.3 Deregulation in July 2018

From July 2018, taxi market regulation was substantially reformed in Finland.[8] The main objectives were: 1) to ensure adequate service availability and especially, to stop the decline in the number of service providers in rural areas, 2) to lower the prices of taxi services and 3) to promote competition in the market. (Ministry of Transport and Communications, 2019)

The first public discussions about the plans to deregulate the taxi market were reported by the media already in the spring of 2017, but the detailed and final version of the government proposal was made public in late April 2018, two months before the new legislation came into force.

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been imposed a fine for crimes concerning employment relationships, bookkeeping, taxes, traffic safety or other laws and requirements related to conducting business for more than three times during the past two years.

[6]The courses were organized by private firms but were audited and the content was monitored by the Finnish Transport Safety Agency Traficom.

[7]To obtain a taxi driver's license, the applicant must not have been found guilty for drunk driving, driving without a license, grossly endangering traffic safety, crimes against life and health, sexual offences or other crimes indicating violent behavior or other crimes that indicate the applicant being inappropriate to serve as a taxi driver, during the past five years.

[8]The reform was implemented in all other parts of the country, except for the autonomous province of Åland, which is a group of islands in the archipelago between Finland and Sweden with approximately 30,000 inhabitants.

Price regulation. After the reform, the price level of taxi rides is free of any regulation. As the new Transport Service Act no longer contains any restrictions on the fee structure, time-based fees also became allowed, and taxi prices may now contain fixed, kilometer-based and time-based components. The price of the taxi ride is however required to be announced before the trip or alternatively, the pricing principles have to be clearly communicated, if the exact price cannot be announced in advance (Act 320/2017, 2017). These changes in price regulation likely made the determination of taxi prices less salient to customers and in many cases made it more difficult to assess the prices of trips beforehand. On the other hand, the removal of entry restrictions facilitated the development of new types of services, such as taxi apps, that potentially facilitated price comparisons for app users.

Entry regulation. The new Law removed the numerical limits on market entry. Entering the market is hence allowed for anyone who fulfills the requirements of practising taxi business. Importantly, the reform also allowed new virtual platforms to start operating in Finland. Self-employed drivers who use their own cars are now able to operate through platforms like Uber and Yango. The regulation related to the criminal history of taxi license applicants became slightly more lenient after the reform.[9] (Act 320/2017, 2017.)

Other quality control. To obtain a taxi driver's license, the applicant must still pass a taxi driver's test, but the new law no longer requires the applicant to attend any taxi driver's education program and the regional knowledge part was removed from the test. The explicit requirements concerning drivers' criminal history remained similar to those prior to the reform.

One important change was the removal of the obligation to use taximeters, i.e., the device showing the distance traveled, the time and price of the taxi ride. If the price of the trip

[9]After the reform, the license holder must not have been convicted of more than 4 criminal offenses concerning employment relationships, bookkeeping, taxation, traffic operations, traffic safety and other professional responsibilities in the past two years (Act 320/2017, 2017; Taxi Traffic Law 217/2007, 2007.) In terms of good reputation, requirements for obtaining a passenger traffic permit relevant for bus operators are identical to obtaining a taxi license in the new Transport Service Act.

was fixed before the trip, for instance, a taximeter was no longer required (Act 320/2017, 2017).[10] Before the reform, the Tax Administration could use taximeter data as a source of third-party information on the use of taxi services.[11] Even though the abolition of the obligation to use taximeters does not directly relate to entry regulation, a key rationale for this change was related to lowering the cost of entry. Similarly, some of the other measures whose primary rationale was to reduce entry costs, such as the changes to the taxi driver's test discussed above, also implied a simultaneous loosening of quality control.

3 Empirical Approach

3.1 Data

We examine the effects of taxi market deregulation on the entry of new businesses, consumer prices, demand for taxi services, tax revenue, and criminal offenses. Studying all these behavioral margins requires utilizing various types of data. The data are obtained from Statistics Finland and the Finnish Transport and Communications Agency (Traficom). Our baseline analysis uses data for 1/2016–12/2019 due to the very large impact of the COVID-19 pandemic on the taxi industry and societies in general.

Price data. We use two different sources of price data. First, we use CPI data collected by Statistics Finland. The CPI data collection is based on a convenience sample of firms drawn from the entire population of firms in each industry. According to information provided by Statistics Finland, the firms are selected in such a way that the data should be representative of the price developments in the industry, and price observations are weighted by region, with observations from regions with larger total sales receiving a higher weight. The exact

[10] The obligation to use taximeters was returned to the Transportation Act starting from September 2021 (Act 299/2021, 2021).

[11] Even though the information from taximeters was not automatically shared with the Tax Administration, the information could be used in the context of tax audits or tax enforcement campaigns, or if a firm was suspected of tax evasion. Taxi entrepreneurs also often used taximeters to be directly connected with their accounting.

sampling procedure, or the identity of the firms that are included in the data, are not public information. Drivers associated with the new platform services (e.g. Uber) operate under the same industry code as traditional taxis, and are therefore part of the population of firms that form the basis for the price collection for the taxi services CPI.

Second, as a complementary source of price data for the taxi industry, we use data collected by the Finnish Transport and Communications Agency (Traficom). The prices in the Traficom data are calculated for standard trips according to the pricing principles of the taxi companies, and these data provide a good estimate of realized taxi prices. Traficom's data includes prices advertised by over 500 taxi companies around the country. Traficom's data however does not include prices announced by dispatch centers or services like Uber, Bolt or Yango. These service providers only operated in the capital region in 2019 and their market share stayed relatively low in the short run after the reform. For example, there were about 500 Uber-drivers in 2019, while there were approximately 35 000 taxi drivers altogether in Finland in that year (Traficom, 2023).

Before July 2018, the maximum price levels for taxis were set annually by the government act as described in Section 2.2. Using the two data sources outlined above, we construct a price index of taxi prices that is comparable across the reform. We use information on 5 and 15 kilometer taxi rides and fixed starting fees. We can also separate between daytime and nighttime prices.

VAT, income and payroll tax data. We use monthly firm-level value added tax (VAT) filing and payroll tax data provided by Statistics Finland to study the development of firm performance measures such as sales and variable costs, as well as VAT payments. These data cover all registered tax liable companies in Finland, and also include information on many important firm-level characteristics such as location and organizational form. To select our baseline sample, we define taxi and bus firms based on the detailed five-digit industry codes, also directly available in the data. The sample includes also platform-based taxi firms as

they are independently required to file VAT and payroll taxes to the Tax Administration and thus, for example, each Uber driver is a separate observation in this data set. Unfortunately, however, we cannot distinguish them from other taxi firms operating in the industry.

Information on reported sales, costs and VAT payments are obtained from the VAT data. All VAT-liable firms are included in this data set. Firms with annual sales under 10 000 euros (15 000 euros from 2021 onward) are not VAT-liable and hence may not be VAT registered, and thus might be excluded from the VAT data.[12] However, we observe these firms in the annual-level tax data, derived from data on annually filed financial statements, which includes the whole population of firms reporting income tax statements to the Tax Administration. This data set includes firm-level information about annual sales reported to the Tax Administration for the purposes of firm-level income taxation, which we can directly compare to the sales reported in VAT filing. A key feature of this data set is that it includes all firms operating in Finland, including also those small firms that are not VAT liable. This data allows us to analyze how taxable profits respond to the reform.

We also use data on monthly payroll tax payments of firms. These data, provided by Statistics Finland, include information on the firm-level payroll taxes and labor costs, and the data includes all firms with employees. We use this dataset to study the effects of the reform on average labor costs of firms. This will capture all changes in working hours and the number of employees, as well as changes in wage levels.

The key outcome variables in our analysis using the VAT and payroll tax data are firm-level VAT payments and reported sales, variable costs (calculated based on VAT deductions[13]), and labor costs. We also use the VAT data to identify firm entry and exit, based on the time period when each firm is observed in the VAT data (see 4.1 for details).

[12]Firms with yearly sales less than 30 000 euros are allowed to report their VAT payments annually, and firms with yearly sales under 100 000 euros are allowed to report VAT quarterly. Firms are included in the monthly VAT data regardless of the reporting period by splitting the VAT of firms that report quarterly or annually equally over the corresponding three or twelve month period.

[13]VAT deductions are VAT payments by the firm on purchases that are intended for business use, such as VAT paid on fuel costs of taxi or bus firms. These payments are tax deductible from the overall VAT payments of the firm. Variable costs are calculated based on VAT deductions, dividing the deductions by the standard VAT rate at the time in Finland.

Vehicle owner and mileage data. We also use Traficom's data on odometer readings to estimate the change in average kilometers driven in the taxi industry. These data are based on vehicle inspections, and enable us to define an additional measure of the demand for services. We can identify buses and taxis from the vehicle inspection data, as these vehicles are subject to a license, and this license information is included in the data.[14] The license is also required for vehicles driven by platform-based taxi drivers and they are thus included in this data set.

In detail, we directly observe the mileage of each vehicle between subsequent inspections. We use this information first to calculate the difference in odometer readings between inspection dates, and then divide the difference by the number of days between inspections to obtain a measure of kilometers driven per day for each vehicle. As vehicles in licensed use must be inspected annually, we can construct this measure for each vehicle between inspections. Note, however, that we are restricted to analyze mileage such that, for example, if a car is inspected in December 2018, it is likely that the preceding inspection took place a year ago in December 2017. Therefore, many observations in the mileage data around the time of the reform will combine data from both before and after the reform. Any changes in demand for taxi services caused by the reform would thus result in a decreasing or increasing trend in the average daily kilometers around the reform and not necessarily a sharp change that exactly coincides with the reform.

In addition to mileage, this data set includes information about the vehicle owner and vehicle-level characteristics.

Criminal offense data. To study the effect of the reform on suspected crime rates in the taxi industry, we use administrative data from Statistics Finland's registers from January 2015 to December 2019. The data includes individual identifiers and exact offense dates, and it covers information on a large set of different suspected criminal offenses from minor

[14] In addition to the license information, we use information on vehicle type, which separates buses from passenger cars (taxis). Taxis form a clear majority of the latter category, with other vehicles subject to a license such as police cars forming a small minority.

traffic-related offenses to very serious criminal activity. We examine the overall crime rates but also focus on more specific crimes such as traffic violations, assaults and physical abuse.

We use job-spell data, including employer and employee identifiers and five-digit industry codes, to define the sample for this analysis. We first link all taxi and bus drivers, including both employees and entrepreneurs, in the job-spell data to the criminal offense data using individual identifiers. As suspected criminal offenses are relatively rare occurrences in our data, we define pooled six month crime rate measures by scaling the number of crimes by the total number of workers in each industry.

Importantly, we focus on suspected crimes – i.e. an individual is a suspect in a reported crime – rather than prosecutions or convictions. Admittedly, this is an imperfect proxy of actual crimes; nevertheless, this measure is of course strongly correlated with actual criminal activity. The reason for focusing on suspected crimes is that criminal processes take a considerable amount of time, and therefore a large and increasing fraction of the crimes towards the end of our data period do not have information on prosecutions or convictions.

3.2 Expected outcomes

Even though there is a clear rationale for regulation of the taxi industry, as explained in Section 2, it is equally clear that it is not obvious that any regulation is better than no regulation. That is, it is not clear a priori whether deregulation leads to better or worse market outcomes, but this depends on the details of regulation as well as market dynamics after deregulation.

Regarding prices, the government expected prices to decline due to competition after the reform, but this is a priori not clear. The effect of deregulation on prices depends on whether effective competition emerges, and how pre-reform regulated and capped prices compare with equilibrium market prices. The regulated prices allowed for a "modest" profit margin, which may be competed away after deregulation; and new and more efficient operators may also enter the market. However, all of this depends on effective competition. It is equally possible

that prices increase for example if informational asymmetries confer monopoly power on firms.

Regarding tax reporting, we have a clear prediction that evasion is expected to increase due to less stringent monitoring following the reform. Abandoning the obligation to use taximeters creates an incentive to evade taxes: upon a potential inspection, there is less information available to the tax authority, and the probability of getting caught with evasion decreases. Further, as less training for entrepreneurship is required from new entrepreneurs after the reform, ignorance and incompetence may give rise to illicit activities. If there is a change in VAT evasion, this would show up as a change in reported sales (the main component of the VAT base) and average VAT payments after the reform.

A key task in our analysis will be to disentangle evasion responses from potential real responses (changes in real economic activity): a decline in demand could lead to a similar development in reported sales as an increase in evasion. How demand may be expected to change due to the reform is not clear a priori: demand changes may arise in response to price changes caused by the reform, or e.g. through emergence of new services that were formerly prohibited. We will assess demand developments in two ways: First, a firm's variable costs and labor costs provide an indication of the scale of activity and hence demand. Second, the data on mileage provides an important source of complementary evidence on changes in demand in terms of how much taxi mileage we observe before vs. after the reform.

Finally, removing entry restrictions may of course lead to an increase in the number of providers. The regulation prior to the reform was associated with an attempt to grant licenses to meet local demand. Therefore, the precise effect of deregulation depends on how well the pre-reform number of providers matched local demand conditions and whether there is scope for profitable entry. Relatedly, changes in the entry restrictions in terms of criminal history of taxi license holders and training requirements might change the characteristics of drivers, and less stringent regulation might also increase criminal offenses among taxi drivers.

3.3 Methodology

We examine the effects of taxi market deregulation using a difference-in-difference (DiD) approach. We compare firms operating in the taxi industry to firms in the bus industry, which were not directly affected by the reform. The two industries exhibit similar seasonal patterns and share broadly comparable demand and cost structures, making the bus industry a plausible control group for the taxi industry. We provide visual evidence supporting this comparison by documenting the evolution of key outcomes in both industries during the pre-reform period, prior to the deregulation of the taxi market in July 2018.

We estimate the following regression model:

$$y_{ft} = \sum_{k=1/2016}^{12/2019} \delta_k \cdot 1[t = k] \cdot D_f + \sum_{k=1/2016}^{12/2019} \mu_k \cdot 1[t = k] + \eta_f + \epsilon_{ft} \tag{1}$$

where y_{ft} denotes the outcome variable of interest for firm f in month t, η are firm fixed effects, D is an industry indicator equal to 1 for firms operating in the taxi industry and 0 for firms operating in the bus industry, μ_k are month fixed-effects, and ϵ is the error term.

The key coefficients of interest are δ_k, which we plot relative to the reference period one year before the reform (July 2017). The estimated time effects thus measure changes in the outcome variable relative to the pre-reform benchmark. In addition to examining the monthly effects, we estimate a pooled difference-in-differences model by interacting a post-reform dummy with the taxi industry dummy $1[t \geq 7/2018] \cdot D_f$, to recover average post-reform effects.

In the baseline analysis, we include both local and long-haul bus service providers in the control group. We define taxi and bus firms based on five-digit industry codes defined by Statistics Finland (codes 49320 for taxis and 49310, 49391 and 49392 for buses). We cluster standard errors at the firm level.

To guide the discussion of the key outcome variables and their counterparts in our data, note that value added is given by $(pq(x) - \phi q(x))$, where p denotes producer prices, $q(x)$

quantities sold, and ϕ input prices. Under a value-added tax (VAT) rate τ, VAT payments equal $VAT = \tau(pq(x) - \phi q(x))$, implying that consumer prices are related to producer prices through $(1 + \tau)p$.

Using monthly VAT data covering the universe of VAT-liable firms, we directly observe taxable sales, $pq(x)$, deductible inputs, $\phi q(x)$, and aggregate VAT payments. Assuming that input prices ϕ, most importantly fuel prices in our setting, do not respond to the reform, changes in deductible inputs provide a proxy for changes in demand, $q(x)$. Similarly, we use monthly labor costs as an additional proxy for demand, as labor demand is expected to increase with output. To complement these measures and alleviate potential challenges in using firm reports to measure demand, we also exploit mileage information as an alternative proxy for demand. Producer prices, in contrast, are not directly observed at the firm level. Instead, we rely on monthly- and industry-level consumer price indices and complementary firm-level price data available only after the reform, neither of which can be linked directly to firm-level administrative data. The VAT data also allow us to study firm entry and exit margins. Finally, we use criminal offense data to examine whether the deregulation affected criminal activity in the taxi market, including violent and property crimes.

When estimating mileage responses, the analysis is conducted at the vehicle-level, and Equation 1 is estimated with vehicle fixed effects rather than firm fixed effects. For the exit, entry and criminal offense analyses, we aggregate the data to the biannual level and estimate pooled DiD specifications with half-year fixed effects to alleviate seasonal fluctuations in these relatively infrequent outcomes. An exception from the approach described above is the analysis of pricing behavior. Since there was virtually no firm-level variation in taxi prices before the reform, we provide only a descriptive analysis of price developments (see Section 4.2).

Furthermore, we complement the analysis with annual firm-level income tax records. This exercise not only provides a robustness check for the results obtained from the VAT and complementary data, but also offers two important advantages. First, it enables us to

observe firms that are not liable for VAT. Second, it allows us to examine a broader set of outcomes, including taxable profits. Since these data are available only at the annual level, the analysis is conducted using yearly observations. A limitation of this approach is that, because the reform took place in July 2018, post-reform effects can only be studied using outcomes observed in 2019 relative to pre-reform years, as the onset of the COVID-19 pandemic makes it difficult to credibly identify longer-run effects.

A potential concern for our identification strategy is substitution between taxi services and local bus transportation. If consumers substitute local bus rides for taxi trips, the reform could indirectly affect the bus industry, violating the SUTVA assumption. This concern would be particularly relevant if the control group consisted only local bus operators. In our baseline specification, however, we include both local and long-distance bus operators in the control group. More importantly, our results are robust to restricting the control group to long-distance bus operators only, which are considerably less substitutable for taxi services than local buses.

