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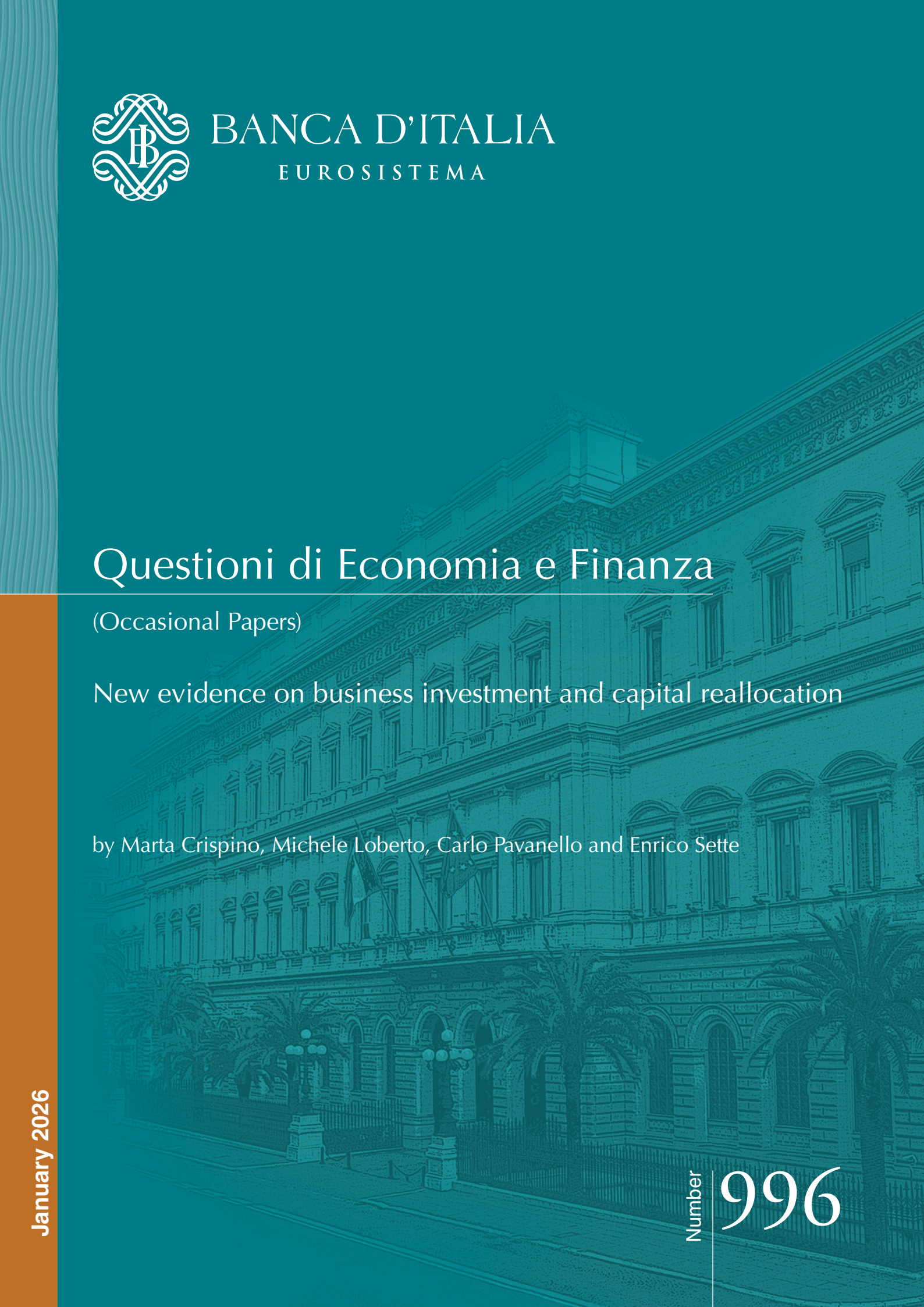

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NEW EVIDENCE ON BUSINESS INVESTMENT AND CAPITAL REALLOCATION

by Marta Crispino*, Michele Loberto*, Carlo Pavanello** and Enrico Sette***

Abstract

This paper provides new facts about business investment and capital reallocation by exploiting a novel and comprehensive dataset of firms' vehicle transactions, covering the universe of purchases of new and used vehicles, as well as the leases recorded by the Italian vehicle register between 2015 and 2023. We show that leasing is very common, as it represents about 50 per cent of vehicle acquisitions. Financially constrained firms have a higher propensity to lease rather than purchase, while young firms rely heavily on the market for used vehicles. Reallocation of used vehicles occurs for about 50 per cent of the transactions within the same industry. Transactions involving used vehicles mostly occur among firms with similar productivity, or between very low productivity firms that sell vehicles to firms with higher productivity, as the former are likely to exit the market. When dealers are involved, vehicles are reallocated much more broadly across industries, geographical areas and firm productivity classes, which is consistent with dealers helping to improve capital reallocation.

JEL Classification: D21, D24, E22, G31.

Keywords: investment, capital reallocation, leasing, financial constraints, productivity.

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* Bank of Italy, Department of Economics and Statistics. Email: Marta.Crispino@bancaditalia.it.; Michele.Loberto@bancaditalia.it.

** Universitat Pompeu Fabra. Email: Carlo.Pavanello@upf.edu.

*** European Central Bank and CEPR. Email: Enrico.Sette@bancaditalia.it.

1 Introduction[1]

Business investment is a key driver of the business cycle and has vast implications for productivity and economic growth. However, the lack of granular data on investment goods prevents addressing several key questions for understanding firms' investment strategies and their implications, such as: what are the technical characteristics (e.g. capital vintage, more or less recent technological features, etc.) of the capital goods deployed? How firm- or industry-specific are these assets? Has the firm purchased the capital asset or leased it? How are capital goods reallocated among firms? The answers to these questions have relevant implications at the micro and macro levels and are at the center stage of a large literature (e.g., Ramey and Shapiro, 2001; Eisfeldt and Shi, 2018).

This paper makes steps in addressing these questions by providing new stylized facts on firms' investment strategies based on unique administrative data on motor vehicle purchases and leases. According to National Accounts data, these assets represent a non-trivial fraction of total investment in equipment (about 20%). For some industries, in particular logistics and transportation, the figure is as high as 72%.

Moreover, data on business investments are usually measured through balance sheet data (e.g., COMPUSTAT, CERVED) or surveys (i.e., INVIND). The former are generally available only for larger firms and with a substantial lag (about 1 year). The latter are representative of the universe of firms and are timely, but they are based on limited samples and are affected by attrition and reporting errors. Our data allow us to precisely measure all investment in vehicles for all firms, including very small ones. In fact, they cover all purchases of new vehicles, transactions in used vehicles, leasing contracts, and vehicle cancellations from the Italian motor vehicles registry (*Motorizzazione civile*) between 2015 and 2023.[2] Vehicles include all means of transportation that carry a plate (cars, buses, trucks, industrial vehicles). Each record reports information about the companies involved in the transaction (including their unique tax identifier) and the vehicle, including the producer, model, the unique Vehicle Identification Number (VIN)[3], the year of production, and technical characteristics of the vehicle, such as the power of the engine, whether this is electric or combustion, etc.. By exploiting the VIN, we can track the whole life cycle of each vehicle in our data.[4]

Leveraging these data, we present new stylized facts on how companies acquire vehicles, how

[1]We thank L. Bartiloro, F. Cingano, A. Rosolia, and R. Torrini for comments and useful discussions. The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank of Italy or the Eurosystem. All remaining errors are our own.

[2]In Italy all transactions must, by law, be recorded in the motor vehicle registry, so the data include the whole population of transactions.

[3]This is typically engraved on the chassis.

[4]Some companies provide their employees with cars as a company benefit. Therefore, these firms do not use these vehicles regularly in their production process. These operations are usually made through long-term rental contracts. However, the insights reported below hold even excluding long-term rentals of cars.

firms' characteristics correlate with investment in vehicles, how used vehicles are reallocated across firms, and how relevant is the role of market dealers. In addition, we document how firms adopt a new technology, electric-powered vehicles, providing evidence on which firms are faster adopters, and on the role of the possibility of leasing versus purchasing in speeding up technology adoption.

Our main findings can be summarized as follows. First, firms lease a large share of their vehicles. Considering only companies acquiring vehicles for use in their core activity, purchases of new vehicles account for 13% of the vehicles acquired by companies in 2023.[5] Accounting also for the purchases of used vehicles, the share of purchases is less than 50% of total transactions.[6] That is important because, by standard accounting rules, investments are defined as purchases of capital goods, and leasing is relevant for physical assets other than vehicles as well.[7] Therefore, the amount of capital goods companies actually employ in production may be substantially underestimated if leased goods are not accounted for.

Second, we document that the choice of the type of vehicle acquired (new or used) and the contractual arrangement (outright purchases or leasing) is correlated with several key firm characteristics. Cash-constrained and riskier firms have a higher propensity to lease over purchase. When purchasing the vehicles, these firms are more likely to buy used rather than new ones. New firms rely significantly on the market for used vehicles. We find that even several large firms, particularly in the public utilities sector, acquire their corporate fleet through rental agreements. Therefore, models of firms' investments should take into account that firms with different characteristics purchase substantially different types of capital goods, and some of them may use more capital than what is purchased, as they resort more intensely to leasing. Exploiting monetary measures of investments from balance sheets and surveys for estimating the elasticity of investment expenditure may lead to biased estimates because they do not consider that the choice of purchasing capital goods and the quality of the goods are correlated with firms' characteristics. Therefore, accumulation behavior and capital intensity, as derived by monetary measures of investment expenditure available in balance sheets and survey data, are likely to yield a distorted picture for two reasons. First, in addition to potentially underestimating the amount of capital used in production, they neglect heterogeneity along age and quality of the channels through which firms acquire productive capital. Second, the choice to purchase capital goods – which triggers the accounting of these assets as investment expenditure – is correlated with the same firms' characteristics that are usually used as regressors in standard investment equations (e.g., Fazzari et al., 1987). For this reason, estimates

[5]By purchase of new vehicles, we refer to purchases of vehicles registered for the first time, and of which the company is the legal owner. This operation differs from acquisitions through financial leasing contracts, where a company acquires a new vehicle, but the legal owner is the leasing company. These leasing contracts are very common in Italy because they can provide significant tax advantages over the outright purchase of a capital good.

[6]Eisfeldt and Rampini (2009) show that leased capital is of first-order importance also in the US, in particular for smaller firms.

[7]Leased machinery and equipment (other than vehicles) account for about 10% of total investments in these assets (ASSILEA, 2024). According to the yearly Survey of Industrial and Services Firms conducted by Bank of Italy, the share of non-financial firms acquiring new capital goods other than vehicles through leasing was 32% in 2023.

of the elasticity of investment expenditure to firms' characteristics may be biased due to selection issues (Heckman, 1979).

Third, since many firms – especially young firms – rely on the market for used capital goods, it is important to understand how this market reallocates assets among firms. Firm-to-firm transactions – i.e., those not involving intermediaries – occur mainly among firms in the same industry and region. Yet, the share of reallocation between industries is still relevant, also because vehicles have a relatively low degree of industry specificity (of course with some heterogeneity, e.g. coaches or certain building machines). On average, considering the manufacturing and market services industries, 56% of capital goods remain within the industry of origin. Smaller firms are the most active and transact mostly with small and medium-sized firms. Last but not least, firm–to-firm transactions occur mainly among firms in the same ventile of the (labor) productivity distribution. The only exception occurs for sellers in the lowest productivity ventile, which most likely exit from the market, that transact with firms distributed across the whole productivity distribution. In contrast, in transactions with intermediaries (tracing the previous owner of the asset), there is greater reallocation of capital goods between industries and regions. Intermediaries also allow larger asset flows from large to small firms as well as across firms with different productivity levels, in particular from high-productivity sellers to lower-productivity buyers. These results suggest that intermediaries play an important role in facilitating capital reallocation, thus reducing misallocation.

Finally, we explore the evolution of the adoption of a green technology, that is, electric-powered vehicles, by non-financial companies. Purchases of green vehicles have risen dramatically in recent years, but their adoption is heterogeneous across contractual arrangements and firms' characteristics. The share of green vehicles is greater for rentals, while the purchases of used green vehicles – which may be seen as a measure of the reallocation of these capital goods – is still low. Moreover, the propensity to acquire green vehicles is higher for younger firms and is positively correlated with firms' size and profitability (as measured by return on assets).

Relative to other available data sources, our dataset has a few limitations but several strengths. On the one hand, we observe only transactions of motor vehicles, that, despite representing a large share of capital purchases of firms, leave out other important assets. Moreover, at this stage, we do not observe transaction prices, yet. On the other hand, our data include a wealth of relevant information. For example, capital reallocation has been studied using companies sales of capital goods from Compustat (Eisfeldt and Rampini, 2006; Lanteri, 2018; Cui et al., 2021). Compustat allows the construction of a long time series on the flow of capital reallocation for US companies. Still, it contains no details about the kind of capital goods, e.g. the vintage or the technology embodied, or about the counterparts of the transactions. Another data source are UCC filings, a sample of US public liens on business properties, to extract information on the type of used capital goods purchased by companies (Edgerton, 2012; Murfin and Pratt, 2019; Ma et al., 2022; Darmouni and Sutherland, 2023). UCC filings provide information on the goods posted as collateral to secured

loans. However, information about the counterparties is poor, and the purpose of the transactions (i.e., purchasing capital goods or refinancing) cannot be precisely identified.

Bhandari et al. (2023) use confidential tax return data on business acquisitions, reporting business purchase prices across different asset classes. Similar to other datasets, these data do not report detailed information about the characteristics of the capital goods.

Richer information can be found in data from closing plants or firms in bankruptcy (through bankruptcy filings). For example, Ramey and Shapiro (2001) use data including the physical characteristics, the selling prices, and the buyers of the assets of four closing aerospace plants in California. Kermani and Ma (2023) rely on a dataset with the assets valuation for about 500 companies under the Chapter 11 procedure to study the relation between assets' specificity and their liquidity. An additional issue is that they do not observe the characteristics of the assets (except for the category of the asset in the balance sheet, i.e., property, plant and equipment, goodwill, etc.), and they estimate asset specificity based on external sources. A potential problem when using data from closing plants or bankruptcy firms is that they may employ lower-quality capital than healthy firms.

A further source of data used in the literature comes from aircraft transactions. These data have been used to study capital reallocation and the choice between buying and leasing. Aircraft are special capital goods because of safety concerns, and all operations on aircraft are tracked and regulated. Thus, these data include a great deal of information, in line with that included in our data on vehicles, which, nevertheless, are more common across industries, while aircraft are capital goods specific to the logistics and transportation industry, and this is not well suited to study capital reallocation across industries.

Our dataset can provide new insights into several strands of literature. First, since we observe vehicles' VIN and the identities of firms we can observe the reallocation of used capital (Ramey and Shapiro, 1998, 2001; Maksimovic and Phillips, 2001; Eisfeldt and Rampini, 2006; Gavazza, 2011b, 2016; Gavazza et al., 2014; Lanteri, 2018; Gavazza and Lanteri, 2021; Cui et al., 2021; Ottonello, 2021; Ma et al., 2022; Lanteri and Rampini, 2023a; Darmouni and Sutherland, 2023; Bhandari et al., 2023). Then, we can exploit the information about vehicles' technical characteristics and the history of the vehicles to investigate how asset specificity affects the market liquidity of the asset (Ramey and Shapiro, 2001; Benmelech, 2009; Kermani and Ma, 2023; Bhandari et al., 2023).

Second, since we observe all possible channels for acquiring vehicles, we can contribute to the literature that studies the choice between buying or leasing capital goods (Bond, 1982, 1983; Hendel and Lizzeri, 1999, 2002; Eisfeldt and Rampini, 2006, 2009; Gavazza, 2010, 2011a; Rampini, 2019; Gavazza and Lizzeri, 2021). Then, since our data cover the universe of firms and are at the transaction level, we can study the determinants of business investments, such as credit, liquidity, or long term interest rates (Fazzari et al., 1987; Cingano et al., 2016; Benmelech et al., 2017; Ottonello and Winberry, 2020) and tax incentives (Goolsbee, 1998; House and Shapiro, 2008; Mian and Sufi,

2012; Zwick and Mahon, 2017; Basu et al., 2022; Lanteri and Rampini, 2023a). We can also study how the determinants of investment have indirect effects through the reallocation of used capital and the impact on the quality of capital goods. Related to the issue of the quality of capital goods, another topical issue is the analysis of technology adoption (Rust, 1987; Gillingham et al., 2022), and in particular the adoption of green technologies (Accetturo et al., 2022; Campiglio et al., 2023; Lanteri and Rampini, 2023b).