3.4 Descriptive Statistics

Table 1 presents the descriptive statistics of our core variables in the VAT and payroll tax data before the reform of the taxi industry. It is clear that an average firm in the bus industry is much larger than the average firm in the taxi industry, bus firms being more than one factor larger compared to taxi firms. Also, there are a lot more taxi service providing firms, with approximately 8,000 unique firms, compared to firms in the bus industry, with roughly 600 firms. For comparability of the two industries, what is crucial is that key outcomes develop in parallel in the absence of the reform. Our graphical analysis below provides support for this assumption. Appendix A presents descriptive statistics for the other datasets used in this paper. We refer to these tables when we discuss the empirical evidence based on these data sources in the main text below.

4 Baseline Results

4.1 Entry and Exit

We first analyze overall market dynamics before and after deregulation by studying entry and exit responses using monthly VAT data. The analysis reveals quite remarkable and immediate changes in the structure of the taxi market, as many incumbent firms in the industry quit and new businesses start.

Figure 1 shows the indexed number of taxi and bus firms reporting VAT to the Tax Administration. There was a declining trend in the number of firms in both industries before the reform. After the reform, the number of taxi firms increases rapidly and 18 months after the reform, the number of taxi firms has increased by 10% compared to bus firms.

Next, we focus explicitly on firm entry and exit rates. We use the panel nature of the data to define firm entry and exit: we mark an entry for the first period when we observe the firm identifier in the VAT data and similarly, an exit for the first period when the firm ceases to report VAT. The entry rate is defined as the number of entering firms divided by the total number of firms in the industry during the previous half-year period, and similarly for the exit rate.[15]

Panel (a) of Figure 2 shows that the increase in the entry rate in the taxi industry after the reform is rapid and large. In the first half a year after the reform, the entry rate quadruples (from approx. 2% to over 8%). There also seems to be a small anticipation effect in the first half of 2018 in entry to the taxi industry. Such anticipation is not a surprise, as some firms may register their business in the first half of 2018 to be ready to enter the market right after the reform.[16] The increase in exit rates in Panel (b) is smaller than the

[15] We regard VAT filing as providing a reasonable proxy for entry and exit. When the firm is registered, it must file a VAT form every period, even if it did not have any sales. In case of a negative net-VAT liability, stemming from deductions exceeding VAT from sales, the firm can obtain a tax refund.

[16] First public discussions about the reform were reported in the media in the spring of 2017, and the final deregulation Act was passed in May 2018.

increase in entry rates: the exit rate increases from 3.5% to on average 6% after the reform, although there is more fluctuation in exit rates compared to entry rates.

Table 2 collects the pooled difference-in-difference estimates for exit and entry rates using aggregated biannual data (as in Figure 2). The estimated average increase in the exit rate is 1.4 percentage points, which is large compared to the baseline mean before the reform (3.7%). However, the change in the entry rate is even larger with a 5.6 percentage point increase, which is more than double the pre-reform entry rate (2.0%).

One of the main objectives of the reform was to ensure availability of taxi services all over the country and especially in rural and sparsely populated areas. Panel (c) of Figure 2 shows how entries to the taxi market are distributed according to municipality size before and after the reform in 20 bins by municipality size.[17] Average entry rates in different size categories of municipalities have generally increased in all size bins after the reform, but the entry rates have increased more in larger municipalities. Therefore, even though new taxi firms do enter the market in many types of municipalities, it does seem that the largest municipalities have become relatively more attractive for entrants. Panel (d) of Figure 2 plots the relationship with net-entry rates, i.e., the number of entering minus exiting firms divided by the number of taxi firms, and the size of the municipality. The net-entry rate is below zero among smallest municipality groups and increases with municipality size. Therefore, the goal of increasing the number of taxi service providers especially in rural areas has not materialized.

The reform of the taxi industry and increased entry might also affect the selection of drivers into the market. We can examine the characteristics of taxi drivers before and after the reform using the vehicle-level data with unique individual identifiers linked to data on individual-level characteristics. Table A.1 in the Appendix shows some characteristics of entering taxi drivers in the upper panel and exiting taxi drivers in the lower panel. The data indicates for instance that the share of new workers with foreign origin has increased after deregulation, which may be related to the loosening of language skill requirements. A larger

[17] There are more than 300 municipalities in Finland.

fraction are entrepreneurs as opposed to wage earners after the reform. This is partly due to the entry of platform operators, as Uber drivers are classified as entrepreneurs in the data. There is no clear pattern in entering or exiting drivers' crime rate. Note that these findings are only descriptive, but they give an indication of how some characteristics of taxi drivers has changed after the reform. We provide causal evidence on criminal activity in Section 5.

4.2 Price Responses

One of the main objectives of the reform was to reduce the prices of taxi rides. To analyze the development of consumer prices, a proper difference-in-differences (DiD) analysis is not feasible, because the pricing of taxi rides was determined by the Government decree before the reform, and there is practically no price variation in taxi rides in the pre-reform data. We provide a descriptive counterfactual analysis, where we examine the development of the prices of local bus rides as a benchmark, using aggregate price index data. An analysis of price developments is important, not only because lowering prices was a key objective of the reform, but also because price developments shed light on the mechanisms behind our main results, as we will discuss below.

Panel (a) of Figure 3 depicts the development of taxi and local bus prices using the Consumer Price Index (CPI) provided by Statistics Finland. The pre-reform price development in these industries is very similar. After the taxi market reform, the CPI in the taxi industry drops in the very first quarter but then starts to rapidly increase, being over 10 points higher a year after the reform compared to the development of local bus prices. Panel (b) of Figure 3 shows the price development using our complementary data source for taxi prices after the reform, namely the Traficom data that allows us to construct separate price indices for 5 and 15 kilometer taxi rides.[18] The data indicates that taxi prices increase after the reform, and especially so for longer, 15 kilometer taxi rides. The longer rides represent the

[18]Table A.2 in Appendix A shows the descriptive statistics for the price data by different price categories available in the data. Table A.3 in Appendix A presents the prevalence of time-based pricing systems in Finland over the study period.

typical length of taxi rides in Finland, as the average length of a taxi ride is 13.6 kilometers (Traficom, 2020). These results are well in line with earlier research studying this reform that documents an increase in price dispersion after the reform (Jääskeläinen et al. (2023)).

Both of our data sources therefore indicate that prices increased in the taxi industry after the reform, while the magnitude of the response differs somewhat in the two data sets. One potential reason for the difference is that the Traficom price data in Panel (b) does not include the prices of Uber etc. service providers but the CPI data in Panel (a) does. Another reason could be related to the collection method of the CPI data. The CPI data aims to provide a credible measure of average price development for the whole country across different consumption items over time and thus it has regional weights, such that observations from regions with high total sales volume receive a higher weight, while the index we form based on the Traficom data is not weighted. The larger price increase evident in the CPI data therefore suggests that prices increased more in regions with a larger taxi market. Next we turn to examine regional heterogeneities in price development.

To provide descriptive evidence on heterogeneities in the price response, Figure 4 shows the price development of taxi rides separately for the capital region and areas outside the capital region[19] for 5 kilometer day and nighttime taxi rides (Panels (a) and (b)) and 15 kilometer day and nighttime taxi rides (Panels (c) and (d)). Interestingly, the figure shows that the average price *increase* was especially sharp and large in the capital region. For example, the price of a daytime 15 kilometer trip has increased by about 10 euros from 2018 to the beginning of 2020 in the capital region (Panel (c) of Figure 4), which represents an increase of over 30% in average consumer prices compared to the 2018 price level.

Based on these figures, it is evident that the main objective of the reform, lower consumer prices, was not reached. If anything, average taxi ride prices increased soon after the reform of the taxi market.

[19]The capital region includes the municipalities of Helsinki, Espoo and Vantaa.

4.3 Firm Performance and Tax Reporting

VAT reporting. Next we turn to a difference-in-difference analysis of firm performance measures using monthly tax reporting data. First, we examine the development of firm sales, which is equal to the price of the goods or services multiplied by the quantities sold, and the development of VAT payments, which are given by the sum of sales subject to different VAT rates multiplied by the VAT rates in question. Second, we examine whether we find corresponding developments in variable costs and labor costs that provide an indication of a firm's scale of operation.

The left panel of Figure 5 shows the monthly development of seasonality adjusted (log) average sales (Panel (a)) and VAT payments (Panel (c)) relative to July 2017 separately for taxi and bus industries.[20] The right panel of Figure 5 shows the corresponding DiD coefficients by month, corresponding to Equation (1), for sales (Panel (b)) and VAT payments (Panel (d)) with 95% confidence intervals.

For both outcomes, the pre-reform development is very similar across industries, which provides evidence for the validity of our empirical approach. Right after the reform, there is a sharp and immediate reduction both in average sales and VAT payments among taxis compared to buses. The DiD estimates indicate that both average sales and VAT reported to the Tax Authority decrease by more than 10 log points after the reform, and the effect seems to be rather stable across the post-reform months.[21] Using a similar graph layout, Figure 6 shows the monthly development of average variable costs and labor costs. The figure indicates no clear effects of the reform on these outcomes.

To further evaluate the magnitude of the effects, Table 3 presents the DiD coefficients where we pool months before the reform (from January 2016 to June 2018) and after the

[20] Appendix A Figure A.1 highlights a clear average level difference across taxi and bus industries, as well as pronounced seasonal patterns in the raw data. To account for these features, we residualize the outcome variables by calendar months using pre-reform data.

[21] Appendix A Figure A.2 further illustrates the change in the distribution of sales in the taxi industry by 100 sales percentiles comparing the last full year before the reform (2017) to the first full year after the reform (2019).

reform (from July 2018 to December 2019) together and interact this indicator with the industry (taxi/bus) indicator. The baseline DiD coefficients in the upper panel with firm fixed-effects are statistically significant and negative for sales and VAT payments. The magnitude of the response is a 12 log point reduction in average sales and a 13 log point reduction in average monthly VAT payments. The DiD estimates for average labor costs and variable costs are much smaller in absolute value compared to the estimates for sales, -2.9 and -1.9 log points, respectively, and are both statically insignificantly different from zero. In the lower panel of Table 3, we estimate the effects without firm fixed effects. These estimates might differ from the upper panel if exploiting between-firm variation would drastically differ from applying only within-firm variation (with firm fixed effects). This could arise, for example, due to the large market-level responses, discussed in Section 4.1. The DiD coefficients without firm fixed-effects suggest larger absolute effects for sales (20 log points decrease) and VAT payments (23 log points decrease) than using only within-firm variation, and the point estimates for labor costs and variable costs are relatively small and remain statistically insignificant. It is not very surprising that the responses are similar with or without firm fixed effects: although the extensive margin responses to the reform are large, yet a majority of firms exist both before and after the reform.

Mileage. We also examine demand responses using an alternative outcome: changes in vehicle-level odometer readings between consecutive inspections, estimated using the same difference-in-differences approach as before.[22] Panel (b) of Figure 7 reports the DiD coefficients of (log) daily kilometers separately for taxis and buses. The downward-sloping trends for both groups largely reflect the structure of the data: our inspection data starts in 2016,

[22]For this analysis, we additionally control for vehicle type and, importantly, include baseline total-mileage splines (20) separately for taxis and buses. These controls account for systematic differences between the groups and usage patterns, as taxis tend to be newer and have substantially lower accumulated mileage than buses, which would affect pre-trends across the groups. Including the spline controls improves the pre-trends and makes the interpretation of post-reform coefficients more credible. We also exclude inspections conducted less than one month apart, as these typically represent follow-up technical checks rather than independent observations and could bias the results. Further, we restrict the sample to mileage changes below 1,000 kilometers per day (approximately the 98th percentile) to reduce the influence of extreme outliers. Descriptive statistics for the mileage data are reported in Table A.4 in Appendix A.

and we follow a fixed set of vehicles that typically accumulate fewer kilometers as they age. Panel (a) of Figure 7 shows that the pre-trends for taxis and busses are parallel, and that there is no immediate change in daily average mileage after the reform. However, the post-2019 estimates reveal a mild and gradual downward trend, suggesting that on average taxi vehicles gradually accumulate fewer kilometers relative to buses.

In the pooled DiD analysis for mileage using January 2016–June 2018 as the pre-period and July 2018–December 2019 as the post-period, the estimated coefficient is –0.011 (SE 0.022). This confirms that there is no statistically significant change in taxi mileage relative to bus mileage after the reform, consistent with the interpretation that any adjustment in mileage is modest, especially when contrasted with the sharp changes observed in monthly VAT reporting at the time of the reform (Figure 5).

When interpreting this decline in mileage, it is important to account for our earlier findings showing a relatively rapid and substantial increase in average prices (Figure 3) and a sharp rise in the number of taxi firms (Figures 1 and 2). Together, these patterns reflect reduced demand *per vehicle*, but the overall market demand may remain unchanged or even increase due to the larger number of taxi firms. As a result, mileage is informative about utilization intensity per vehicle rather than total market demand.

Estimating the price elasticity of demand for taxi rides is challenging with the data available. Ideally, this would require ride-level information on both prices and quantities. Because we cannot link provider-level prices to vehicle- or firm-level mileage, we approximate demand responses using average changes in mileage and variable costs as proxies for quantities, combined with average CPI changes as a proxy for price variation. The post-reform DiD estimates imply changes of -0.019 (SE 0.027) for variable costs and -0.011 (SE 0.022) for mileage, while the corresponding estimate for prices is 0.063. Combining these estimates yields implied price elasticities of demand of approximately -0.30 and -0.17, respectively, suggesting relatively inelastic demand for taxi services. These elasticity estimates should be interpreted with caution. Beyond the measurement limitations discussed above, they do not

capture broader market adjustments following deregulation, such as increased entry of taxi providers, changes in average trip length, shifts in taxi availability across times of day, days of the week, and seasons, or other potential changes in quality. Such margins are likely to affect both pricing and demand that may not be adequately captured by the aggregate price and mileage measures available in our data. Taken together, our estimates are yet indicative of relatively inelastic demand for taxi rides. Section 6 provides a more detailed discussion of the tax revenue and aggregate demand implications of the reform.

Annual reporting. We provide supplementary evidence on the development of firm performance and tax reporting from an alternative data source, annual financial statement data from Statistics Finland. To estimate the changes in yearly firm-level financial statement variables, we use the same type of analysis as presented above for monthly outcomes. In these analyses, we use the time period 2015–2019 to allow us to evaluate a longer pre-trend across industries, and when conducting graphical analysis we make comparisons relative to year 2017. However, as the reform took place in July 2018, year 2019 is the first and only full post-reform year that we can credibly examine in this annual level analysis due to the COVID-19 pandemic.[23] The left panels of Figure 8 show the development of sales, taxable profits and labor costs relative to 2017 by year and group, and the right panels plot the corresponding DiD estimates with 95% confidence intervals for each outcome. These figures again show that the pre-trends across industries in all three outcomes are very similar, lending further support to our empirical approach. The message from these analyses is also very similar to the findings we obtained using VAT data: there is a clear decrease in annual reported sales. We further find that in the annual financial statement data, both taxable profits and annual labor costs also seem to decrease after the reform.[24]

To make the comparisons to our baseline results using monthly data easier, Table 4

[23]Table A.5 in Appendix A shows the descriptive statistics for the annual financial statement data.

[24]Note that the latter finding does not necessarily contradict the finding of no clear decline in labor costs based on the payroll tax data, as the data sources are different. Here the data comes from annual financial statements, whereas the payroll tax data is based on separate monthly reports by the firms.

collects the pooled DiD estimates using the annual financial statement data. As the reform is in the middle of year 2018, we exclude that year from the analysis and use 2015–2017 as a pre-period and compare that to year 2019 only available full year after the new legislation is fully implemented. We find an approximately 12 log point reduction in annual reported sales after the reform, which is very similar to the effect found in the VAT data (12 log points). Average labor costs and taxable profits have decreased by approximately 11 and 26 log points, respectively. This suggests that our key results are robust to using this alternative data source, although the response in labor costs is larger in absolute terms in the annual data compared to the one observed in the monthly payroll tax data. As the taxable income often has negative or zero values, we also estimate the pooled DiD for taxable profits in euros. The fourth column of Table 4 shows that the point estimate is -1800 euros and that the estimate is not statistically significantly different from zero. However, the size of the point estimate is rather well in line with the results using the log transformation.[25]

A key question for understanding the results is whether they can be explained by real responses – e.g. a reduction in demand – or a reporting response i.e. an increase in tax evasion. As a summary, our findings imply a substantial decline in average sales and VAT payments, but no change in monthly variable costs, labor costs or mileage after the reform. Together, our results indicate that the most likely driver of the sales and VAT decline is a reporting response rather than a real response: firm sales are a product of the price of services times the quantity of produced services, and for real sales to decline, either average prices or quantity should have declined after the reform. However, it is clear from Section 4.2 that average prices did not decline. Further, as average variable costs or labor costs did not decline, it is unlikely that average demand significantly decreased after the

[25]Our results are robust to using long-haul bus firms only as an alternative control group. Appendix A Figures A.3 and A.4 present these results following the same empirical approach as in our baseline specification. The results are very similar to those presented in Figures 5 and 6. Further, Appendix A Tables A.6 and A.7 present the descriptive statistics using only long-haul bus firms as the control group, whereas A.8 and A.9 present the DiD estimates based on monthly tax data and annual financial statement data using only long-haul bus firms as the control group. These tables confirm that the results are robust to excluding local bus firms from the control group.

reform either. Therefore, the decline in average sales and VAT payments is likely due to a reporting response, i.e. an increase in tax evasion after the reform. The results we obtained using financial statement data, regarding the reporting of profits, similarly show a decline in reported average profits. These findings together indicate a story of consistent misreporting reflected in the different reporting obligations of the firm.

4.4 Heterogeneity Analysis

We study potential heterogeneity in the effects of the reform by area (large vs. small municipalities), by firm size, and by incumbency status (whether the firm was in operation at the end of 2017). We do this analysis as responses might vary by these characteristics, for example, because of different demand conditions in large vs. small municipalities; or due to different opportunities for tax evasion in firms of different size (see e.g. Kleven et al., 2016). Providing separate estimates for incumbents only allows us to examine whether the effects we found are due to selection, i.e. entrant firms being different from incumbent firms.