Finally, since we observe the entire network of the market for vehicles we can investigate the role of intermediaries in alleviating frictions in the over-the-counter markets (Rubinstein and Wolinsky, 1987; Shevchenko, 2004; Duffie et al., 2005; Gavazza, 2011b, 2016; Babus and Hu, 2017; Farboodi et al., 2018, 2023).

This paper is organized as follows. Section 2 describes the dataset and provides a broad overview of the main patterns. Section 3 shows that the acquisition arrangements chosen by firms are correlated with firms' characteristics. Section 4 provides stylized facts about reallocation in the secondary market. Section 5 describes additional applications. Finally, Section 6 concludes.

2 Data

We analyze a large dataset of all motor vehicle transactions involving incorporated firms, either as buyers, or sellers, or both, in Italy between 2015 and 2023.[8] The Italian Department of Transport regularly collects these data because regulations require tracking the entire life of motor vehicles and collecting lots of technical information.[9] The dataset includes cars, buses, and trucks.

The data allow us to distinguish six different operations. The first is the purchase and registration of a new motor vehicle.[10] The second is the acquisition of a new vehicle through a financial leasing contract. This is widely used by small and medium-sized firms to acquire physical assets.[11] The third is the property transfer of a used vehicle. The fourth is the long-term rental of a vehicle. By long-term rental, we refer to a leasing contract lasting at least 30 days.[12] Different from financial leasing, long-term rentals usually do not allow the end users the possibility to purchase the vehicle. The fifth is the purchase of a used vehicle from abroad. The last operation is the cancellation of

[8] When a (incorporated) firm is on only one side of the transaction, the other side may involve households, non-incorporated firms, or any other entity.

[9] The main source of information is the vehicle registration certificate. This certificate is an official document providing proof of vehicle registration and reporting the vehicle's owner and technical characteristics.

[10] A motor vehicle registration is a procedure that assigns to the motor vehicle a license plate and allows an individual to drive the vehicle on the road.

[11] In these transactions, a finance company acquires the motor vehicle and leases it to the end user. The end user pays a monthly fee to the finance company and usually, after a certain period, may purchase the vehicle from the finance company.

[12] Rental duration goes from 30 days to several years, granting a flexible instrument to firms to adjust the capacity of their fleet to their needs but also providing an additional channel to acquire and use a vehicle in the medium term. This type of contract often includes a number of complementary services such as periodical maintenance, insurance, and easy replacement of the vehicle at demand.

the vehicle. This consists of the cancellation of the license plate associated with the vehicle. This may occur because the vehicle has been scrapped or exported abroad.

For each operation, we observe the vehicle identification number (VIN), the day of the operation, the intended use of the vehicle (i.e., whether it is intended for own use, for the transport of other persons, or for the transport of goods), the duration of the leasing or of the rental contracts, and the parties involved. For each of these, we know the denomination, the full address of the establishment, and the unique tax identifier. For the acquisitions of a new vehicle through a financial leasing contract and for rentals, this information refers to the lessee. The corporations in our dataset are companies, public administrations, professional firms, and associations. For property transfers of used vehicles, we observe both the buyer and the seller. The dataset includes all transactions involving legal entities and, therefore, also transactions between legal entities and individuals.[13]

For each vehicle, we know the VIN, the day of registration, the carmaker, the brand, the model, the vehicle category (e.g. car, truck, van, etc.), and the main technical information. The latter includes the engine specifications, the vehicle's mass, the power source, CO_2 emissions, and details about the vehicle's body.

We perform several steps to clean the data from errors and omissions. Reporting errors in vehicle registrations are rare, while they are slightly more frequent for property transfers.[14] When some technical information about the vehicles (e.g., weight, power, etc.) is missing or contains implausible values due to typing errors (e.g., a 40-tonne car, where the weight should be at most 3.5 tonnes), we replace the cell with the median by brand-model-year of registration.[15] The VIN follows international standards and identifies a vehicle uniquely. We removed all vehicles with VIN that do not follow these standards.[16] Next, we checked the consistency of all operations on each vehicle, i.e., we verified that for each vehicle, the seller in transaction n had been the buyer in transaction $n-1$. After these checks, we drop 2% of the observations. Our final sample includes 18.5 million vehicles and 45 million transactions.

Transactions in our sample occur for several reasons. A large proportion (65%) of ownership transfers occurs between households and dealers (as these are incorporated firms). In addition, many transactions involve the operations of rental companies or financial intermediaries offering financial leasing services. Dealers and rental companies do not acquire motor vehicles for their use. In addition, the purchase choices of these parties may respond to different reasons than those of companies that acquire vehicles for use within the production cycle. For this reason, we merged the dataset with the business register to identify the 6-digit NACE code and selected only the

[13]The identity of individuals is concealed, though, for privacy reasons.

[14]The information related to registrations is subject to stricter checks compared to property transfers.

[15]Records with implausible values account for less than 1% of the dataset, while missing information is more common, particularly for property transfers of used vehicles (up to 28% for some variables).

[16]The VIN is a 17-digit alphanumeric code. For very old vehicles, VIN was a numeric code defined by the carmaker. Therefore, different vehicles may share the same VIN. We removed these vehicles. These are 130,000, only 0.7% of the whole sample.

transactions in which the firms purchasing/leasing the asset are not dealers and rental companies, i.e., these firms need vehicles to run their operations but have their core business in different sectors than selling or leasing cars and trucks.[17] Moreover, we discard the acquisitions made by public administrations, government-owned firms, and associations. Therefore, because our focus is on vehicle acquisitions, we will consider only a subsample of transactions made by firms for their use: *(i)* purchases of new and used vehicles; *(ii)* purchases of new vehicles through a financial leasing contract; *(iii)* and long-term rentals with duration above one year.[18]

Hereafter, we continue our analysis with this dataset of operations, which includes 4.9 million operations involving 4 million motor vehicles (1.7 million vehicles are trucks) and about 1 million companies. Tables A1 and A2 report descriptive statistics about the main characteristics of the vehicles considering separately cars and trucks.[19]

2.1 Main patterns

In this paragraph, we describe trends in different types of operations and report breakdowns by firm size and NACE 2-digit industry.

A first striking observation is that a significant proportion of assets are acquired through financial leasing or leased from a rental company. Figure 1 displays the number of operations and the share of each operation on the total by year since 2016. We display the shares since 2016 because reporting rental contracts to the Italian Department of Transport has been mandatory only since November 2015. The main trend we observe is the rise of long-term rentals relative to the other acquisition modes. The share of rentals was 23% in 2016 and increased to 41% in 2023. The second arrangement by importance was the purchases of used vehicles, and their share on total acquisitions decreased over time from 36% to 32%. The share of new vehicle purchases almost halved to 13%, and even the share of new vehicle acquisitions through financial leasing decreased from 13% to 10%.

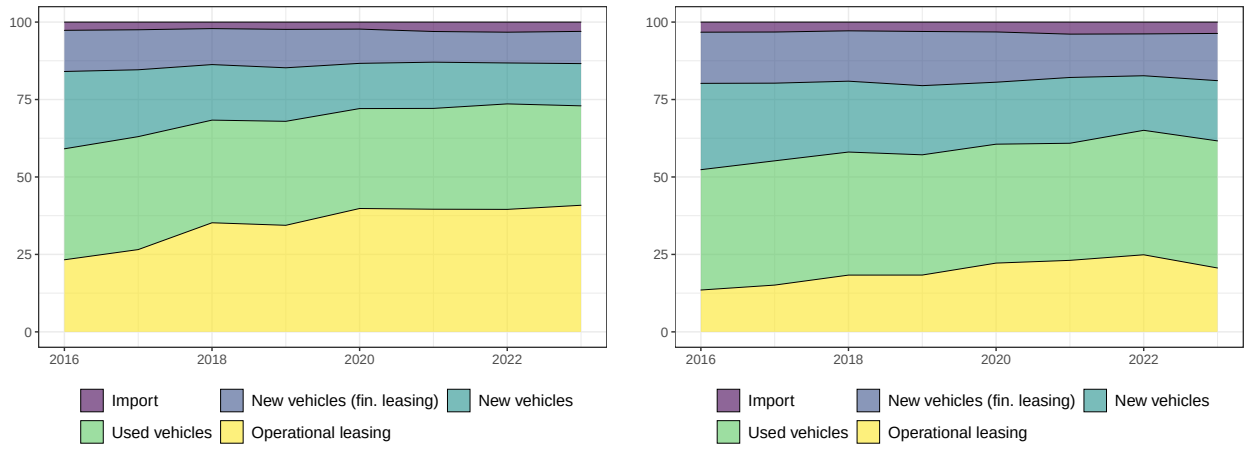
Overall, we find that more than 50% of all vehicles were acquired through long-term rental or financial leasing in 2023. These operations do not figure out as investments but as operating costs, although firms use these vehicles regularly in their production process for a prolonged period. The large share of rental is partly due to the fact that some companies use this tool to provide their employees with cars as a company benefit. However, focusing only on commercial vehicles, the share of vehicles acquired through rental or financial leasing is still substantial (36%).