We first compare responses between large and small municipalities by applying a triple difference approach. Table A.10 in Appendix A presents the DiD-estimates interacted with a city size dummy that is one for the cities that have more than 100,000 inhabitants, and zero otherwise. The results show that the reduction in average sales and VAT payments among taxi firms has been especially large in these larger cities compared to other areas. Interestingly, average wages have also decreased statistically significantly in large cities, but not in other areas. A potential explanation for these findings is that the larger decline in reported sales in large cities may have been a mixture of a reporting response – which we have argued to have been the main driver of the overall effects we found – and a real response in these areas; recall also that prices increased more in the capital region than in other areas.[26]

To study the heterogeneity of the responses by firm size, we divide the firms into two

[26]Alternatively, a decline in reported average wages may be an indication of a more sophisticated evasion response, where the decline in reported sales and VAT is matched with a decline in reported costs, to show an overall and consistent decline in the scale of operation. For evidence of this type of an evasion strategy used by firms more generally, see Harju et al., 2025.

groups by the median of sales one year before the reform. We then apply a similar triple difference approach as above, such that the big firm indicator is one for firms with above-median sales, and zero otherwise. The results are presented in Table A.11 in Appendix A. There seems to be no clear heterogeneity in the effects of the reform by firm size in any of our main outcomes.[27]

Figure A.5 in the Appendix presents a more granular analysis of how sales and variable costs are correlated before and after the reform for the taxi and bus industries. The idea is that a reduction in sales without a corresponding reduction in variable costs may be an indication of under-reporting of sales, though this type of evidence is only suggestive. In this analysis, the firms are divided into 20 equally sized bins within each sector, and the average sales and variable costs are calculated within each bin. The figure shows that after the reform, small firms in the taxi industry report systematically less sales, on average, in comparison to inputs. This provides suggestive evidence that under-reporting of sales may be more prevalent among small firms.

One potential channel for heterogeneous responses could be due to the fact that a sizable fraction of taxi rides are publicly funded in Finland, and the share of publicly funded rides varies by region. In addition, the reform involved changes to public procurement rules, which could have led to price changes for publicly funded taxi rides. Using data provided by the Social Insurance Institution of Finland (Kela), we first document a modest price decline for publicly funded taxi rides in the first years after the reform, see Figure A.6 in Appendix A. We then show that the share of publicly-funded rides is smaller in those regions where we find the largest reductions in VAT payments in response to the reform, see Figure A.7 in Appendix A. Based on this evidence, it is very unlikely that the changes in the prices of publicly funded rides would be an important driver behind our main results.

Finally, let us examine whether the results change if we analyze incumbent firms only.

[27]Further, our baseline difference-in-difference results are qualitatively unaffected if we run the analysis with firm-level pre-reform (log) sales as weights, see Table A.12 in Appendix A. This further suggests that there are no major differences in the responses to the reform across the firm size distribution.

In Section 4.1, we already provided evidence that the reform lead to a notable increase in entry into the taxi industry, and an interesting question is whether some of the effects we find may be due to selection, i.e., entrant firms being different from incumbents. However, the results of this analysis indicate that our findings are not driven by this type of selection. Table A.13 shows our main results for incumbent firms only. The results are very similar to the baseline results reported in Table 3. This is not surprising, given that despite the increase in entry rates, the large majority of firms in the sample are incumbent firms.

5 Effects on Criminal Offenses

In credence goods markets such as the taxi market, consumer trust is essential for efficient market functioning, making crime outcomes an important complement to traditional measures of market performance. In this section, we examine whether the reform lead to an increase in suspected criminal offenses by taxi drivers. As explained above, the reform implied less stringent regulation of entry, and accordingly caused a significant increase in entry into the taxi industry. In particular, the regulation of entry became slightly more lenient also in terms of the criminal history of taxi traffic permit holders. The reform was followed by press reports of increased suspected criminal activity by taxi drivers[28], and anecdotal evidence suggests that feelings of insecurity among customers may have increased after the reform. We examine whether such impressions are supported by administrative records on criminal activity. This analysis is of particular interest in our context, as trust is a crucial feature for the efficient functioning of credence goods markets.

Figure 9 shows the number of suspected criminal offenses divided by the number of taxi drivers over six-month periods before and after the reform, for all crimes and separately for three different crime categories. Panel (a) of Figure 9 does not show any increase in the overall crime rate right after the reform. This measure is driven by traffic violations, as 78% of all criminal offenses in our data are these types of crimes, presented separately in Panel

[28]See, for example: https://yle.fi/a/3-12202410 (in Finnish)

(b). The crime rates relating to the less frequent crimes in Panels (c) and (d) of Figure 9 are more volatile, but do not indicate any clear increase in suspected crimes by taxi drivers after the reform compared to drivers in the bus industry.

The conclusions from the graphical analysis are supported by the results from a pooled difference-in-differences analysis with biannual data, reported in Table 5. We do not observe any effect on suspected total crimes, traffic offenses or violent crimes. The results indicate a small increase in the property crime rate. Note that property crimes include criminal procedures initiated by the Tax Administration against individuals due to tax evasion. An increase in these types of criminal charges is consistent with increased tax evasion in the taxi market. However, only the most serious cases of tax evasion lead to a criminal investigation, so not all cases of negligence with tax reporting would show up in the crime record data.

6 Discussion

Our analysis shows that the deregulation of the taxi industry resulted in higher average prices, together with a reduction in the value of average sales and VAT payments, but no clear indications of demand responses. Overall, the results suggest that the sharp and immediate decline in reported sales and VAT payments is most likely driven by a reporting response – an increase in tax evasion – rather than by a real response. Firm sales are the product of service prices and quantities sold, and for real sales to decline, either average prices or quantities would need to fall substantially immediately after the reform. Quantity adjustments are typically sluggish in the short run, and prices are often downward rigid, making such rapid real responses less plausible than changes in reporting behavior.

More importantly, the combination of price and demand developments after the reform is inconsistent with a decline in the true value of sales: average prices increased and demand did not decline according to input usage or separate mileage data. Therefore the decline in reported average sales most likely does not reflect a real change in average sales.[29] Rather,

[29]To be precise, $E(sales) = E(P*Q) = E(P)*E(Q)+COV(P,Q)$. Therefore the development of average

the observed decline in reported average sales and VAT likely indicates a reporting response i.e., an increase in tax evasion after the reform. This type of a response was likely facilitated by the reduction in monitoring opportunities and availability of third-party information, which has been shown to be important for maintaining a high level of tax compliance (e.g. Kleven et al. (2011)). Further, the increase in the share of independent contractors (small-business owners or self-employed individuals) in the market might make tax enforcement more difficult, a point raised for example by Alm (2021).

Furthermore, we construct a summary measure capturing the changes in VAT reporting caused by the reform, as illustrated in Figure 10. The figure shows the development of the estimated VAT tax deficit in the taxi industry before and after the reform. To construct this measure, we approximate the development of "true sales" (relative to July 2017) using information on the development of average prices, average mileage and the number of vehicles, three components that together reflect the market-level volume of sales for VAT reporting. The average price change is estimated using monthly comparisons between taxi and bus industries and the price index information presented in Figure 3. For mileage changes, we directly apply the DiD coefficients from panel (b) of Figure 7. Finally, changes in the number of vehicles are approximated using inspection data on monthly counts of inspected taxis and buses, again using a DiD strategy similarly to that applied above.

This proxy for true sales is then contrasted with the development of reported VAT-liable total sales in the taxi and bus industries. Reported sales reflect both changes in average firm-level sales, plotted in panel (b) of Figure 5, and changes in the number of firms filing VAT returns. Panel (a) of Figure 10 plots the estimated true sales and reported sales changes relative to July 2017 for the taxi industry. The gap between the two series provides an

sales can deviate from the development of the product of average price $\times$ average quantity, depending on how prices and quantity covary at the firm level after the reform. Before the reform, this covariance was approximately zero as all firms typically charged the same price corresponding to the price ceiling set by regulation. If the covariance were negative after the reform, this could contribute towards lower average sales after the reform. Unfortunately, we do not have price data at the firm level. Anecdotal evidence suggests that prominent incumbent firms charged higher prices after the reform than newly established firms, which would imply a positive covariance.

estimate of the change in the VAT deficit, which is shown directly in Panel (b) of Figure 10. The approximated VAT deficit widens sharply at the time of the reform, reaching roughly a 40% increase within six months and then stabilizing at that level. Note, however, that this VAT deficit does not capture the full tax revenue impact of the reform, as our analysis clearly suggested that the reform also reduced the income tax base which directly affects income tax revenues. Consequently, the total tax revenue losses are considerably larger than those reflected in the VAT deficit alone.

Our results therefore indicate that deregulation did not bring immediate benefits to consumers in the form of lower prices, albeit this was one of the key motivations for the reform. For a more comprehensive analysis of effects on consumer welfare, we would like to have an estimate of changes in service quality, most notably availability or waiting times, which is a crucial dimension of quality in the transport sector. While we do not have detailed data to measure changes in quality, our evidence clearly shows (see Panel (c) of Figure 2) that the entry of taxi service providers increased in many regions, notably in urban areas. This is likely to increase the availability of taxi services in particular locations and during particular hours, and thus increase service quality. However, despite extensive entry, evidence from surveys carried out by the regulatory agency Traficom suggests that consumers were not more satisfied with the availability of services after the reform (Traficom (2020)). It should be noted however that the majority of respondents in these surveys were over 50 years old, whereas we conjecture that younger customers would have been more likely to be able to take advantage of increased supply through newly launched taxi apps. Unfortunately, there are no data available on taxi waiting times before and after the reform, that would allow a formal analysis of the effects of the reform on this crucial dimension of service quality. Some post-reform survey data is available, showing that average waiting times were around 8 minutes in bigger towns but there was considerable variation, with average waiting times of up to 20 minutes in rural areas in 2022.[30]

[30]Traficom reports on the development of the taxi market (in Finnish): Traficom (2020) and https://tieto.traficom.fi/fi/tilastot/taksipalvelujen-saatavuus (last accessed 9 September 2024).

On the one hand, it is not entirely surprising that the reform did not lead to effective competition in the first years following the reform, given the informational problems associated with the taxi market. On the other hand, the reform also allowed the entry of new types of service providers, such as Uber, that one might expect to relax some of the traditional informational constraints that customers face (e.g. Liu et al. (2021)). Despite this, platform services have been found in other countries to be associated with higher prices especially at peak times (e.g. Hall et al. (2023)). In practice, the entry of these new types of operators in Finland has concentrated in large cities: Uber started operating in Helsinki in July 2018 and a similar provider, Yango, in November 2018. As for market share, Uber drivers accounted for a small fraction of all taxis with about 500 drivers in 2019, mostly in the capital region, while there were approximately 35 000 taxi drivers in Finland altogether (Oppegaard et al., 2020; Traficom, 2023). Complementary survey evidence indicates that after the reform in 2020, a rather low share of taxi users had a taxi app in their phone (10%) and a high share of customers still ordered taxi services by a phone call (50%), while hailing taxi rides consisted of more than 30% of all rides (Traficom, 2020). Nevertheless, experiences with the reform may be highly heterogeneous across consumers, with consumers who are more agile in utilizing new types of services potentially benefiting from new entry.[31]

One further point to note about the entry of Uber is that even though the individual Uber drivers are part of our data, as they are classified in the data as entrepreneurs in the taxi industry, the mother company Uber Suomi Ltd on the other hand is not included in our baseline VAT data, because its industry classification is not taxi services, but "other telecommunications services". As we cannot directly identify individual firms in the data, it is not possible to manually incorporate Uber Suomi into our main analysis. Therefore, that part of the value added created by Uber, that goes to the mother company and not to the individual drivers, is not incorporated in our estimates. This omission is very unlikely

[31] Jääskeläinen et al. (2023), for example, show, using price data collected from mobile applications, that the reform increased price dispersion and enabled consumers using these apps often to obtain better deals than before. Nevertheless, also the mobile app price data shows an increase in average prices, similar to the more general price index data used in our analysis.

to drive our results, as the annual sales of Uber Suomi Ltd amounted to approximately 1.3 million euros in both 2018 and 2019[32], which is negligible relative to aggregate sales in the taxi industry (approximately 1.1 billion euros) during the corresponding years.

In thinking about the broader implications of the reform, two further remarks are in order, one relating to aggregate market developments, and another to the longer-run effects of the reform. First, entry naturally has implications for aggregate market outcomes. Even if there was an increase in firm-level tax evasion as suggested by our results, this would be consistent with no change or an increase in aggregate VAT payments, given that there was an increase in the number of firms due to new entry. Figure A.8 in Appendix A shows the development of aggregate VAT payments in the taxi and bus industries and indeed, there was no significant change in aggregate VAT payments in the taxi industry caused by the reform. A simple difference-in-difference analysis confirms this: by using these aggregate monthly VAT payment measures across industries provide an estimate of 0.008 (SE 0.017). This result is simply a product of lower average VAT payments and a higher number of firms after the reform. However, analyzing firm-level responses is essential, as it shows that some VAT indeed goes uncollected after the reform, as indicated by our analysis of the development of the tax deficit shown in Figure 10 and discussed above. These effects on evasion would be hidden if we were to examine the development of aggregate VAT payments only. Our results also imply that the developments in aggregate VAT payments likely give an underestimate of market growth, as some VAT has likely been unreported, and the share of unreported VAT increased at the reform.

Second, our main results discussed above relate to the developments we observe over the first 1,5 years after the reform. In the longer term, it is possible that more intense competition develops if new entrants gain a stronger position in the market, for instance. An analysis of the long-run effects of policy reforms is typically difficult, as over time it becomes more and more likely that there may be multiple confounding factors (further

[32]Source: Orbis database

changes in legislation, changes in market conditions, etc.) that may affect the treatment and control groups differently, and there will be a weaker case for causal claims related to the original reform under study. In our case, a credible long-run analysis is in particular compromised by two major factors. First, the initial experiences with the reform spurred a series of further – albeit smaller – reforms to taxi market legislation. Second, and more importantly, the huge market shock caused by COVID-19, which essentially shut down the country from March-April 2020 onward for many months renders further analyses of market developments highly contentious.

To provide a descriptive analysis with the available data over a slightly longer post-reform period, Figure A.9 in the Appendix A presents the development of entry and exit rates, price indices, total crime rates, as well as average sales and the corresponding difference-in-difference estimates, with an extended study period up to the third quarter of year 2021 (depending on data availability for each outcome). The figure indicates a reduction in entry and an increase in exits during the COVID-period. A rather sharp increase in the price index in the taxi industry within a year after the deregulation seems to stabilize for the last 1,5 years we have data on. Crime rates clearly fell after the start of the pandemic.[33] Correspondingly, for sales, the DiD-estimates during the COVID-19 pandemic are statistically zero: there was a large drop in sales in both the taxi and bus sectors, as many people were confined to their homes when many workplaces, schools, etc. shut down due to restrictions introduced to slow down the spread of the pandemic. It is fascinating to document market developments during the COVID-period, but it is equally clear that an identification of long-run reform effects is compromised by this extraordinary shock.

[33]The decrease in crime rates might be also partly related to a change in legislation concerning traffic offenses. Starting from June 2020, minor traffic offenses are sanctioned by an administrative penalty. These offenses are no longer included in the crime records.

7 Conclusions

Our paper fills a gap in the literature on taxi markets and the regulation of service industries characterized by asymmetric information, by providing a comprehensive analysis of the causal effects of deregulation on key market outcomes, using exceptionally rich Finnish administrative data. The reform removed geographical entry restrictions, abolished the previous price cap regulation, and also loosened certain dimensions of quality control and monitoring in the industry. Simultaneously, the reform allowed the entry of new platform-based operators such as Uber into the taxi market.

Our key findings are two-fold. First, our analysis reveals quite remarkable and immediate changes in the structure of the taxi market, as many incumbent firms in the industry quit and new businesses start. Overall, there is a large increase in net entry after the reform. Despite these developments, average prices did not decline. This finding is consistent with the common rationale for regulation of this industry, relating to problems of asymmetric information that hinder effective price competition.

Second, we find a notable decline in the average value of reported sales and VAT after the reform. Our rich data allows us to pinpoint the likely mechanism behind this finding: Given the development of prices, combined with small changes in demand as measured by operating costs or mileage driven, it is unlikely that the decline in reported VAT reflects a decline in the real value of sales. Hence this finding likely reflects a reporting response, i.e. an increase in tax evasion. Accordingly, our analysis of aggregate market developments indicates a considerable increase in the gap between estimated true sales and reported sales after the reform, which would contribute to a higher tax gap in the taxi industry. This interpretation is also consistent with our finding of a small increase in property crime in administrative records on reported crimes, while we find no effects on other types of criminal activity. A higher prevalence of illicit activity has particular relevance in a credence goods market based on trust between the customer and the provider.