[17] For the same reasons, we discard companies producing motor vehicles and operating in the financial sector. The latter may be intermediaries providing financial leasing services. Therefore, we remove all companies with the following NACE 2-digit codes: 29, 45, 64, 77.

[18] We drop rental contracts with a duration below one year because firms could enter into these contracts for short-term needs. Instead, rental contracts over one year are an alternative form of acquiring assets rather than buying.

[19] The distinction is based on the United Nations Economic and Social Council classification. We label as *cars* or *non-commercial vehicles* those used for carriage of up to eight passengers (categories M1 and M1G). Other vehicles in categories M and N are labeled *trucks* or *commercial vehicles*.

Figure 1: Vehicles' acquisition arrangements



(a) All vehicles

(b) Commercial vehicles

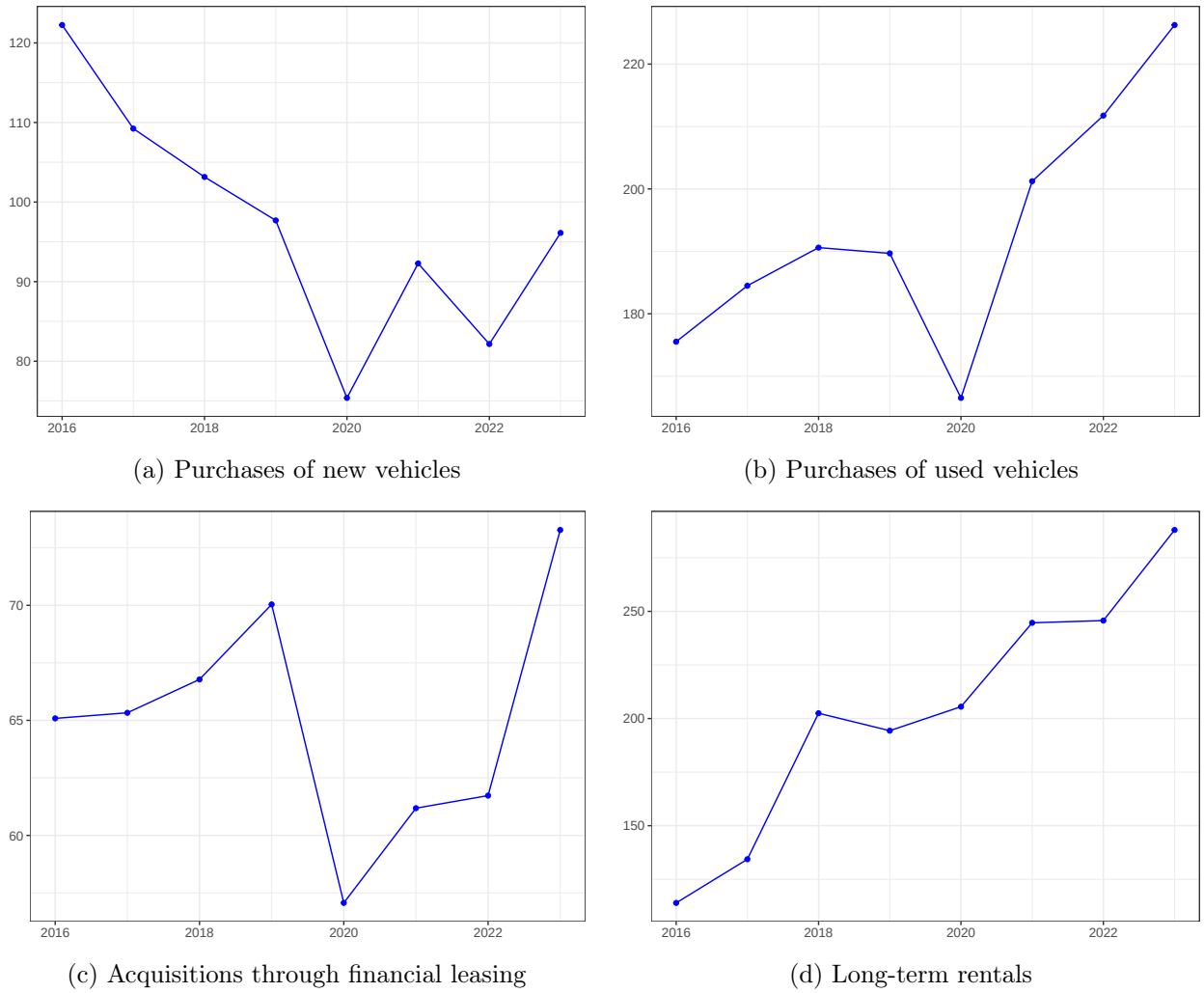
Note: This figure shows the share of each trading arrangement in total vehicles (panel a) and total commercial vehicles (panel b) acquired by firms. Commercial vehicles include all vehicles in categories M, except for M1 and M1G, and N (i.e., buses and trucks). Acquisitions made by dealers, renters, vehicle manufacturers, and financial intermediaries are excluded. Annual data.

Some patterns emerge when looking at specific contractual arrangements (Figure 2 and A1). First, there was a collapse in transactions, except for rentals, in 2020 due to the lockdown related to the Covid-19 pandemic. Second, for all new vehicle purchases, the peak occurred before the Covid-19 pandemic. This pattern was probably due to the presence of strong tax incentives for the acquisition of new capital goods (*Superammortamento 150* and *Legge Sabatini*). In addition, in 2022, there was a decrease in new vehicle purchases caused by the widely documented emergence of bottlenecks in chip supply that has curbed new vehicle production (Darmouni and Sutherland, 2023). Third, used vehicle purchases returned to similar levels as pre-pandemic since 2021 despite the lower inflow of new vehicles. This pattern is likely related to the collapse in vehicle cancellations that offset the decline in inflows of new vehicles (Figure A2). Fourth, long-term rentals have been the fastest-growing type of transaction after the pandemic. There could be several factors underlying this trend (e.g., increased uncertainty in the economic environment, lower availability of vehicles for purchase, excessive purchase prices), and identifying which is the most relevant is left for future research.

Micro-firms – by far the largest group in terms of number of firms – carry out the largest number of transactions for all types of operations except rentals (Figure A3).[20] In the case of rentals, large firms make the largest share of transactions. In fact, several large companies, particularly in the public utilities sector, acquire their corporate fleet through rental agreements. Generally, the trends

[20]We define firm size according to the number of employees: micro (less than 10), small (between 10 and 50), medium (between 50 and 250), and large (more than 250). Data on employees are provided by the Italian Social Security Institute (INPS).

Figure 2: Main trends



(a) Purchases of new vehicles

(b) Purchases of used vehicles

(c) Acquisitions through financial leasing

(d) Long-term rentals

Note: This figure shows the annual number of transactions for the four main motor vehicle acquisition arrangements. Both cars and commercial vehicles are included. Values on the y-axis are in thousands.

in different operations across firm sizes are similar. Looking at the NACE 2-digit classification of firms, service enterprises carry out most of the operations (Figure A4). The construction sector showed the biggest increase in transactions after the COVID-19 crisis, except for rental contracts, overcoming the pre-pandemic levels and the industrial sector. This trend has been plausibly driven by the large increase in demand for the construction sector driven by the large fiscal incentives for house renovations and improved energy efficiency.

3 Vehicle acquisition and firms characteristics

In this section, we investigate whether the different propensity to acquire a vehicle with a specific arrangement correlates with the firms' characteristics. For this analysis, we restricted our attention to an unbalanced panel of about 1.1 million firms recorded in the Cerved databaset, from which we retrieved companies' financial statements.[21] The dataset includes about 700,000 firms yearly between 2016 and 2022. On average, 22% of firms acquire at least one vehicle yearly, and 15% of firms purchase a new or used vehicle. Focusing on firms performing tangible investment expenditure above 10,000 euros, those purchasing at least one vehicle are 37%.

We begin our analysis by examining how the average number of transactions varies with three firm characteristics: number of employees, age, and financial conditions. We provide a set of binscatter plots in which we divide the support of the distribution of the covariate variable into 20 or 100 bins and use the marginal empirical quantiles of the covariate to space the bins.[22]

Figure A5 shows the binscatter plots of the average annual number of transactions by the bin of employees and type of transaction. The relationship between the average number of operations and the number of employees is concave for all operations except for rentals. For rentals, instead, we observe a convex relation. The results are similar if we measure firms' size by using total assets (Figure A6).

Distinguishing acquisition modes by firm age reveals that young firms (up to 10 years old) typically purchase used vehicles (Figure A7). The average number of purchases of used vehicles is non-linear in age, as it decreases and then increases again. For the other acquisition arrangements, instead, the relation between the average number of operations and age is monotonically increasing.

We consider two measures of financial conditions. The first is financial leverage (defined as financial debt out to financial debt and equity). The second is a score variable classifying firms into three categories according to the probability of default.[23] The score is a discretization of the probability of default and it is computed by Cerved, the data provider. Further information can be found in Peydró et al. (2021) and Rodano et al. (2018). The relationship between vehicle acquisitions and leverage is non-monotonic (Figure A8). Ignoring the first bin of the distribution – i.e., the 5% of firms with the lowest leverage – the average number of vehicle acquisitions initially increases with leverage. Then, the number of operations decreases as leverage increases, consistently with a debt-overhang effect. In the case of new vehicle purchases, the average number of transactions begins to fall from the 30^{th} percentile of the distribution. In the case of the other types of transactions, the peak corresponds to the 75^{th} percentile. We find similar evidence by looking at the barplot of the

[21] As before, we remove dealers, rental companies, motor vehicle producers, and financial companies.

[22] We trim the distribution of the number of employees and firms age at 99^{th} percentile to improve the visualization of the bin scatter plots.

[23] For this analysis, we consider a subset of 340,000 companies that report information on financial debt. Other firms, smaller ones, file a simplified balance sheet that does not report that information.

average number of operations by riskiness class (Figure A9). The average number of operations is lower for high-risk firms. Moreover, the differential in the number of operations between low-risk and high-risk firms is lower for purchases of used vehicles and those financed through financial leasing contracts than purchases of new vehicles. Therefore, worse financial conditions are associated with a lower propensity to purchase new vehicles.

We perform a regression analysis to assess the robustness of the insights coming from these descriptive statistics. We have no ambition to identify causal relationships but only conditional correlations. First, we create a dataset of firm characteristics and balance sheet items from the dataset of financial statements. The dataset is an unbalanced panel spanning from 2016 to 2022. For each firm, we observe the yearly number of operations on vehicles by type of operation. Then, we create two dummy variables: OWN_{it} is equal to 1 if in year t firm i purchases at least one vehicle (new or used); $LEASE_{it}$ is equal to 1 if in year t firm i leases at least one vehicle (through financial leasing or long term rental). To keep the analysis simple, we drop all the observations with OWN_{it} and $LEASE_{it}$ both equal to 1 or 0, i.e., we focus on firms that in a given year purchase or lease a vehicle but they do not do both.[24] The regression model is:

$$logit\left(\mathrm{E}(OWN_{it} \mid \mathbf{X}_{it})\right) = \beta \mathbf{X}_{it} \tag{1}$$

The vector of covariates includes the logarithm of age, the logarithm of total assets, the ratio of cash over assets, the ratio of turnover over assets, the return on assets (ROA), and the riskiness score. We include a set of NACE 2-digit industry-by-year dummies. We cluster standard errors at the NACE 2-digit level. Column 1 in Table 1 shows that firms that buy instead of rent or lease are safer, and they feature a larger cash-to-assets ratio and profitability. However, there is a negative correlation between the choice to buy instead of lease and firm size, measured by the logarithm of total assets. Therefore, ceteris paribus, large firms tend to rent instead of buy (we get similar results using the number of employees instead of total assets as a measure of firm size). Finally, firms that buy instead of lease have a lower turnover-to-assets ratio.

We do not find, instead, a significant linear correlation between age and the choice to buy instead of rent or lease, and the reason is the non-linear relation between the average number of purchases of used vehicles and age reported in Figure A7. In particular, for new or very young firms, the market of used vehicles is the most important acquisition channel, far outpacing other acquisition arrangements in relevance. Restricting the sample to firms at least 5 years old, the correlation between age and the choice to buy instead of rent or lease is positive and statistically significant (column 2).

[24] An alternative approach is the multinomial logistic model, but the presence of many alternatives would make it difficult to interpret the results. A firm faces the choice of acquiring a vehicle or not. If a firm acquires a vehicle, at least four potential acquisition arrangements exist. Finally, since these choices are not alternatives (a firm can buy and rent), we should consider all possible combinations among these arrangements.

Table 1: Vehicles' acquisition arrangements and firms' characteristics

	OWN		*NEW*	*RENT*
	(1)	(2)	(3)	(4)
Age	0.0080	0.1645***	0.5871***	-0.1322***
	(0.0251)	(0.0236)	(0.0193)	(0.0283)
Total assets	-0.2457***	-0.2510***	0.1096***	0.4103***
	(0.0136)	(0.0145)	(0.0111)	(0.0381)
Cash-to-assets	0.4783***	0.5910***	0.9899***	0.4747***
	(0.1344)	(0.1415)	(0.0681)	(0.0821)
Turnover-to-assets	-0.1673***	-0.2159***	-0.0807***	0.1504***
	(0.0438)	(0.0542)	(0.0102)	(0.0484)
ROA	0.0029*	0.0022	0.0055***	-0.0039
	(0.0015)	(0.0017)	(0.0012)	(0.0026)
Medium-risk	-0.1713***	-0.2444***	-0.4504***	0.0872**
	(0.0201)	(0.0170)	(0.0418)	(0.0388)
High-risk	-0.3319***	-0.3734***	-0.7586***	0.1911***
	(0.0243)	(0.0208)	(0.0624)	(0.0591)
Observations	569,055	485,213	340,145	189,994
Squared Correlation	0.08493	0.08467	0.13248	0.19674
Pseudo R^2	0.06632	0.06524	0.10493	0.15754
BIC	692,978.7	602,375.8	409,559.9	225,180.9
Industry-by-Year FE	✓	✓	✓	✓

Note: This table reports conditional correlations between trading arrangements choices and firms characteristics. Columns (1) and (2) show the results of a logit model for the choice to buy instead of lease (equation 1). Results in column (1) are based on the full sample, while those in column (2) are based on the subset of firms at least 5 years old. Column (3) refers to the choice to buy a new vehicle instead of a used vehicle (equation 2). Finally, column (4) refers to the choice of long-term rental instead of financial leasing (equation 3). Standard errors are clustered at the industry (Nace 2-digit) level. Yearly data for the period 2016-2022.

The second step is to investigate if buying a new vehicle instead of an old one correlates with firm characteristics. We select the observations with OWN_{it} equal to one, and we discard the cases where the firms purchased both a new and an old vehicle. Then, we estimate the following model:

$$logit\left(\mathrm{E}(NEW_{it} \mid \mathbf{X}_{it})\right) = \beta \mathbf{X}_{it} \tag{2}$$

where NEW_{it} is a dummy variable equal to 1 if firms i in year t purchased a new vehicle instead of an old vehicle. The covariates are the same as in equation (1). Older, larger, and less financially constrained firms have a higher propensity to buy new vehicles than old ones (column 3 in Table 1).