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Figures

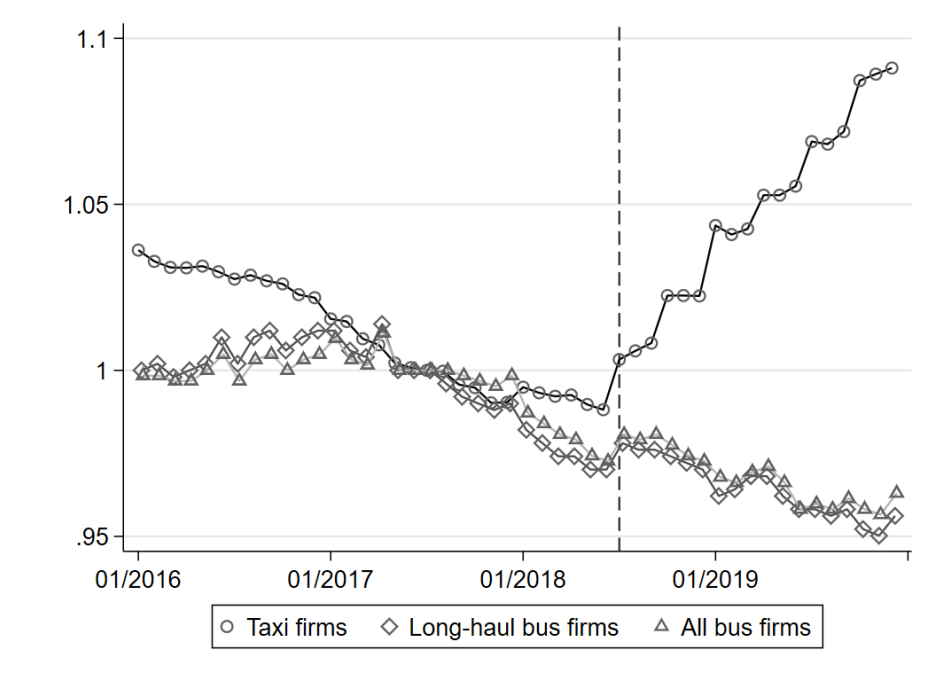


Figure 1: Indexed number of taxi and bus firms: VAT data

Notes: This figure illustrates the development in the number of taxi and bus firms, based on VAT data, indexed to 1 in July 2017. The dashed vertical lines mark the timing of the reform.

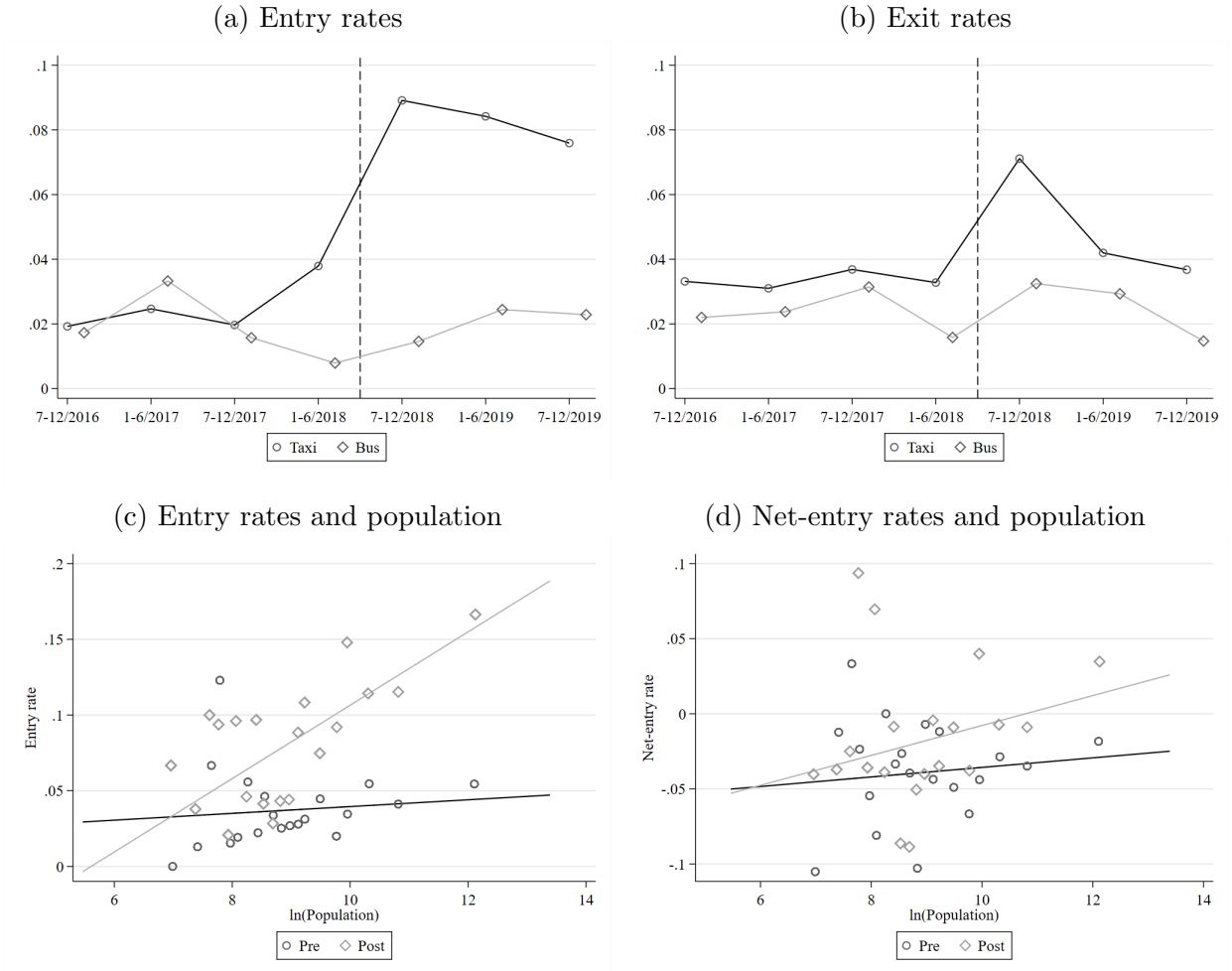
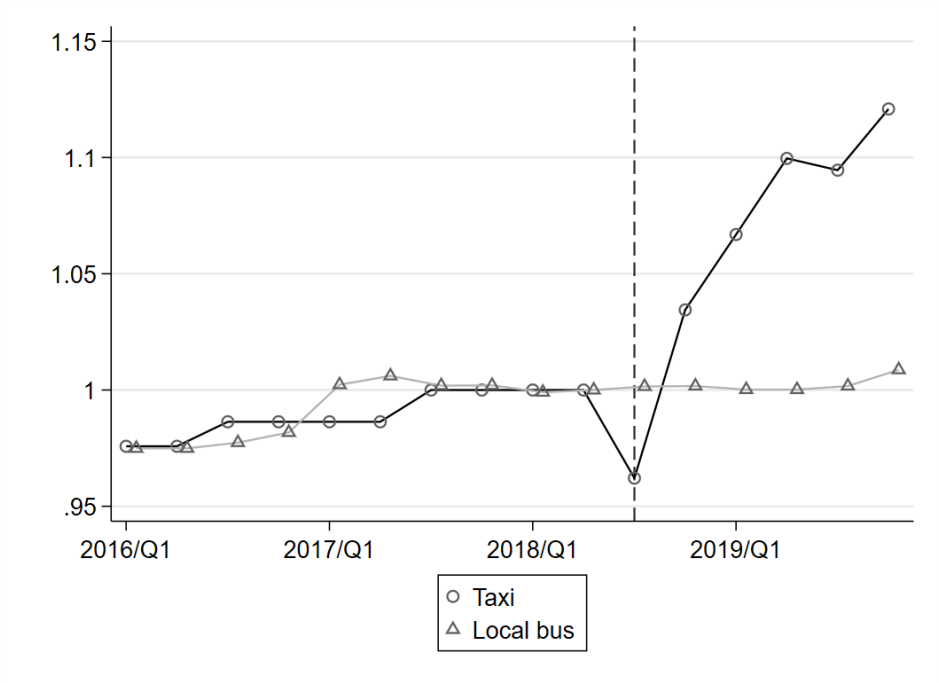


Figure 2: Entry and exit rates

Notes: Panel (a) of this figure shows the entry rates to the taxi and bus industries. Panel (b) illustrates the corresponding exit rates for the two industries. Entry is defined as the first appearance of a firm in the VAT data. Exit is defined as the last appearance of a firm in the VAT data. The entry and exit rates are calculated by dividing the number of entries or exits within each half a year by the number of firms in the VAT data during the previous half-year period. The dashed vertical lines mark the timing of the reform in Panels (a) and (b). Panels (c) and (d) show the relationship between entry and net-entry rates to the taxi industry and the municipality-level population in a log scale one year before (Pre) and after the reform (Post) in 20 bins. The municipality-level entry rates are first calculated by dividing the total number of entries by the total number of existing taxi firms in a given municipality during a one-year interval before or after deregulation. The figure also illustrates linear slope between these two measures before and after deregulation, respectively.

(a) Price indices: CPI data



(b) Price indices: Traficom and CPI data

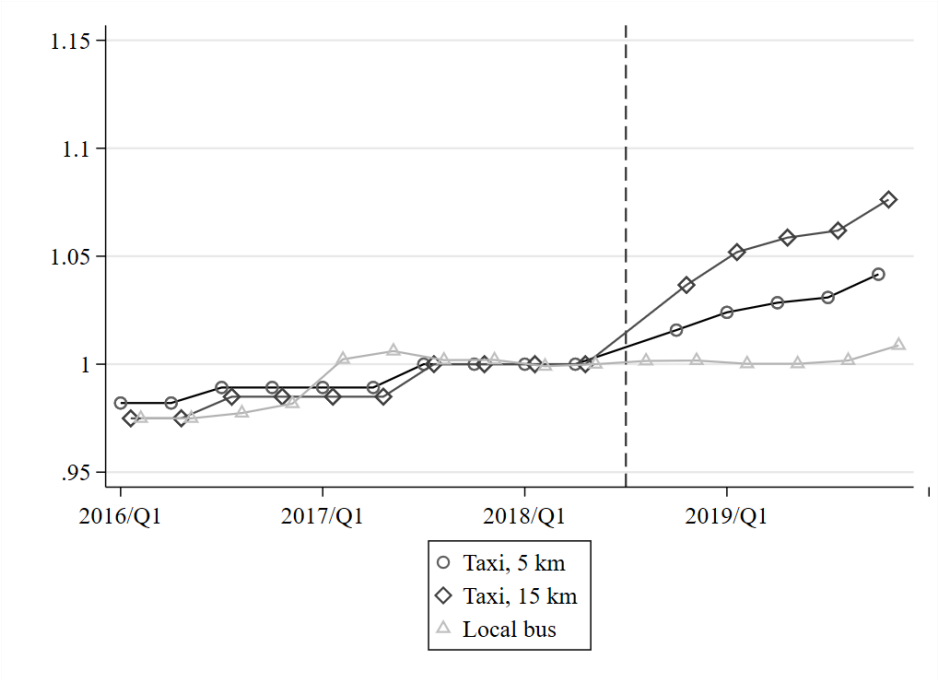


Figure 3: Taxi and local bus price indices

Notes: This figure shows the development of taxi ride price indices together with a price index for local bus tickets, both indexed to 1 for the quarter preceding the reform. Panel (a) presents the Consumer Price Indices (CPI) for taxi rides and local bus rides, obtained from the public database of Statistics Finland. Panel (b) shows the price indices for taxi rides, where the pre-reform data comes from Statistics Finland's CPI data, and the post-reform data is based on our own calculation using Traficom data. The dashed vertical lines mark the timing of the reform.

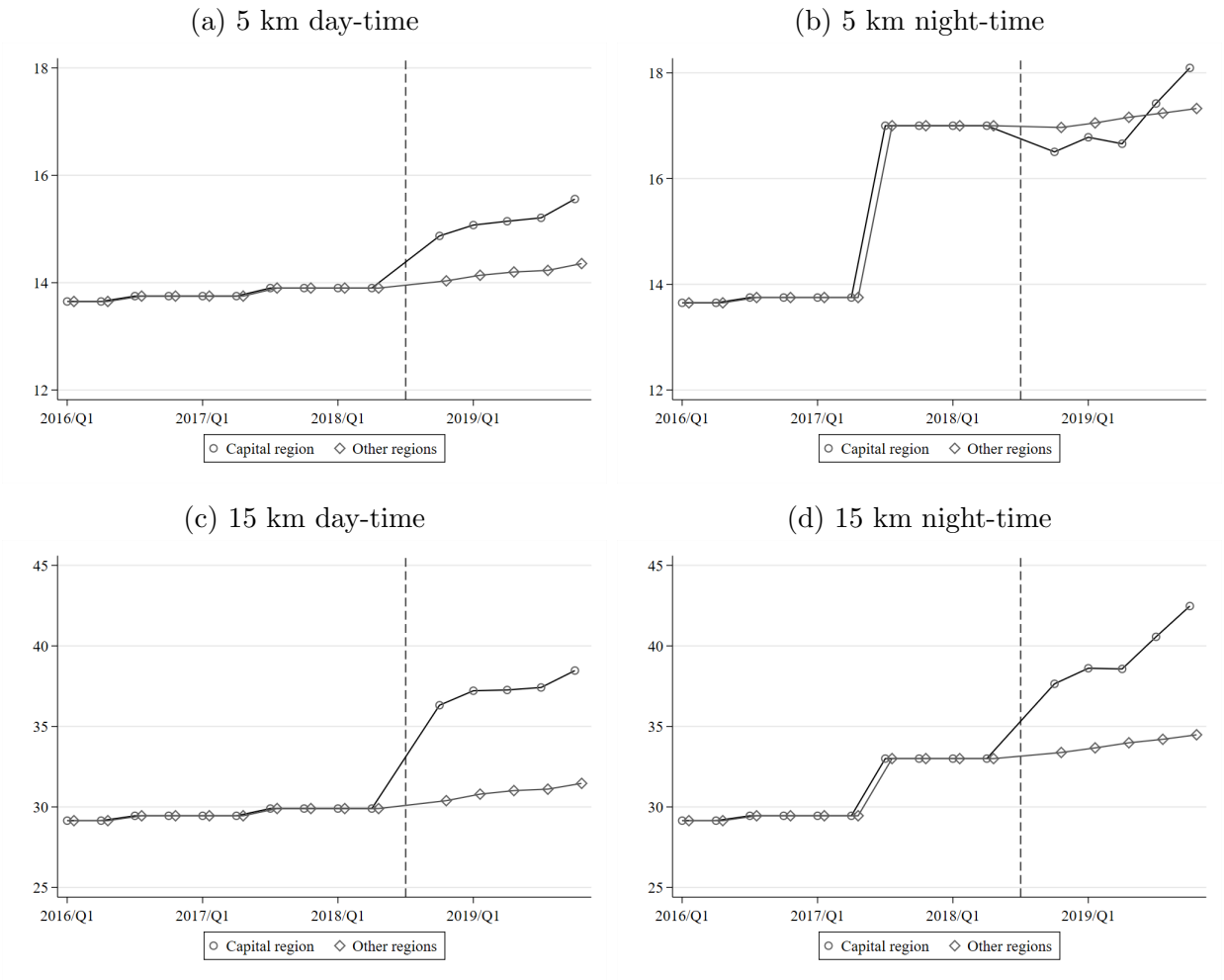


Figure 4: Taxi prices by region and distance over time, measured in euros

Notes: This figure shows the evolution of average prices for standard 5- and 15-kilometer taxi rides in the capital region and other areas in Finland over time, distinguishing between day- and nighttime rides. Panel (a) illustrates the average prices for a 5 km daytime ride, panel (b) for a 5 km nighttime ride, panel (c) for a 15 km daytime ride, and panel (d) for a 15 km nighttime ride. Prices on the y-axis are expressed in euros. For the pre-deregulation period, they are taken directly from CPI data, while for the post-deregulation period they are constructed using menu prices for standard 5- and 15-kilometer trips from Traficom. The dashed vertical lines mark the timing of the reform.