Finally, we perform a similar analysis for leased vehicles, looking at potentially significant differences between firms choosing long-term rental and financial leasing. We drop the observations related to firms that in the same year did both operations, and we estimate the following model

$$logit\left(\mathrm{E}(RENT_{it} \mid \mathbf{X}_{it})\right) = \beta \mathbf{X}_{it} \tag{3}$$

where $RENT_{it}$ is a dummy variable equal to 1 if firms i in year t acquired a vehicle through long-term rental instead of financial leasing. Firms choosing long-term rental are younger and larger (column 4 in Table 1). In particular, the data show that several large firms with intensive use of vehicles, such as utilities, prefer long-term rental over purchasing the vehicles. This choice could be due to savings in operating costs for a large fleet of vehicles and explains why, in column 1, we find a negative correlation between firms' size and the choice to purchase the vehicles. Riskier firms feature a higher propensity for long-term rental than financial leasing. Finally, we find that firms choosing long-term rental have a higher cash-to-assets ratio and turnover-to-assets ratio and lower profitability.

These results are consistent with the theoretical literature. Purchasing vehicles requires initial cash availability for a downpayment that young, small, or financially constrained firms may not have. New firms overcome this issue by relying on the market for used vehicles. Alternatively, long-term rental and leasing allow vehicle costs to be spread over several months and greater flexibility in adjusting the stock of vehicles in response to external shocks, such as demand shocks. It is worth noticing that long-term rentals are used by large firms not only as benefits for employees but also in the core production process. Moreover, long-term rental and leasing are relevant acquisition arrangements for other capital goods. According to the yearly Survey of Industrial and Services Firms conducted by Bank of Italy, the share of non-financial firms acquiring new capital goods other than vehicles through leasing was 32% in 2023. Since rental expenses are accounted for as operating costs instead of investments, using only information from balance sheet data results in underestimating the capital stock used in the production process for these firms and, thus, total factor productivity (TFP) estimation.

The widespread diffusion of rental and leasing contracts as acquisition channels of capital goods does not affect the estimation of aggregate productivity, as leased capital is still included in the economy's capital stock. However, there are relevant redistributive implications, as leased capital belongs to lessors but it is used in the production process by the lessees. Therefore, accounting for the real utilization of a capital good would imply an upward revision of TFP estimates for lessors and a downward revision for lessees. Finally, the correlation between firm characteristics and choice between purchase and other acquisition arrangements has implications for estimating the elasticity of investment spending to its main determinants. This estimate is usually obtained in the literature by exploiting balance sheet data. Therefore, it does not consider the possible choice of firms to acquire vehicles through leasing. The choice between different arrangements generates a selection bias, so it is important to consider that variation in investment could be due to the choice of acquisition arrangement and not to the actual availability of capital goods.

4 Reallocation

In a frictionless neoclassical macroeconomic model with homogeneous capital, the efficient allocation of factors is achieved when all firms have the same marginal revenue product of factors in equilibrium. When firms experience idiosyncratic productivity shocks, efficiency requires that production factors, including capital, shift from less efficient to more efficient firms. In reality, various frictions prevent the reallocation of capital among firms (e.g. taxes, regulations, barriers to entry, imperfection in financial markets). However, quantifying the impact of these frictions and, more generally, studying the mechanism of capital reallocation is complex due to limited data availability. Capital reallocation occurs in several secondary markets, but until now, direct observation of trade in these markets has been scant. Our dataset addresses this limitation because it contains all transactions in the used vehicle market, allowing us to observe the characteristics of both counterparts and the vehicles (that is, capital).

In this section, we document stylized facts about the reallocation of used vehicles and the characteristics of buyers and sellers. For this analysis, we consider only purchases of used vehicles where the buyer is firm and the seller is a dealer or another firm.[25] We then split this sample into two subsets depending on whether the seller is an intermediary (dealer) or a firm using vehicles in its production process. Transactions involving a dealer account for approximately 60% of the sample. In business-to-business (not-intermediated) transactions, we can immediately identify the characteristics of the firms. For transactions involving intermediaries, we constructed the chain of owners of all motor vehicles, exploiting all transactions in the dataset since 2015.[26] Then, we trace the chain of transactions back to the original seller of the vehicle. Through this procedure, we find that the original seller is a firm in almost 20% of the observations. In the remaining operations, we find that the original seller was a dealer or a household.[27]

We focus on reallocation along five dimensions: *(i)* NACE 1-digit sector, *(ii)* region (NUTS-2) where the firm is located, *(iii)* age, *(iv)* size in terms of employment, and *(v)* productivity, defined as value added per worker. For each of these dimensions, we consider separately the case of direct business-to-business (B2B) transactions and the case of transactions via dealers (D2B). Our final

[25] Therefore, we remove all operations where the seller is a household, which accounts for approximately one-third of the total purchases of used vehicles by firms. It should be noted that the household sector includes self-employed individuals.

[26] For building the chain of the owners, we used all transactions of the original datasets, including dealer-to-dealer and dealer-to-household transactions.

[27] In about 60% of these operations the original seller was a dealer, while in the remaining 40% it was a household. Several reasons may explain the prevalence of transactions in which the original seller is a dealer. First, our dataset is truncated to January 1, 2015, so for many dealer-intermediated transactions early in the sample we do not observe all previous transactions. Second, the dealer may actually be the original owner of a vehicle. In fact, it is very common in Italy for dealers to register new vehicles at the end of the year (to achieve sales targets set by carmakers) and then resell them to households and businesses as used vehicles (so-called *Km0 vehicles*). Third, we do not distinguish between dealers and rental companies because, in many cases, companies do both activities. However, in several cases, these could be car sales by rental companies following the renewal of their vehicle fleets.

Table 2: Shares of used vehicles that remain within the same sector

NACE code	A Agriculture	B Mining	C Manufacturing	D Energy supply	E Water supply	F Construction	G Trade
B2B	0.28	0.24	0.54	0.29	0.50	0.65	0.54
D2B	0.04	0.02	0.30	0.02	0.11	0.37	0.33

NACE code	H Logistics	I Accommodation and food	J Information and communication	K Financial activ.	L Real estate	M Professional activ.	N Support service activ.
B2B	0.74	0.36	0.46	0.54	0.16	0.32	0.45
D2B	0.25	0.06	0.05	0.06	0.06	0.07	0.08

Note: This table reports the shares of vehicles that remain in the same sector out of the total acquired by the same sector. The first row refers to direct trade between firms (B2B). The second row shows the shares in case of intermediated trade (D2B).

sample includes about 390 thousand B2B transactions and 95 thousand D2B transactions.

Starting with reallocation between sectors, 56% of vehicles remain within the same sector in the case of direct trade between firms.[28] Conversely, when transactions are mediated by dealers, only 27% of vehicles remain within their sector of origin. In Table 2, the shares of used vehicles acquired from the same NACE sector out of the total acquisitions are reported for each NACE. The first row reports the shares in the case of direct B2B trade, while the second row reports the shares in the case of intermediated D2B transactions. We note that the figures are consistently lower when a dealer is involved, suggesting that market dealers generate a greater reallocation of vehicles among different sectors.

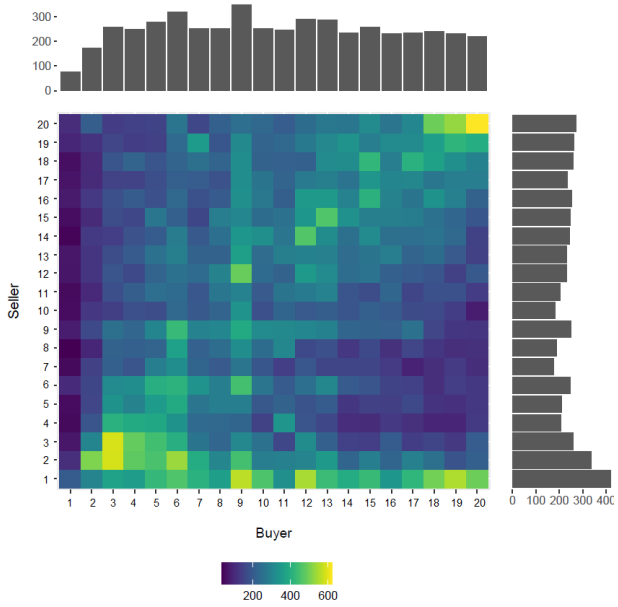
Reallocation is more limited across the spatial dimension. Intra-regional used vehicle transactions account for 78% of B2B direct transactions. Even when mediated by a dealer, the majority of vehicles (53%) remains within the same region. This finding is surprising, as vehicles are generally regarded as the easiest capital assets to relocate due to their relatively low moving costs, even over long distances. However, this pattern might indicate challenges in monitoring the quality of the assets, which could discourage long-distance transactions.