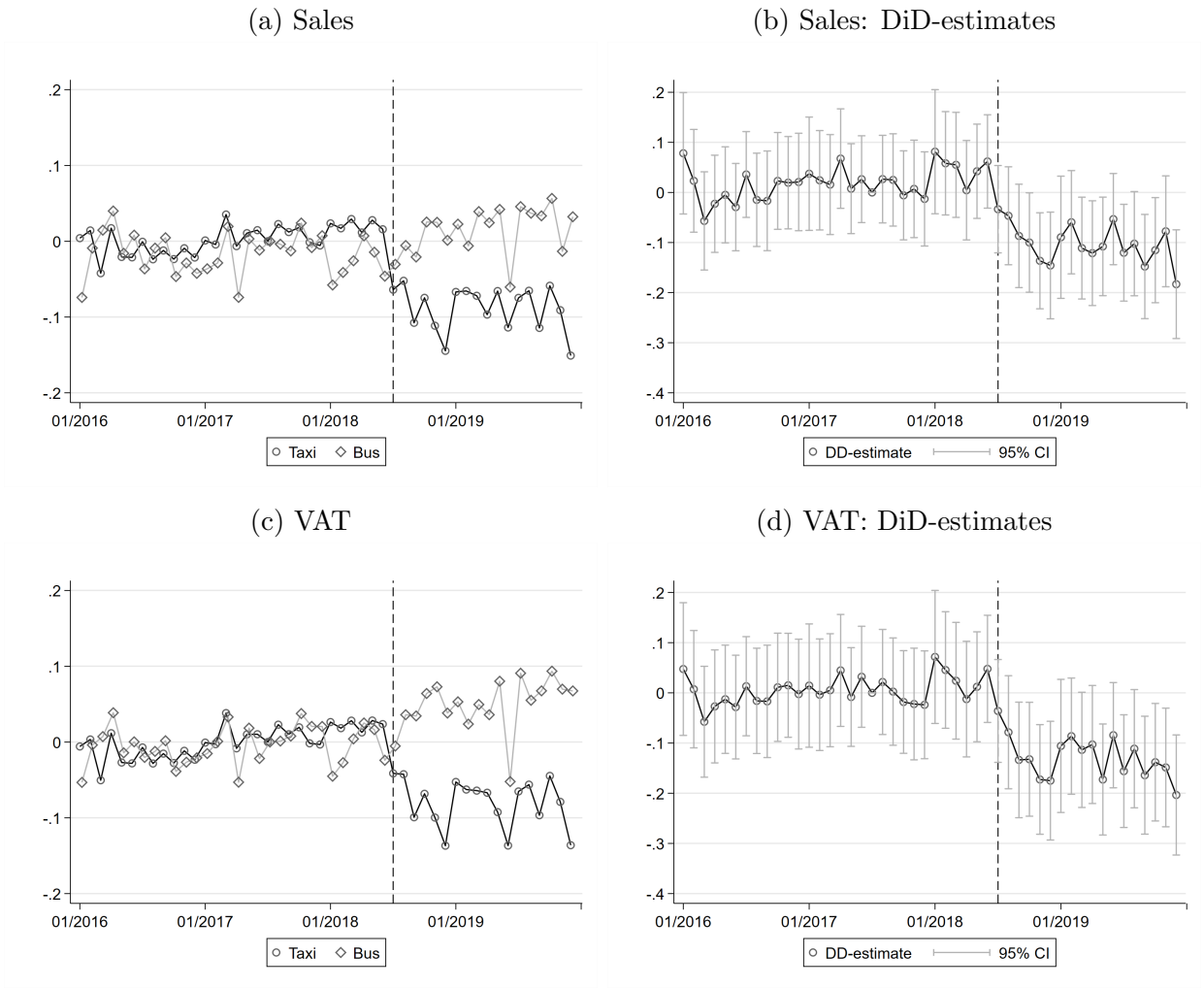
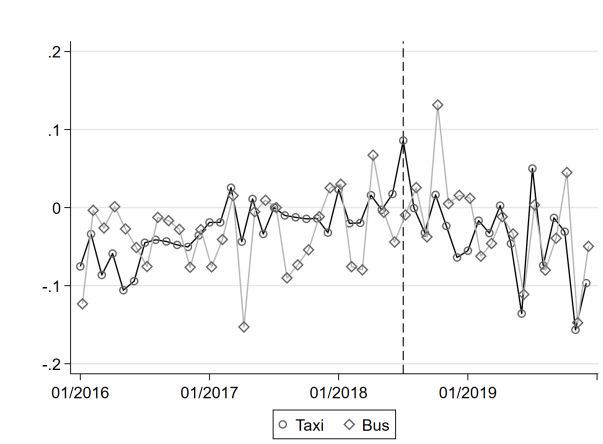


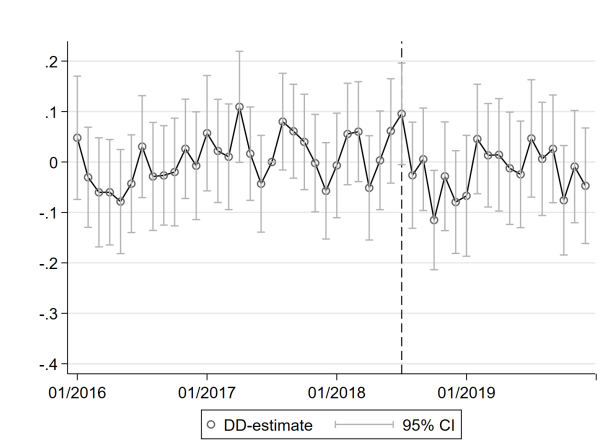
Figure 5: Sales and VAT payments over time

Notes: Panel (a) of this figure illustrates the seasonally adjusted development of average sales, relative to July 2017, for the taxi and bus industries. Panel (b) shows the corresponding difference-in-difference estimates from Equation (1). Panels (c) and (d) show the same results using reported VAT as an outcome variable. All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

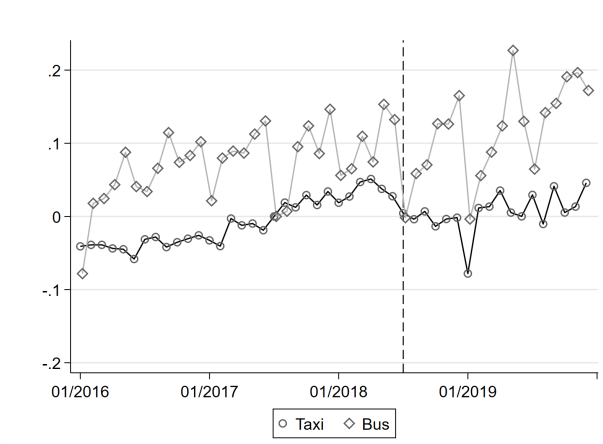
(a) Variable costs



(b) Variable costs: DiD-estimates



(c) Labor costs



(d) Labor costs: DiD-estimates

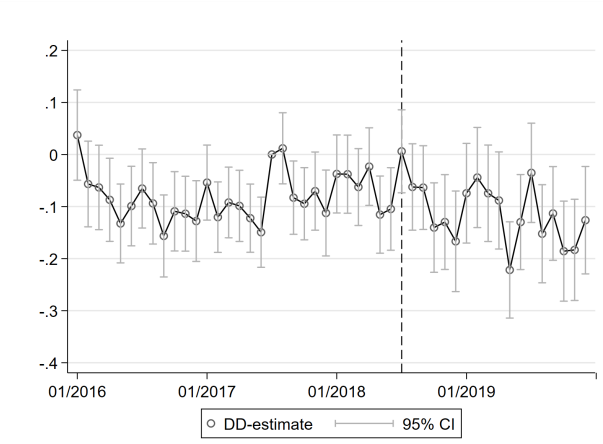
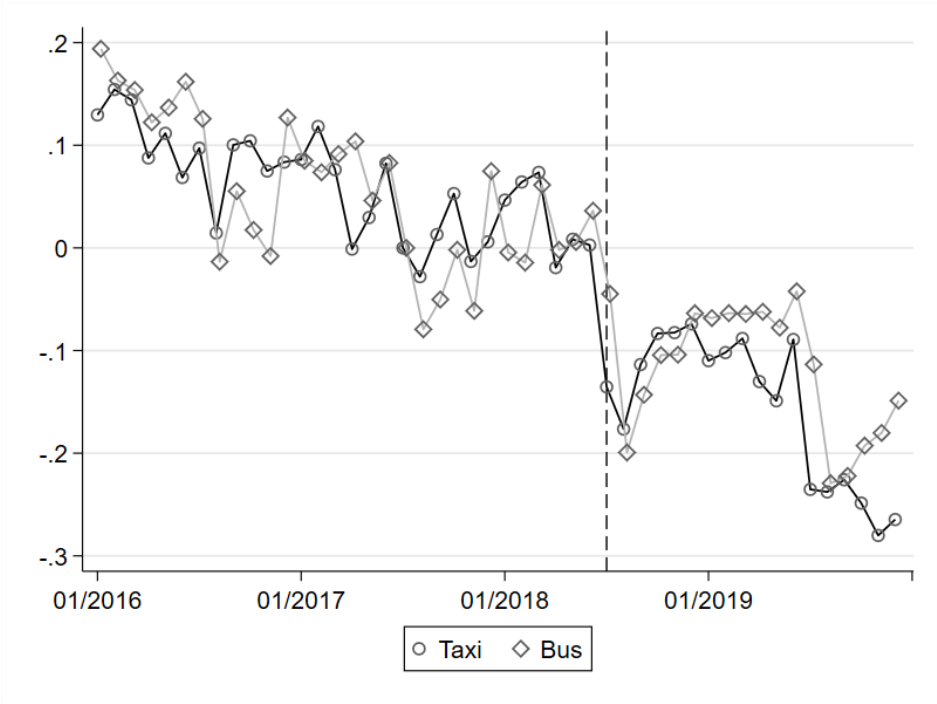


Figure 6: Labor costs and variable costs over time

Notes: Panel (a) of this figure shows the seasonally adjusted development of average variable costs, relative to July 2017, for the taxi and bus industries. Panel (b) plots the corresponding difference-in-difference estimates from Equation (1). Panels (c) and (d) show the corresponding results for average labor costs. All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

(a) Daily kilometers



(b) Daily kilometers: DiD-estimates

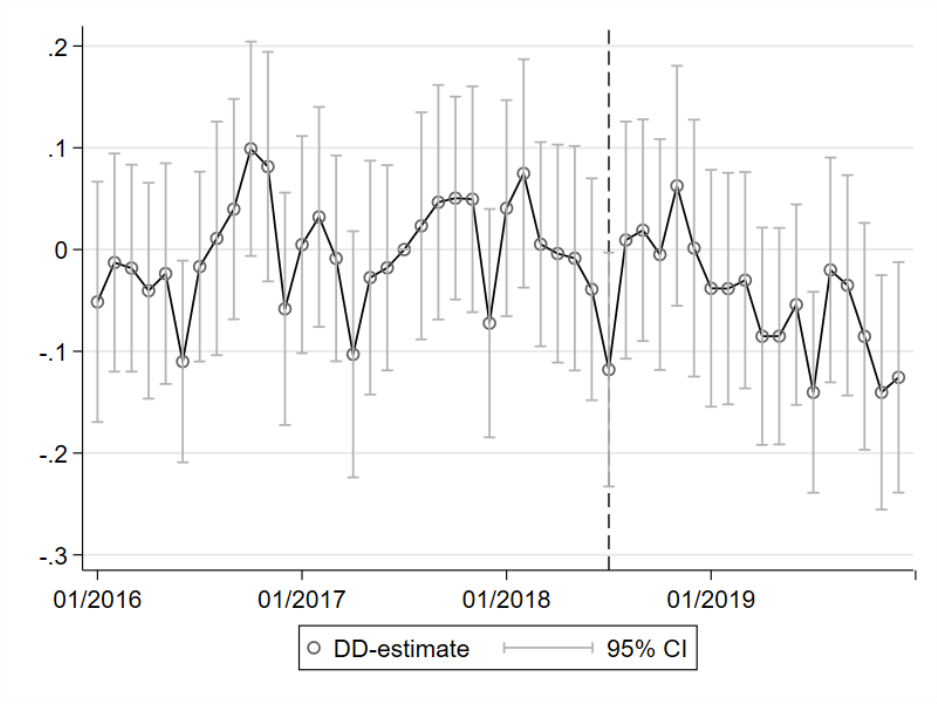


Figure 7: Average daily kilometers driven over time

Notes: Panel (a) of this figure shows the seasonally adjusted development of average daily kilometers driven, relative to July 2017, for the taxi and bus industries. Panel (b) plots the corresponding difference-in-difference estimates from cross-sectional difference-in-difference regression. The outcome variable is in logarithmic form, and the dashed vertical lines mark the timing of the reform.

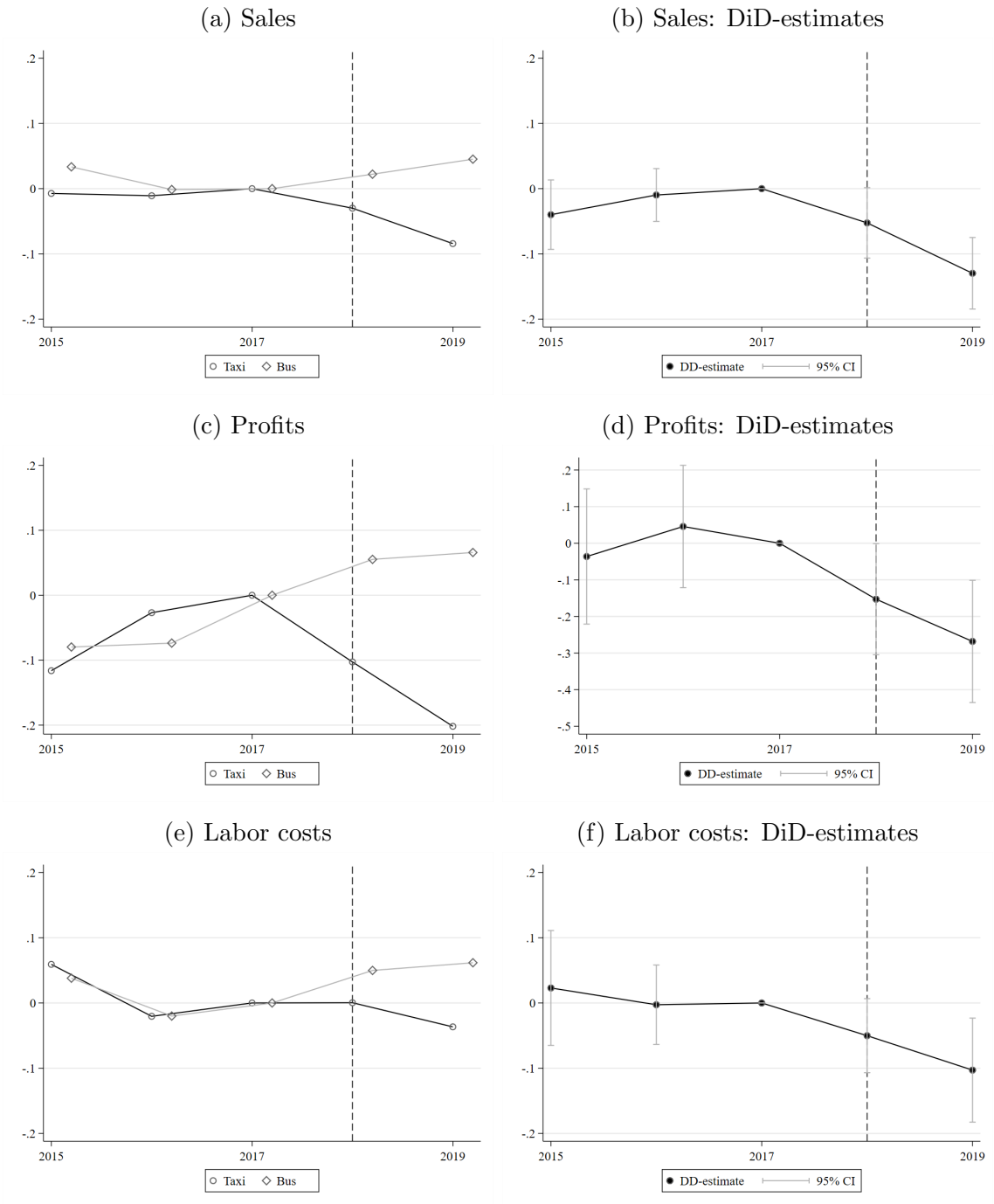


Figure 8: Annual sales, taxable profits and labor costs over time

Notes: Panel (a) of this figure illustrates the development of average sales relative to year 2017 for taxi and bus industries based on financial statement data. Panel (b) plots the corresponding difference-in-difference estimates. Panels (c) and (d) provide the corresponding results for profits, and panels (e) and (f) for labor costs. All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

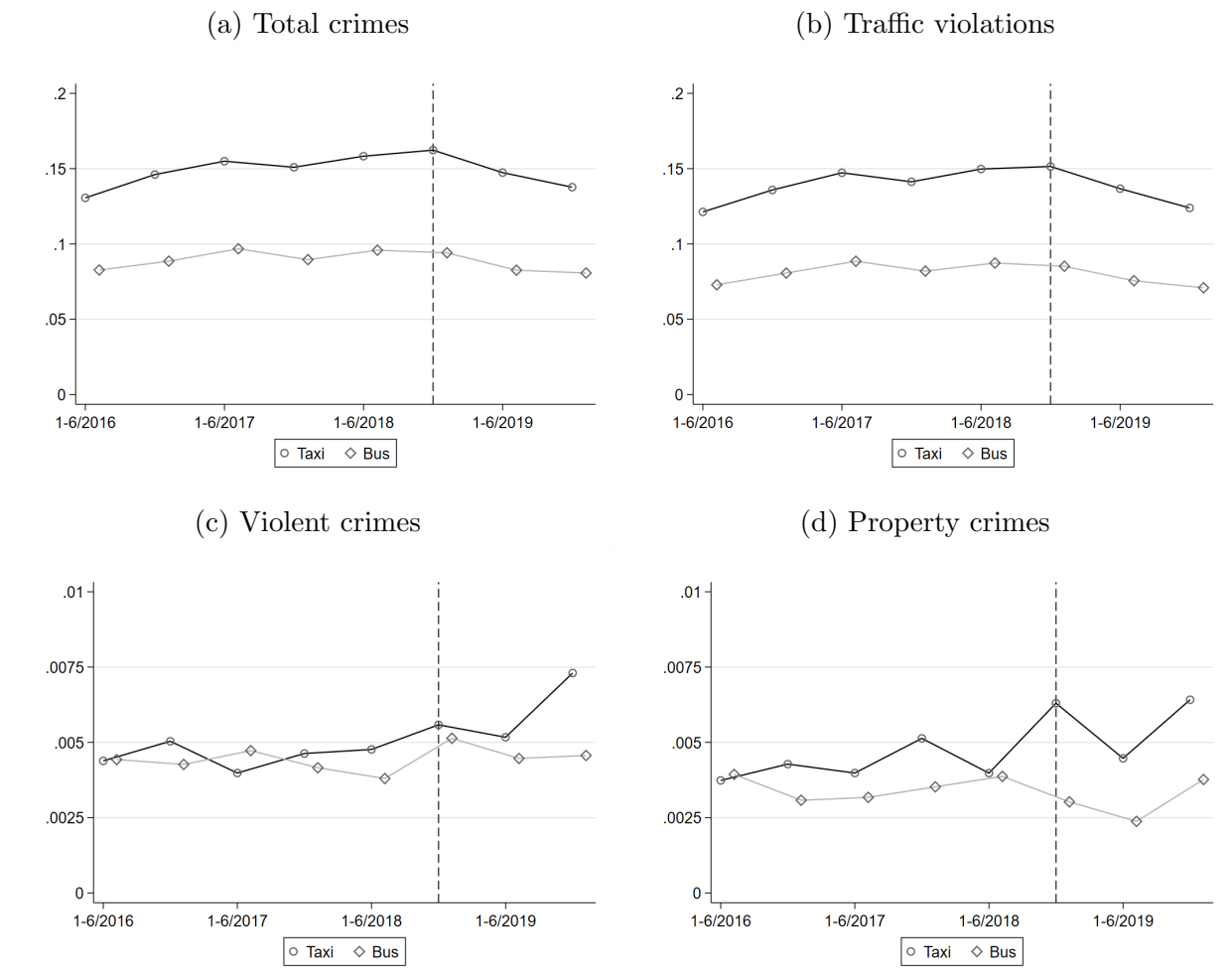
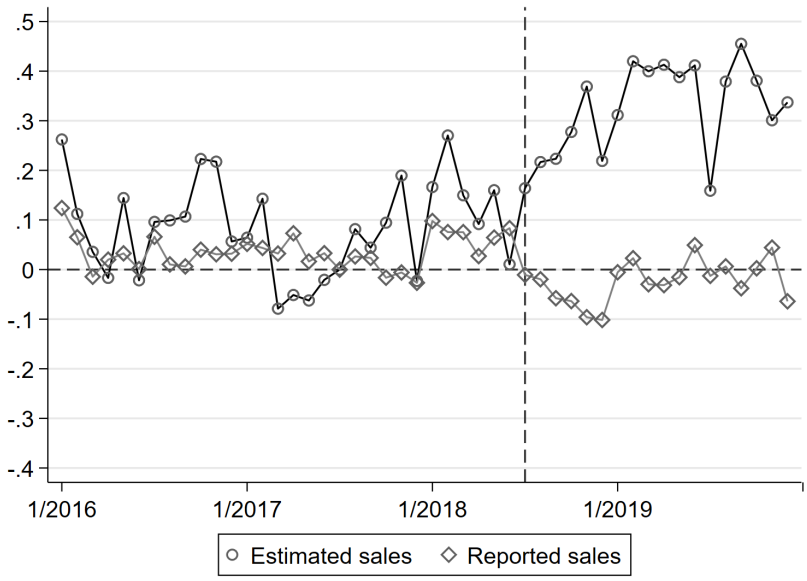


Figure 9: Suspected criminal offenses among workers and entrepreneurs in the taxi and bus industry

Notes: Panel (a) of this figure illustrates the development in the total number of suspected criminal offenses among individuals working in the taxi and bus industries, illustrated as a ratio of workers suspected of a crime and the total number of workers in each sector. Both the number of suspected criminal offenses and the number of individuals working in each sector are calculated on a biannual basis. The total number of suspected criminal offenses is broken down by traffic violations in Panel (b), violent crimes in Panel (c) and property crimes in Panel (d). The dashed vertical lines mark the timing of the reform.

(a) Estimated and reported sales relative to July 2017



(b) Difference between estimated sales and reported sales

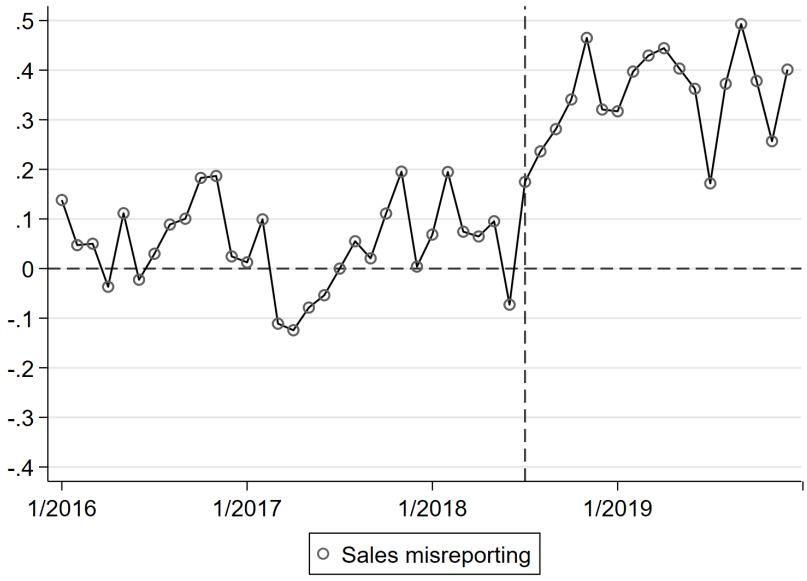


Figure 10: Estimated tax deficit over time

Notes: Panel (a) of this figure shows the development of estimated and reported sales relative to July 2017. Estimated sales relative to July 2017 is constructed as the sum of mileage DiD-coefficients from Figure 7 panel (b), price index DiD-coefficients based on Consumer Price Indices for taxi and bus rides, presented in panel (a) of Figure 3, and DiD-estimates for the total number of inspected taxi and bus vehicles. Reported sales relative to July 2017 is constructed as the sum of DiD-coefficients for sales, presented in panel (b) of Figure 5, and DiD-coefficients for the total number of firms in taxi and bus sectors. Panel (b) displays the estimated tax deficit, which is calculated as the difference between difference in estimated sales relative to July 2017, and difference in reported sales relative to July 2017, as VAT is directly given as a fraction of sales. The dashed line marks the timing of the reform.

Tables

Table 1: Descriptive statistics: VAT data

Variable	Taxi industry	Bus industry
	1/2016-6/2018	1/2016-6/2018
Sales	12 574	158 295
N	231 498	18 515
VAT	1 331	15 724
N	231 498	18 515
Labor costs	4 064	70 949
N	158 331	14 865
Variable costs	4 854	72 634
N	231 498	18 515
Number of firms	7 824	620

Notes: This table compares the averages and numbers of observations for the baseline monthly outcome variables, measured in euros, for taxi and bus industries during the pre-treatment period 1/2016-6/2018 using VAT data.

Table 2: DiD estimates: Exit and entry rates

	(1) Exit rate	(2) Entry rate
DiD estimate	0.014	0.056**
	(0.007)	(0.011)
N	14	14
7-12/2017 baseline rate (treatment)	0.037	0.020
7-12/2017 baseline rate (control)	0.031	0.016

Notes: This table shows the pooled difference-in-difference estimates using biannual exit and entry rate data illustrated in Panels (a) and (b) of Figure 2, comparing taxi and bus industries before (from July 2016 to June 2018) and after (July 2018 to June 2019) the reform. Entry is defined as the first appearance of a firm in the VAT data. Exit is defined as the last appearance of a firm in the VAT data. The entry and exit rates are calculated by dividing the number of entries or exits within each half a year by the number of firms in the VAT data during the previous half-year period. The baseline rates show the average exit and entry rates during the second half of 2017 separately for taxi and bus industries. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table 3: DiD estimates: VAT data

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
DiD: With Firm FEs				
	-0.121***	-0.134***	-0.029	-0.019
	(0.022)	(0.023)	(0.027)	(0.027)
DiD: Without Firm FEs				
	-0.202***	-0.231***	0.047	-0.001
	(0.034)	(0.034)	(0.038)	(0.037)
N	375 869	375 288	228 292	373 823
Number of firms	10 865	10 860	7 897	10 604
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	133 189	13 347	72 489	56 986
Jul 2017 average (control, in logs)	11.80	9.50	11.19	10.95

Notes: This table shows the pooled difference-in-difference estimates for the logs of the outcome variables with firm fixed effects: sales, VAT payments, labor costs and variable costs. All outcome variables are seasonally adjusted at the monthly level. The pooled pre-reform period is from January 2016 to June 2018 and the pooled post-reform period is from July 2018 to December 2019. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table 4: DiD estimates: Financial statement data

	(1) Sales	(2) Labor costs	(3) Taxable profit	(4) Taxable profit (€)
DiD estimate	-0.120***	-0.112*	-0.259**	-1800
	(0.029)	(0.044)	(0.080)	(1491)
N	32 881	24 592	29 082	33 123
Number of firms	10 652	8 637	10 209	10 727
2015-2017 average (treatment, euros)	140 105	33 519	23 066	22 626
2015-2017 average (treatment, in logs)	11.85	10.42	10.05	10.03
2015-2017 average (control, euros)	1 963 074	730 946	29 120	24 848
2015-2017 average (control, in logs)	14.49	13.50	10.28	10.12

Notes: This table shows the pooled difference-in-difference estimates for sales, labor costs and taxable profit using annual financial statement data with firm fixed effects. In the fourth column, we winsorize the taxable income variable at the 2% level. The pre-reform period in this analysis is 2015–2017 and the post-reform period is only 2019. Year 2018 is excluded from the analysis as the reform took place in July 2018. All variables are in logarithmic form, except for the last column, in which taxable profit is measured in euros. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table 5: DiD estimates: Probability of being suspected of committing a crime

	(1) Total crimes	(2) Traffic offenses	(3) Violent crimes	(4) Property crimes
DiD estimate	0.002	0.000	0.001	0.002***
	(0.003)	(0.002)	(0.001)	(0.001)
N	259 542	259 542	259 542	259 542
Number of drivers	49 400	49 400	49 400	49 400
7-12/2017 baseline rate (treatment)	0.151	0.141	0.005	0.005
7-12/2017 baseline rate (control)	0.090	0.082	0.004	0.004

Notes: This table shows the pooled difference-in-difference estimates for the probability of an individual being suspected of committing a crime using biannual data covering years 2016-2019, comparing drivers in taxi and bus industries. The outcome variable is a dummy that obtains value one if the person has committed a particular crime type, and zero otherwise. The post-deregulation period is from July 2018 to December 2019 and pre-deregulation period is from January 2016 to June 2018. Violent crimes include violent assaults and sexual crimes. Standard errors clustered at the individual level and asterisks denote significance levels 0.05, 0.01, and 0.001.

A Appendix: Additional Figures and Tables

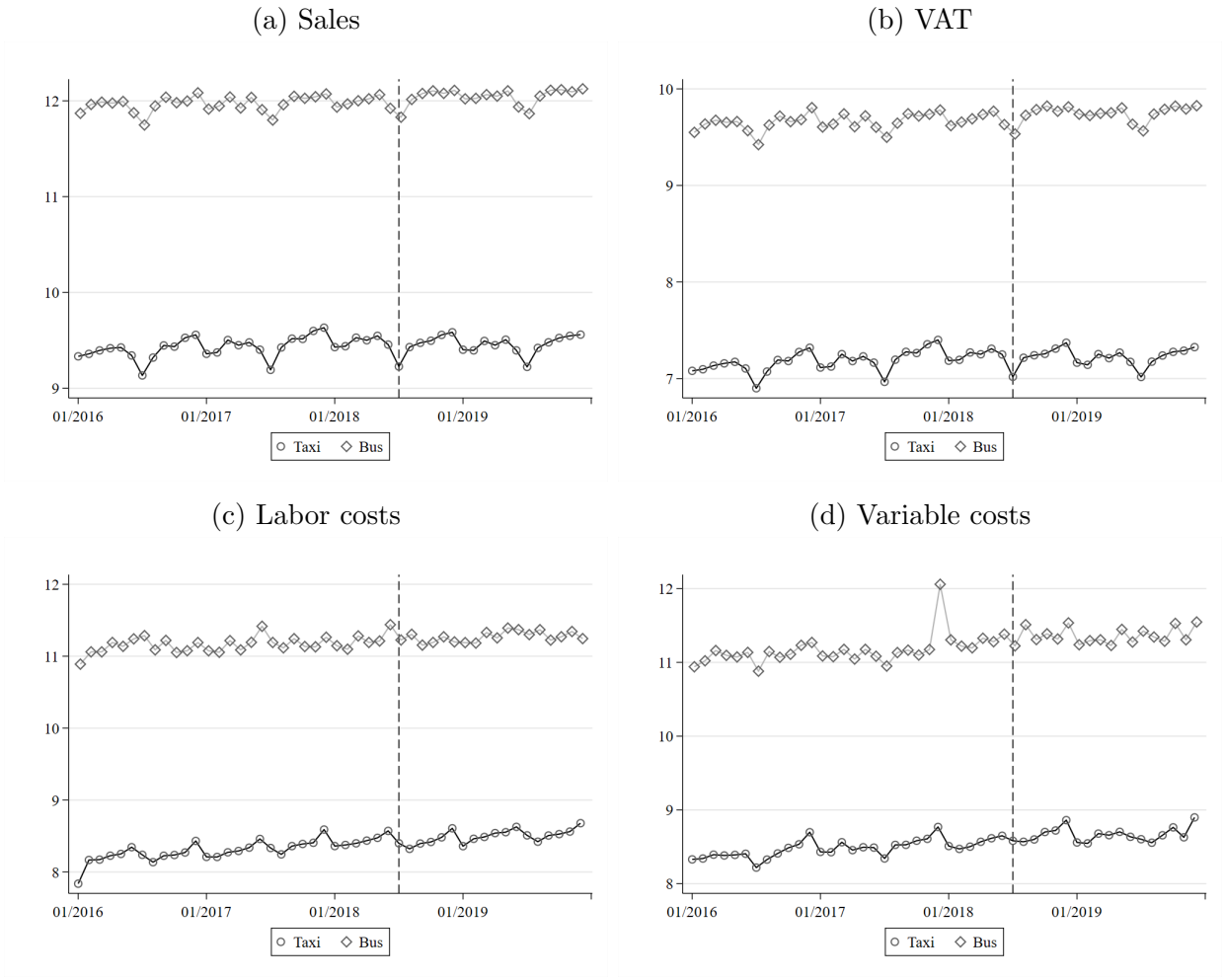


Figure A.1: Baseline outcomes in VAT data over time

Notes: This figure illustrates the development of average main outcome variables in levels using the monthly VAT data: sales in the panel (a), VAT-payments in panel (b), labor costs in panel (c), and variable costs in panel (d). All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

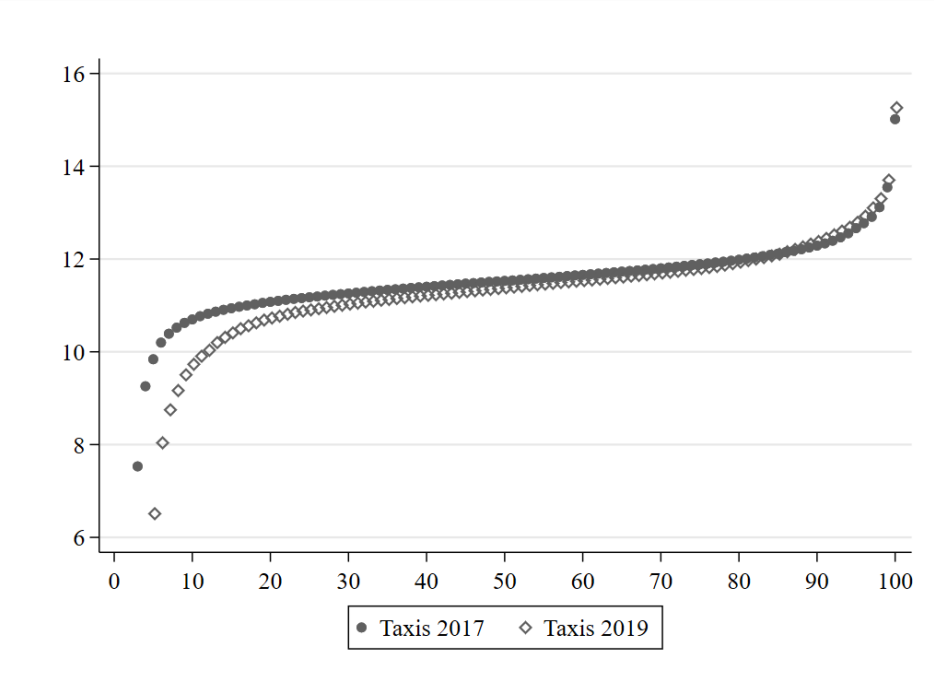


Figure A.2: Distribution of log sales in the taxi industry by 100 sales percentiles in 2017 and 2019

Notes: This figure displays the distribution of annual log sales for taxi industry in 2017 and 2019 separately by 100 sales percentiles. The VAT data in this analysis is restricted to those firms that are actively reporting VAT each month within a year.