Considering firms' age and size, most transactions occur between young and small firms. In the case of B2B purchases by firms up to 5 years old, about 43% of the transactions are with firms up to 10 years old. For mediated transactions, the previous share is about 28%, which implies a significant increase in flows from older to younger firms. Strong segmentation in the market for used vehicles also emerges concerning firm size. More than 50% of business-to-business exchanges by firms with fewer than five employees is with firms of the same size, while in the case of transactions through a dealer, this share is about 33%.

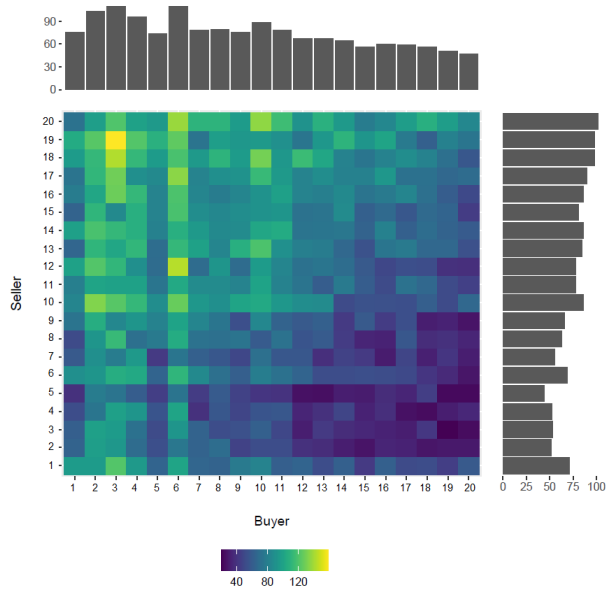
Finally, we investigate the role of productivity, defined as the nominal value added per worker.

[28]The most active sectors in this used market are manufacturing (C), construction (F), trade (G), and transportation and logistics (H), which account for approximately 75% of the total transactions.

Figure 3: Reallocation by productivity



(a) Business-to-business



(b) Business-to-dealer

Note: This chart shows the flows of vehicles across firms of different productivity – computed as value added per worker – in the case of direct trade between firms (panel a) or when the transaction is intermediated by dealers (panel b). Each heatmap represents a matrix whose $(i, j)-$th element is the number of vehicles sold by firms with productivity in the interval i to firms with productivity in the interval j. The histograms show the marginal distributions of sellers and buyers.

The heatmaps shown in Figure 3 illustrate the distribution and volume of vehicle transactions between firms with varying productivity levels. Each heatmap represents a matrix whose $(i, j)-$th element indicates the number of vehicles sold by firms with productivity in row i to firms with productivity in column j. In the case of B2B (panel a), we observe two facts. First, companies with negative productivity, indicating financial distress, are selling a considerable number of vehicles to companies with positive productivity. This phenomenon can be attributed to the need for struggling companies to liquidate assets in order to alleviate financial pressure, while productive companies, benefiting from stable financial positions, can take advantage of discounted prices to expand their fleet or replace existing vehicles at a lower cost. Second, a more interesting trend lies in the significant exchange of vehicles among the most productive companies. This may reflect efficient fleet management practices within specific industries. In fact, productive companies often maintain larger fleets due to operational demands, necessitating regular updates and replacements. The pattern of transactions facilitated by dealers is quite different: the majority of exchanges occur from more productive companies to less productive ones. There are alternative hypotheses that can potentially explain this result. Selling to dealers can be a residual choice for high-productivity firms if they cannot find a direct buyer or they do not want to bear search costs. Moreover, selling used capital goods to dealers may allow these companies to upgrade their inventory faster. We leave the investigation of the causes of this phenomenon for future research.

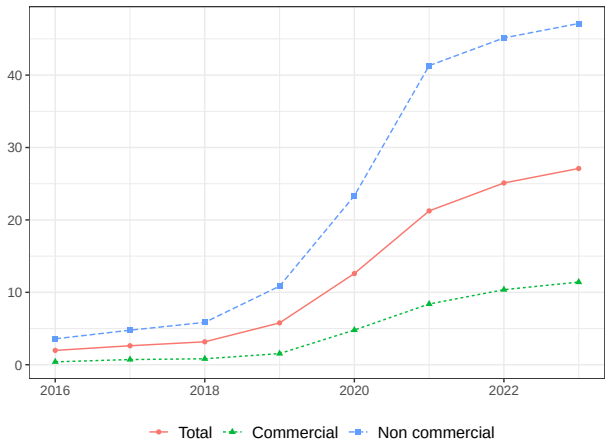
Overall, these results provide three important insights. First, young and small businesses are the most active in the used vehicle market. Since young firms have an important role in business cycle dynamics, frictions in the market for used capital can have relevant macroeconomic effects. Second, the market for used vehicles is segmented along different dimensions, and market dealers generate greater reallocation of vehicles among different sectors or types of firms. Whether the benefits of increased reallocation outweigh brokerage costs is an empirical question to investigate. Finally, the reallocation of used vehicles across industries is limited, even if we observe that the presence of dealers facilitates it. This result is unexpected because vehicles are presumed to be easily reallocated, as they are generally versatile across sectors. This result implies that for other types of capital goods, we should expect even greater difficulties in reallocation.

5 The adoption of a green technology: electric vehicles

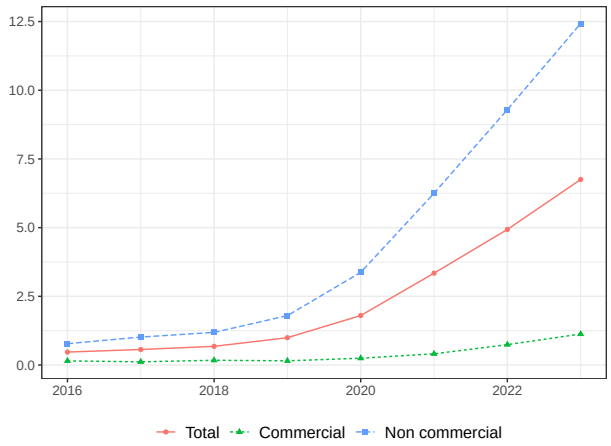
In this section, we provide a concise picture of firms' adoption of electric and hybrid vehicles. To do so, we present the evolution of the share of vehicles powered, at least partially, by electricity, distinguishing between commercial and non-commercial vehicles. Moreover, we show how the propensity to acquire green vehicles is correlated with firms' characteristics.

Following a widespread convention, we define both hybrid (mild and full hybrid) and fully electric vehicles as green vehicles. The share of acquisitions of green vehicles by non-financial companies

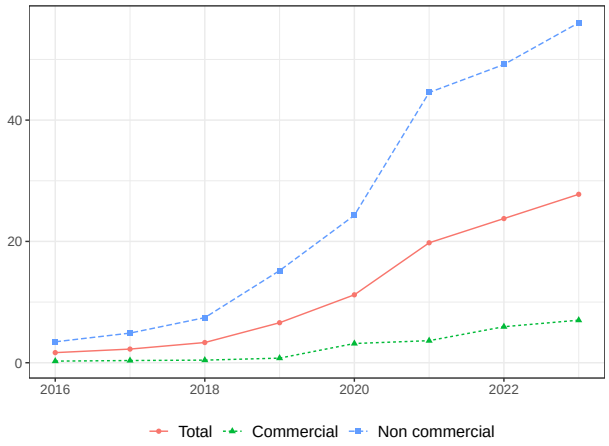
Figure 4: Green technology adoption



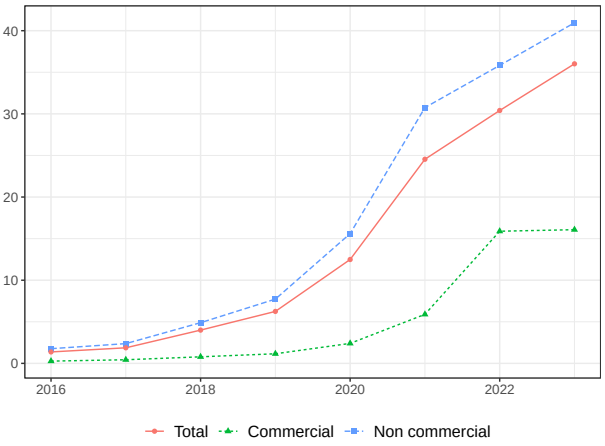
(a) Purchases of new vehicles



(b) Purchases of used vehicles



(c) Acquisitions through financial leasing



(d) Long-term rentals

Note: This figure reports the share of green motor vehicle acquisitions by contractual arrangement and type of vehicle. Green vehicles include hybrid (mild and full hybrid) and fully electric vehicles.