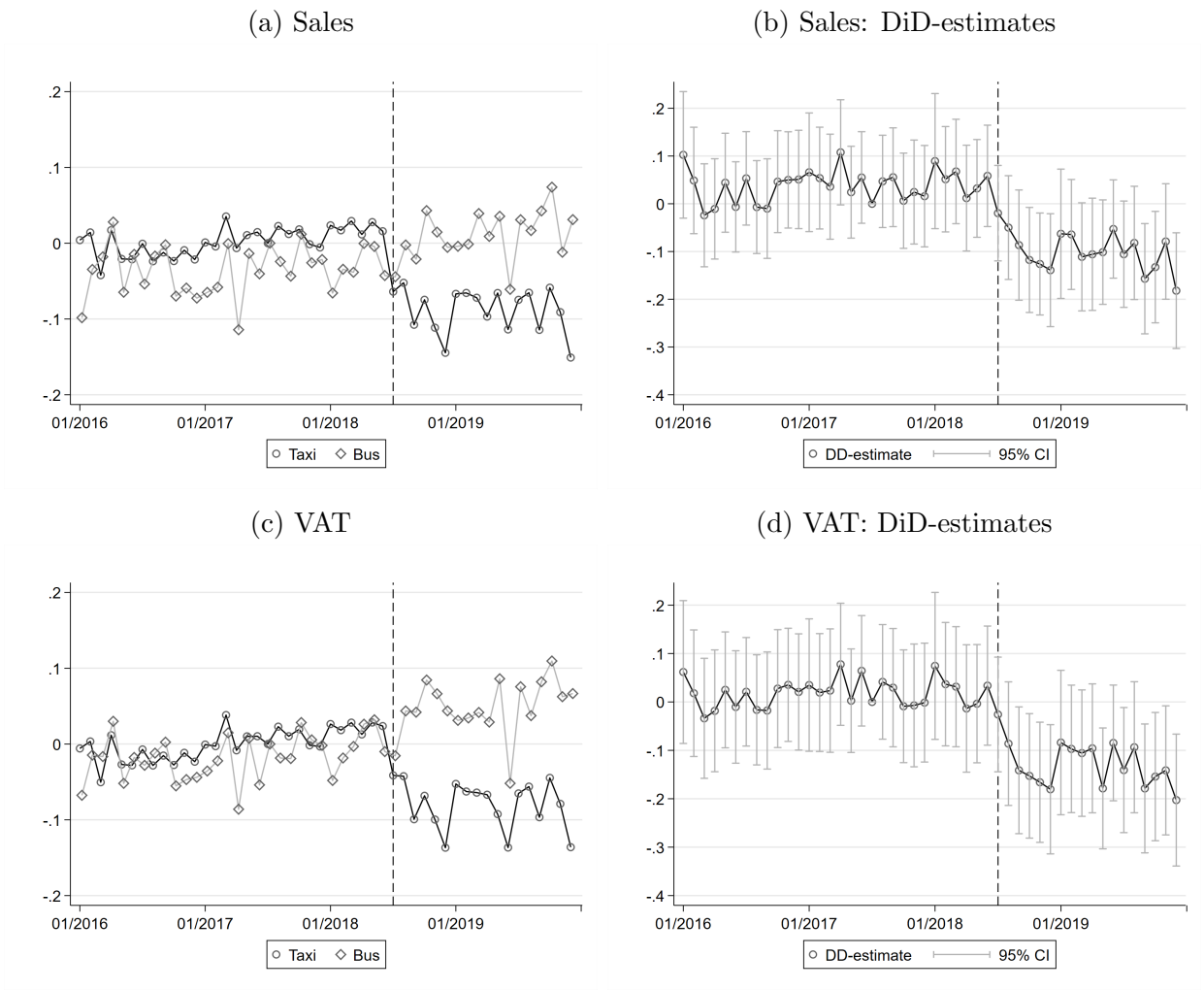


Figure A.3: Sales and VAT payments over time using long-haul buses as a control group

Notes: Panel (a) of this figure illustrates the seasonally adjusted development of average sales, relative to July 2017, for the taxi and long-haul bus industries. Panel (b) shows the corresponding difference-in-difference estimates from Equation (1). Panels (c) and (d) show the same results for using reported VAT as an outcome variable. All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

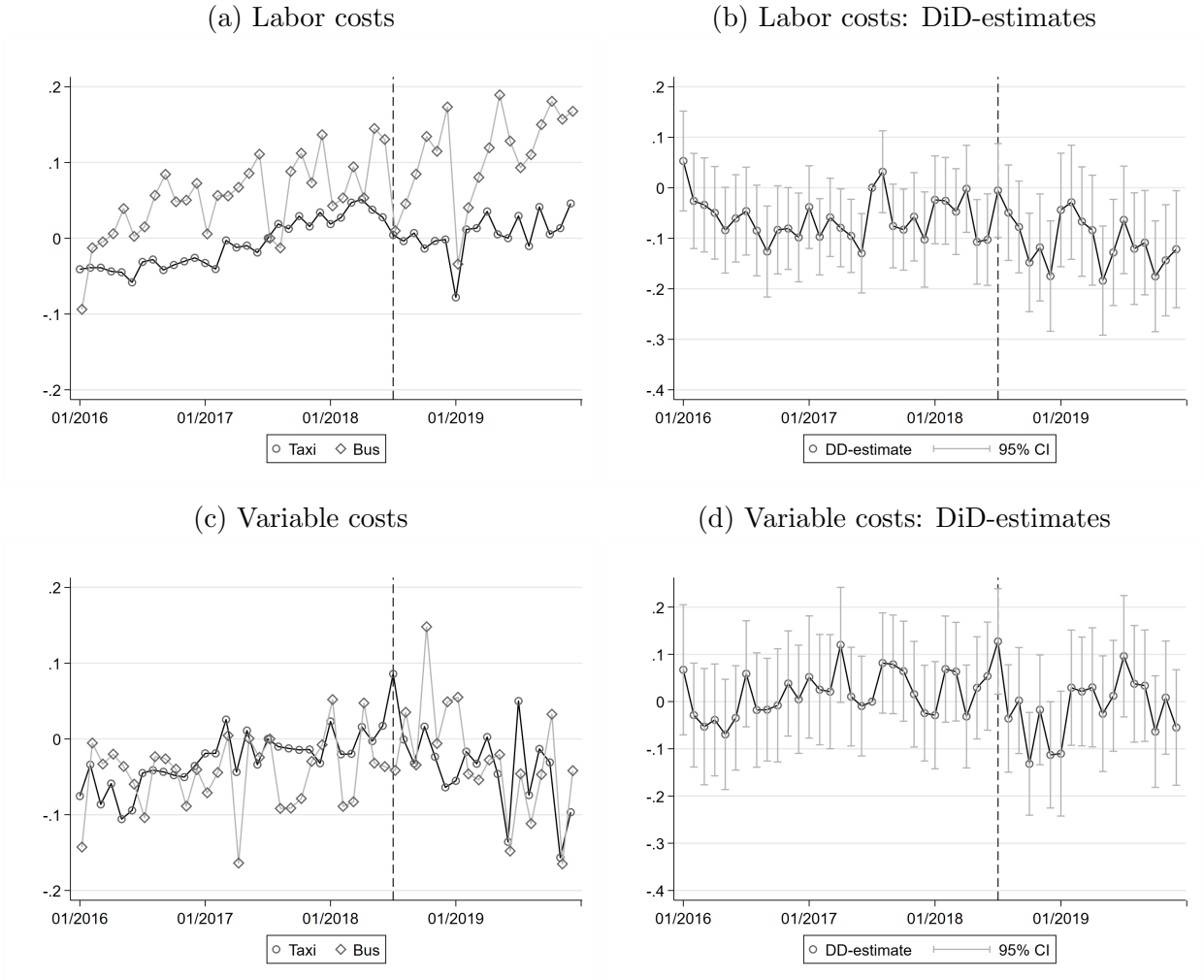
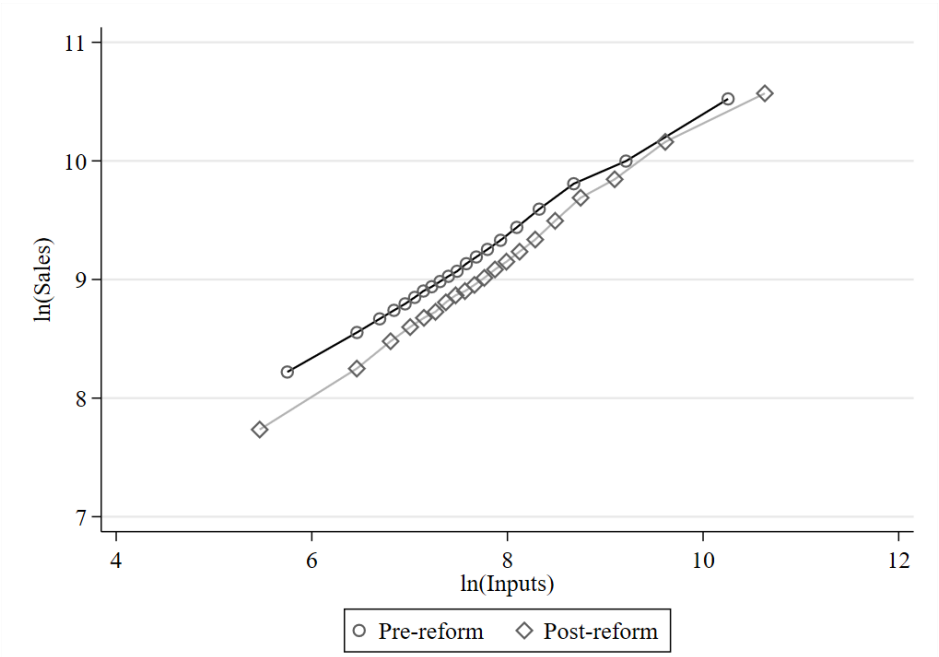


Figure A.4: Labor costs and variable costs over time using long-haul buses as a control group

Notes: Panel (a) of this figure shows the seasonally adjusted development of average labor costs, compared to July 2017, for the taxi and long-haul bus industries. Panel (b) plots the corresponding difference-in-difference estimates from Equation (1). Panels (c) and (d) show the results for average variable costs. All outcome variables are in logarithmic form. The dashed vertical lines mark the timing of the reform.

(a) Sales vs inputs, taxi sector



(b) Sales vs inputs, bus sector

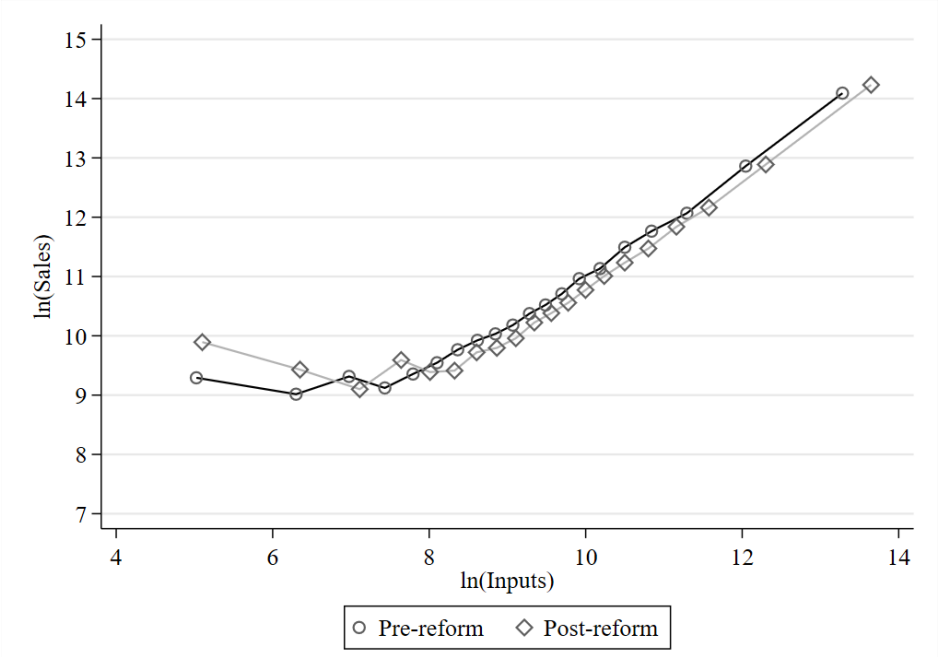
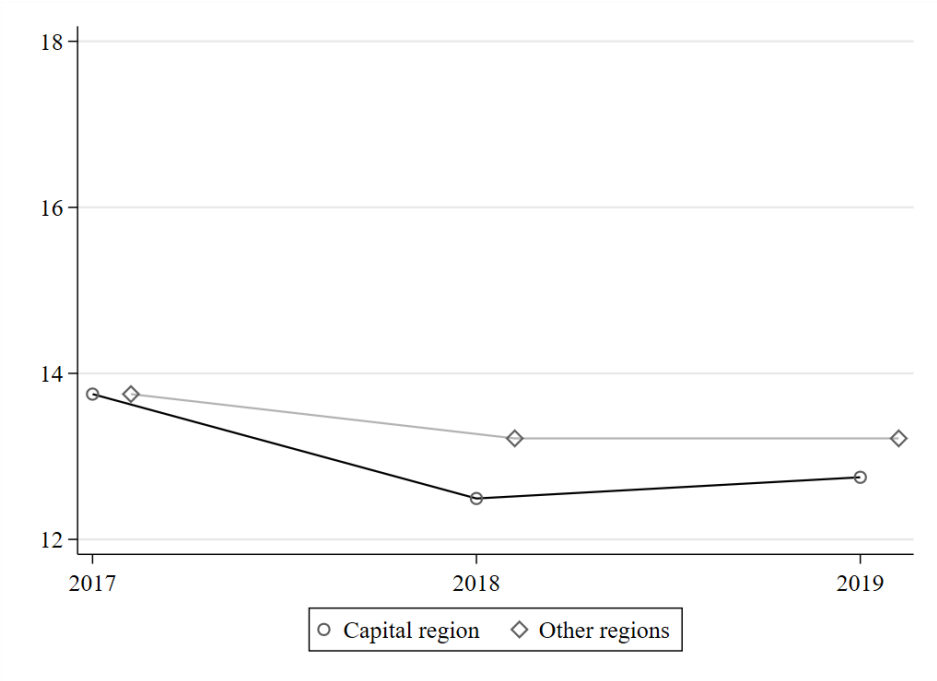


Figure A.5: Relationship between sales and inputs before and after the reform across industries

Notes: This figure displays the relationship between firms' average sales and inputs with 20 bins before and after the reform for taxi industry (Panel (a)) and bus industry (Panel (b)).

(a) 5 km rides



(b) 15 km rides

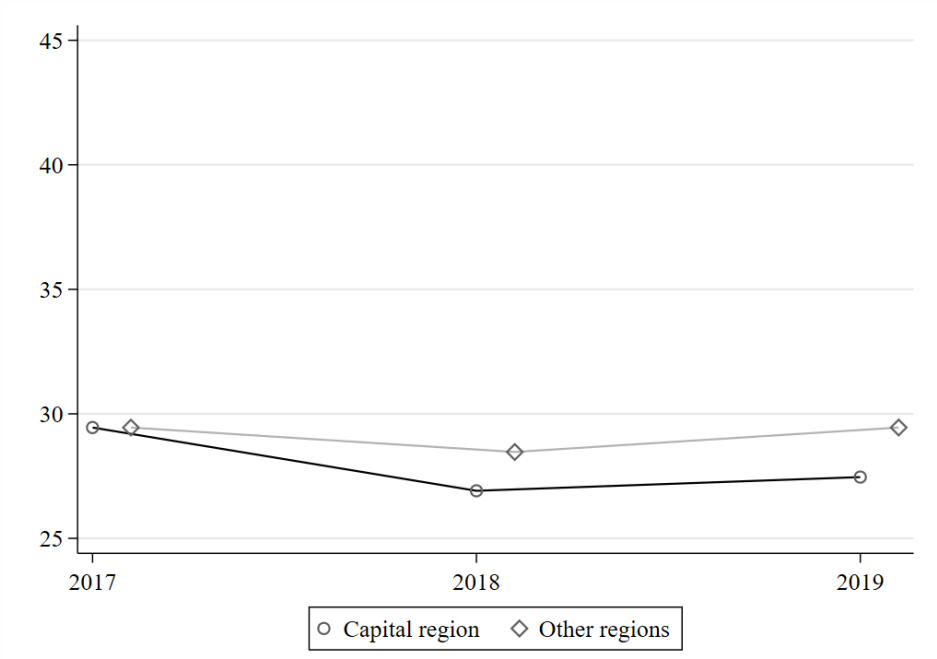


Figure A.6: Estimated average prices of publicly subsidized taxi rides in the capital region and other areas in Finland over time

Notes: This figure presents the estimated average prices of publicly subsidized taxi rides based on the data from the Social Insurance Institution of Finland (Kela). Panel (a) presents the estimated prices of 5 km publicly subsidized rides in capital region and in other areas, and Panel (b) presents the corresponding estimated average prices for 15 km trips.

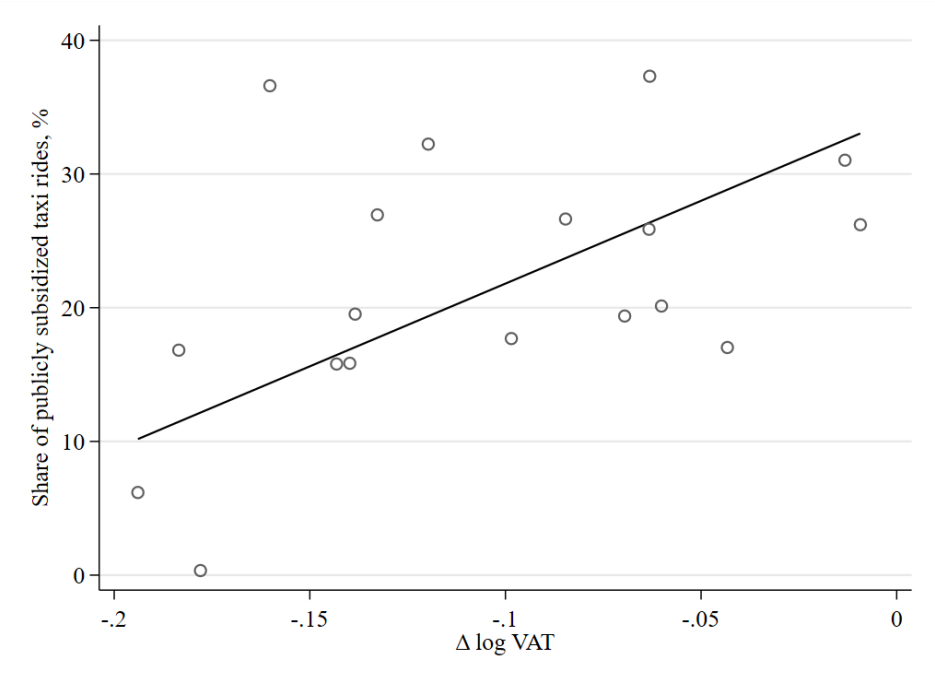


Figure A.7: Relationship between the change in VAT payments and share of publicly subsidize taxi rides

Notes: This figure shows the relationship between the share of publicly subsidized taxi rides and the change in log VAT payments of taxi firms by region. Scatter points represent 17 provinces in Finland.

(a) Aggregate VAT payments

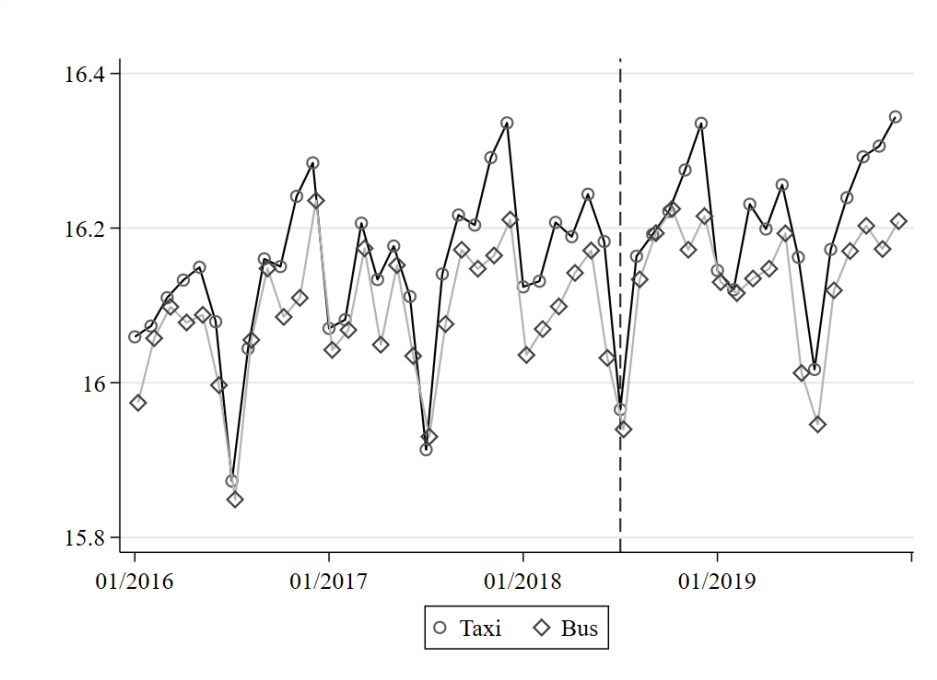


Figure A.8: The development of aggregate VAT payments over time

*Notes:*This figure illustrates the evolution of aggregate VAT payments from taxi and bus industries. The figure presents the aggregate VAT payments (in natural logs) separately for both industries over time. The dashed vertical line marks the timing of the reform. The difference-in-difference estimate for aggregate VAT payments is 0.008 (0.017) using the aggregated data in the figure.

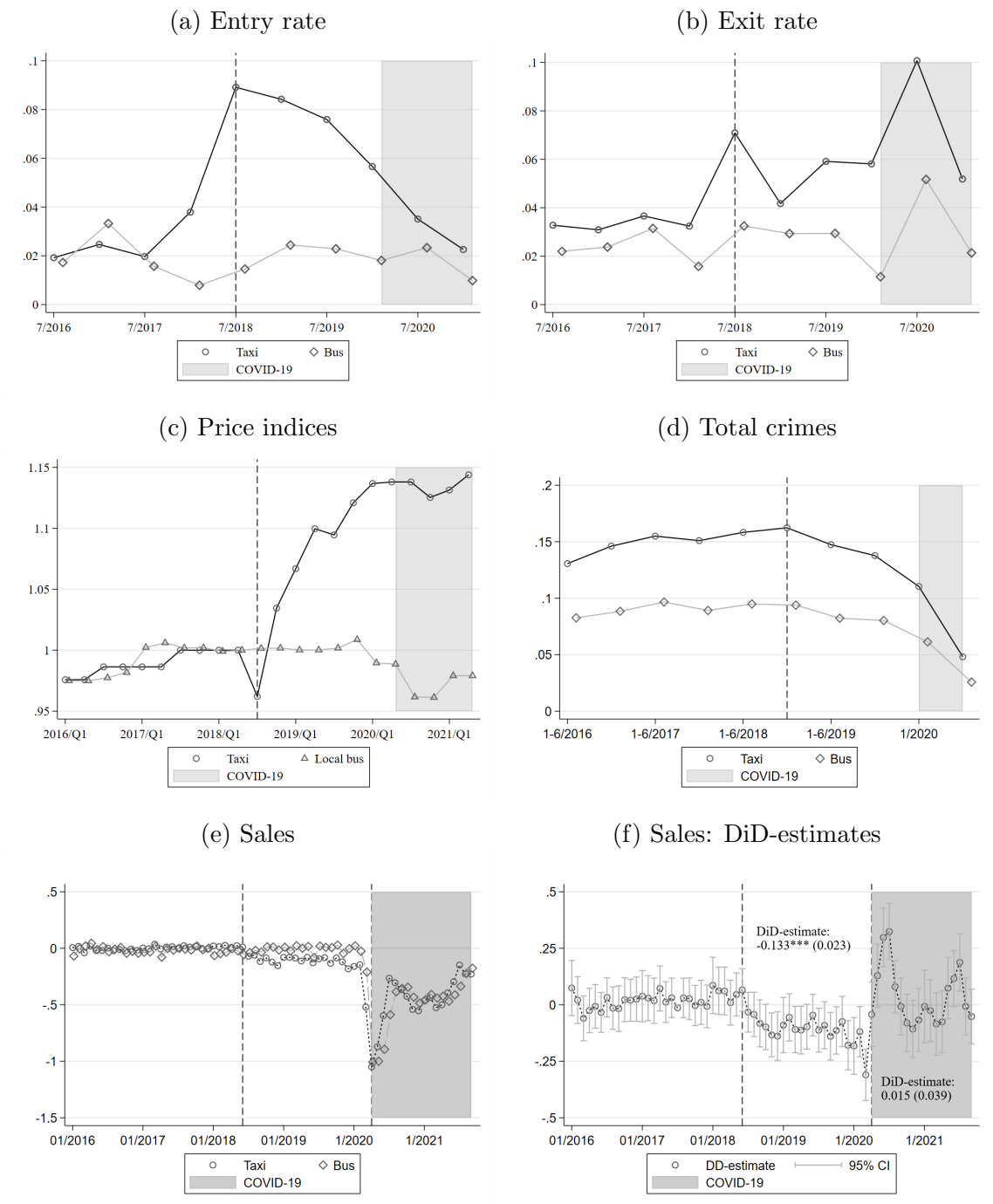


Figure A.9: Long-term analysis

Notes: This figure extends the baseline sample to include the time period after the start of COVID-19 pandemic for our main outcomes. Panels (a) and (b) of this figure replicate the analysis presented in Panels (a) and (b) of Figure 2 until September 2021. Panel (c) presents the evolution of Consumer Price Indices for taxi and local bus rides similarly as in Panel (a) of Figure 3 until the second quarter of 2021. Panel (d) presents the total suspected crime rate for the extended post-regulation period (until the end of 2020) similarly as in Panel (a) of Figure 9. Panels (e) and (f) similarly repeat the analysis presented in Panels (a) and (b) of Figure 5 until the end of 2020. The dashed vertical lines mark the timing of the reform. The timing of COVID-19 pandemic is marked with grey colour.

Table A.1: Characteristics of entering and exiting taxi drivers over time

Year	7/2016-6/2017	7/2017-6/2018	7/2018-6/2019	7/2019-12/2019
New taxi drivers				
High school diploma	0.25	0.29	0.26	0.22
No high school diploma	0.74	0.70	0.74	0.77
Finnish origin	0.88	0.84	0.80	0.71
Foreign origin	0.12	0.16	0.20	0.29
Male	0.78	0.79	0.78	0.81
Entrepreneurs	0.03	0.04	0.09	0.09
Wage earners	0.75	0.79	0.75	0.73
Capital region	0.31	0.43	0.34	0.43
Suspected of a crime	0.09	0.12	0.13	0.13
Mean age	37	37	36	36
Taxable income, year after entry, eur	25 764	25 990	25 996	-
N	2 056	2 303	3 700	2 417
Exiting taxi drivers				
High school diploma	0.24	0.25	0.26	0.25
No high school diploma	0.76	0.74	0.74	0.74
Finnish origin	0.93	0.92	0.87	0.83
Foreign origin	0.07	0.07	0.13	0.17
Male	0.82	0.81	0.81	0.81
Entrepreneurs	0.11	0.12	0.14	0.10
Wage earners	0.51	0.54	0.56	0.58
Capital region	0.35	0.36	0.38	0.37
Suspected of a crime	0.12	0.14	0.15	0.15
Mean age	45	44	43	41
Taxable income, year before exit, eur	27 128	27 992	27 942	27 530
N	2 335	2 793	4 194	2 915

Notes: This table shows the characteristics of workers entering and exiting the taxi industry based on employment spell data by four time intervals: July 2016 – June 2017, July 2017 – June 2018, July 2018 – June 2019 and July 2019 – December 2019. New taxi driver refers to a person who enters the industry for the first time during the given time period either as an employee or an entrepreneur, based on the five-digit industry classification of the firm. Exiting taxi driver refers to a person who exits the taxi industry, i.e. was employed on the taxi industry in $t-1$ but is not anymore in t. The shares of individuals suspected of criminal offenses are calculated based on the fraction of entering or exiting drivers who committed a crime during the year before entry or exit. Note that for some drivers information is missing, and thus the shares of drivers by some characteristics do not sum up to 100 percent, this is especially true on whether taxi drivers are entrepreneurs or wage earners.

Table A.2: Descriptive statistics: CPI and Traficom's price data

Variable	Pre-reform: 2016-Q2/2018	Post-reform: Q4/2018-Q2/2020
5 km standard trip during daytime	13.79	14.24
5 km standard trip during nighttime	15.01	17.08
15 km standard trip during daytime	29.57	31.46
15 km standard trip during nighttime	30.78	34.32
Starting fee, all firms	5.90	5.62
Starting fee, firms with time-based pricing	5.90	4.07
Starting fee, firms without time-based pricing	5.90	5.88
Euros per km, all firms	1.58	1.54
Euros per km, firms with time-based pricing	1.58	1.03
Euros per km, firms without time-based pricing	1.58	1.62
Euros per minute, firms with time-based pricing	Minute-fee not allowed	0.76
Number of firms announcing their prices in data	CPI	537

Notes: This table shows the descriptive statistics of price measures and their components in price data for taxi sector before and after deregulation. The prices for period 2016-Q2/2018 are obtained from Statistics Finland's CPI-data, and prices for period Q4/2018 onwards are obtained from Traficom's data. The prices in Traficom's data are collected from a large number of taxi operators and the data include prices for standard trips and separate price components. For the third quarter of 2018 comparable price information is not available.

Table A.3: Number of firms in Traficom's price data with and without time-based pricing systems in Finland, Q4/2018–2019

Quarter	No time-based pricing	Time-based pricing	Total
2018/Q4	475	62	537
%	88.45	11.55	100
2019/Q1	459	78	537
%	85.47	14.53	100
2019/Q2	452	85	537
%	84.17	15.83	100
2019/Q3	453	84	537
%	84.36	15.64	100
2019/Q4	450	87	537
%	83.80	16.20	100

Notes: This table shows the number of firms with and without time-based pricing systems in Finland. Time-based pricing was not allowed in Finland before July 2018.

Table A.4: Descriptive statistics: Mileage data

Variable	1/2016-6/2018	7/2018-12/2019
Average odometer record, kilometers		
Passenger cars	254 387	254 937
Buses	421 819	465 250
Average difference in odometer records between inspections		
Passenger cars	68 622	57 378
Buses	55 211	49 771
Average daily kilometers		
Passenger cars	200	162
Buses	158	140
Average days between inspections		
Passenger cars	339	353
Buses	343	349
Average number of inspections, per month		
Passenger cars	795	1 070
Buses	917	893

Notes: This table shows the descriptive statistics of our baseline variables and the numbers of different vehicle types in the mileage data for taxi and bus sectors.

Table A.5: Descriptive statistics: Financial statement data

Variable	2017	2019
Sales		
Taxi industry	147 436	157 253
Bus industry	2 060 840	1 996 678
Labor costs		
Taxi industry	35 218	37 693
Bus industry	762 515	724 346
Taxable profit		
Taxi industry	25 008	16 430
Bus industry	37 108	23 981
Number of firms		
Taxi industry	7 596	7 409
Bus industry	574	556

Notes: This table presents the descriptive statistics of the main outcome variables in the financial statement data for taxi and bus sectors before and after the reform.

Table A.6: Descriptive statistics: VAT data, long-haul bus firms as control group

Variable	Taxi industry	Bus industry
	1/2016-6/2018	1/2016-6/2018
Sales	12 574	73 267
N	231 498	14 954
VAT	1 331	7 188
N	231 498	14 954
Labor costs	4 064	32 291
N	158 331	11 950
Variable costs	4 854	34 398
N	231 498	14 954
Number of firms	7 761	500

Notes: This table presents the descriptive statistics of main outcome variables for taxi and long-haul bus industries in VAT data before deregulation in July 2018.

Table A.7: Descriptive statistics: Financial statement data, long-haul bus firms as a control group

Variable	2017	2019
Sales		
Taxi industry	147 436	157 253
Bus industry	1 031 250	1 093 095
Labor costs		
Taxi industry	35 218	37 693
Bus industry	376 845	388 961
Taxable profit		
Taxi industry	25 008	16 430
Bus industry	11 206	26 831
Number of firms		
Taxi industry	7 596	7 409
Bus industry	461	452

Notes: This table presents the descriptive statistics of the main outcome variables in the financial statement data for taxi and long-haul bus sectors before and after the reform.

Table A.8: DiD estimates using VAT data and long-haul buses as a control group

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
DiD estimate	-0.137***	-0.147***	-0.041	-0.025
	(0.025)	(0.027)	(0.031)	(0.029)
N	370 806	370 276	223 946	368 806
Number of firms	10 773	10 728	7 785	10 447
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	57 069	5 718	31 644	27 975
Jul 2017 average (control, in logs)	10.95	8.65	10.36	10.24

Notes: This table replicates the analysis from Table 3 using long-haul buses as a control group. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table A.9: DiD estimates using financial statement data and long-haul buses as a control group

	(1) Sales	(2) Labor costs	(3) Taxable profit
DiD estimate	-0.125***	-0.126**	-0.272**
	(0.033)	(0.045)	(0.085)
N	32 460	24 214	28 753
Number of firms	10 527	8 527	10 094
2015-2017 average (treatment, euros)	140 105	33 519	23 066
2015-2017 average (treatment, in logs)	11.85	10.42	10.05
2015-2017 average (control, euros)	1 011 630	365 895	20 228
2015-2017 average (control, in logs)	13.83	12.81	9.91

Notes: This table replicates the analysis from Table 4 using long-haul buses as a control group. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table A.10: Triple difference estimates using VAT data: heterogeneity of responses by the size of the city

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
Big cities X Taxi X After (DDD)	-0.135*	-0.127*	-0.262***	-0.076
	(0.053)	(0.059)	(0.058)	(0.073)
Big cities X After	0.068	0.048	0.105	0.003
	(0.052)	(0.058)	(0.056)	(0.071)
Taxi X After	-0.083***	-0.096***	0.059	0.008
	(0.026)	(0.026)	(0.033)	(0.028)
N	375 869	375 288	228 292	373 823
Number of firms	10 865	10 860	7 897	10 604
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	133 189	13 347	72 489	56 986
Jul 2017 average (control, in logs)	11.80	9.50	11.19	10.95

Notes: This table shows the triple-difference estimates for sales, VAT payments, labor costs and variable costs, with firm fixed effects. Big cities -dummy obtains value 1 for firms that are registered in cities with over 100 000 inhabitants and zero otherwise. Taxi-dummy obtains value 1 if the firm operated in the taxi industry and zero for firms that operate in the bus industry. After-dummy obtains value 1 for periods from July 2018 to December 2019. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table A.11: Triple difference estimates using VAT data: heterogeneity of responses by firm size

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
Big firm X Taxi X After (DDD)	-0.003	-0.005	-0.032	-0.054
	(0.047)	(0.049)	(0.061)	(0.055)
Big firm X After	0.016	0.014	0.028	0.092
	(0.045)	(0.048)	(0.058)	(0.053)
Taxi X After	-0.120**	-0.131**	-0.006	0.012
	(0.039)	(0.042)	(0.051)	(0.045)
N	354 971	354 445	220 529	353 982
Number of firms	8 543	8 540	6 760	8 391
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	133 189	13 347	72 489	56 986
Jul 2017 average (control, in logs)	11.80	9.50	11.19	10.95

Notes: This table shows the triple-difference estimates for sales, VAT payments, labor costs and variable costs, with firm fixed effects. Big firm-dummy obtains value 1 for firms that have sales above median one year prior to the reform and zero otherwise. Taxi-dummy obtains value 1 if the firm operated in the taxi industry and zero for firms that operate in the bus industry. After-dummy obtains value 1 for periods from July 2018 to December 2019. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table A.12: DiD estimates using VAT data with pre-reform firm-size weights

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
DiD estimate	-0.123***	-0.134***	-0.028	-0.026
	(0.021)	(0.022)	(0.027)	(0.026)
N	352 130	351 607	219 036	350 776
Number of firms	8 306	8 303	6 622	8 176
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	133 189	13 347	72 489	56 986
Jul 2017 average (control, in logs)	11.80	9.50	11.19	10.95

Notes: This table replicates the analysis presented in Table 3 using firm size analytical weighting based on pre-reform data. The firm-level weights are calculated from sales between January 2016 and June 2018. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.

Table A.13: DiD estimates using VAT data and incumbent firms

	(1) Sales	(2) VAT	(3) Labor costs	(4) Variable costs
DiD estimate	-0.122***	-0.134***	-0.030	-0.018
	(0.022)	(0.023)	(0.028)	(0.027)
N	356 665	356 126	222 000	356 683
Number of firms	8 917	8 913	7 042	8 803
Jul 2017 average (treatment, euros)	9 821	1 060	4 164	4 197
Jul 2017 2017 average (treatment, in logs)	9.19	6.97	8.33	8.34
Jul 2017 average (control, in euros)	133 189	13 347	72 489	56 986
Jul 2017 average (control, in logs)	11.80	9.50	11.19	10.95

Notes: This table replicates the analysis from Table 3, focusing only on firms that were operating in the market in December 2017 or earlier. All variables are in logarithmic form. Standard errors are clustered at the firm level. Asterisks denote significance levels 0.05, 0.01 and 0.001.