has risen dramatically in recent years (Figure 4). Starting from about 3% in 2016 for all types of operations, in 2023 it reached about 35% for rentals and 27% for purchases of new vehicles and financial leasing. Looking at the purchases of used vehicles, we see that the share of green vehicles is still about 7% in 2023, possibly because of the low supply of used green vehicles, reflecting the fact that the technology is relatively new. These dynamics benefited somewhat from fiscal incentives to the substitution of high-emission vehicles with lower-emission ones. In general, though, such incentives have been weaker in Italy than in other EU countries, such as the Netherlands, France, and Germany.

For all types of operations, adopting green commercial vehicles seems to be much slower than

adopting green cars. This may reflect the lower availability of green commercial vehicle models compared to cars. However, the larger share of green commercial vehicles among rentals may indicate that firms may also face uncertainty in adopting these new technologies, and therefore, they favor more flexible acquisition solutions.

As in Section 3, we perform a regression analysis to identify conditional correlations between the propensity to acquire green vehicles and firms' characteristics. To do so, we exploit the same unbalanced panel described in Section 3. Then, we create new variables for the total number of green vehicle acquisitions and the number of green vehicles by type of operation. As most companies do not perform vehicle acquisition every year, and the acquisition is lumpy, we run the following Poisson regression:

$$\log\left(\mathrm{E}(y_{it}^{g} \mid \mathbf{X}_{it})\right) = \beta \mathbf{X}_{it} + \delta z_{it} \tag{4}$$

where $\mathbf{X}_{it}$ is the same set of covariates we considered in equations (1)-(3). The dependent variable y_{it}^{g} is the number of acquisitions of green vehicles by firm i in year t, and we control for the total number of operations made in the same year, z_{it}. As before, we include a set of NACE 2-digit industry-by-year dummies, and we cluster standard errors at the NACE 2-digit level.

We estimate equation (4) separately for total acquisitions and for each operation separately. Column (1) in Table 3 shows that the propensity to acquire green vehicles is higher for younger firms (presumably as these firms hold fewer legacy assets) and is positively correlated with total assets, the ratio of turnover to assets, and the return on assets. We observe a negative conditional correlation with the cash-to-assets ratio and the firm's riskiness. However, as observed in Section 3, firms' characteristics plausibly affect the choice of the acquisition arrangement. Therefore, the results in column (1) conflate the relationship of firms' characteristics with the propensity to acquire green vehicles and the choice of trading arrangement.

For this reason, Table 3 reports the results when considering separately the purchases of new vehicles (column 2), the purchases of used vehicles (column 3), the acquisitions through financial leasing (column 4), and rentals (column 5). The acquisition of green vehicles is positively correlated with total assets, the ratio of turnover to assets, and the return on assets independently of the trading arrangement. The correlation with firms' age and the cash-to-assets ratio is generally negative, except for the purchases of new vehicles. A potential explanation for this result is that green vehicles, ceteris paribus, are more expensive than standard gasoline-powered vehicles. Finally, safer firms feature a higher propensity to purchase green vehicles under all trading arrangements except for rentals. In the latter case, there is no significant correlation between a firm's riskiness and the propensity to rent green vehicles.

Our data would allow further analysis, disaggregating adoption by industry and firm character-

Table 3: Green vehicles' acquisitions and firms' characteristics

	ACQ_g (1)	NEW_g (2)	$USED_g$ (3)	$LEAS_g$ (4)	$RENT_g$ (5)
Age	-0.0779**	0.2153***	-0.1725***	-0.0921***	-0.1340***
	(0.0311)	(0.0429)	(0.0398)	(0.0296)	(0.0358)
Total assets	0.6521***	0.4114***	0.4737***	0.4324***	0.8036***
	(0.0117)	(0.0182)	(0.0222)	(0.0217)	(0.0218)
Cash-to-assets	-0.4491***	0.2614*	-0.1932***	-0.7284***	-0.7812***
	(0.0903)	(0.1432)	(0.0596)	(0.0683)	(0.1243)
Turnover-to-assets	0.1592***	0.0195	0.1210***	0.1414***	0.1951***
	(0.0420)	(0.0273)	(0.0376)	(0.0346)	(0.0476)
ROA	0.0081***	0.0121***	0.0078***	0.0101***	0.0071***
	(0.0016)	(0.0016)	(0.0020)	(0.0008)	(0.0022)
Medium-risk	-0.1532***	-0.4200***	-0.1909***	-0.0117	-0.0993
	(0.0464)	(0.0285)	(0.0393)	(0.0246)	(0.0626)
High-risk	-0.3046***	-0.7182***	-0.3791***	-0.2303***	-0.1803**
	(0.0622)	(0.0833)	(0.0631)	(0.0858)	(0.0798)
Observations	2,356,990	2,347,590	2,314,537	2,343,099	2,298,513
Squared Correlation	0.25708	0.07522	0.02373	0.00177	0.53030
Pseudo R^2	0.27553	0.15248	0.13726	0.13266	0.35121
BIC	837,842.9	254,676.3	127,696.1	221,855.6	481,011.4
Industry-by-Year FE	✓	✓	✓	✓	✓

Note: This table reports conditional correlations between the amount of green motor vehicle acquisitions and firms characteristics. Green vehicles include hybrid (mild and full hybrid) and fully electric vehicles. Column (1) shows the results of a Poisson regression of the number of acquisitions of green vehicles and firm characteristics, controlling for the total number of acquisitions (equation 1). Columns (2)-(5) report the results by acquisition arrangement. Standard errors are clustered at the industry (Nace 2-digit) level. Yearly data for the period 2016-2022.

istics. Future work in progress will focus on these more extensive analyses.

6 Conclusions

This paper documents new facts about business investment and capital reallocation by exploiting a comprehensive administrative dataset of firms' vehicle transactions from the Italian Department of Transport. First, we show that firms lease a large share of vehicles. Second, the choice of the type of vehicle acquired (new or used) and the contractual arrangement (outright purchases or leasing) is correlated with firm characteristics. Cash-constrained and riskier firms show a higher propensity to lease over purchase, and very young firms rely heavily on the market for used vehicles. Third, the market for used vehicles is segmented along different dimensions, and market dealers generate a greater reallocation of vehicles among different sectors or types of firms than direct transactions, which typically occur within the same geographical area, industry, and between firms of similar size and productivity. However, overall, the reallocation of used vehicles remains limited in some dimensions, even in the presence of dealers, and despite the fact that vehicles are a relatively less

specific capital good.

Our results have relevant implications for policy and analysis. By standard accounting rules, investments are defined as purchases of vehicles. Therefore, given the large share of leased and rented vehicles and the survey evidence related to other capital goods that we discussed in the introduction, the amount of capital goods that companies employ in production may be significantly underestimated according to the standard definition. Moreover, standard models of business investments exploiting monetary measures of investments from balance sheets and surveys may be mis-specified because they do not consider that the choice of purchasing capital goods and the quality of the goods are correlated with firms' characteristics. Finally, the limited reallocation of used vehicles in some dimensions is surprising because vehicles are considered the easiest capital assets to reallocate, as vehicles are generally not specific to individual firms or industries. This result suggests that for other types of capital goods, we should expect even greater difficulties in reallocation.

This paper is the first example of the potential offered by this new database we have built. Each stylized fact we explored in this paper calls for further in-depth investigations to identify robust causal relationships. In addition, this dataset can enable us to answer several highly relevant questions about the relationship between asset specificity and firm liquidity, the determinants of investment, the adoption of new technologies, and the role of intermediaries in the allocation of capital goods. We leave these questions for future research.

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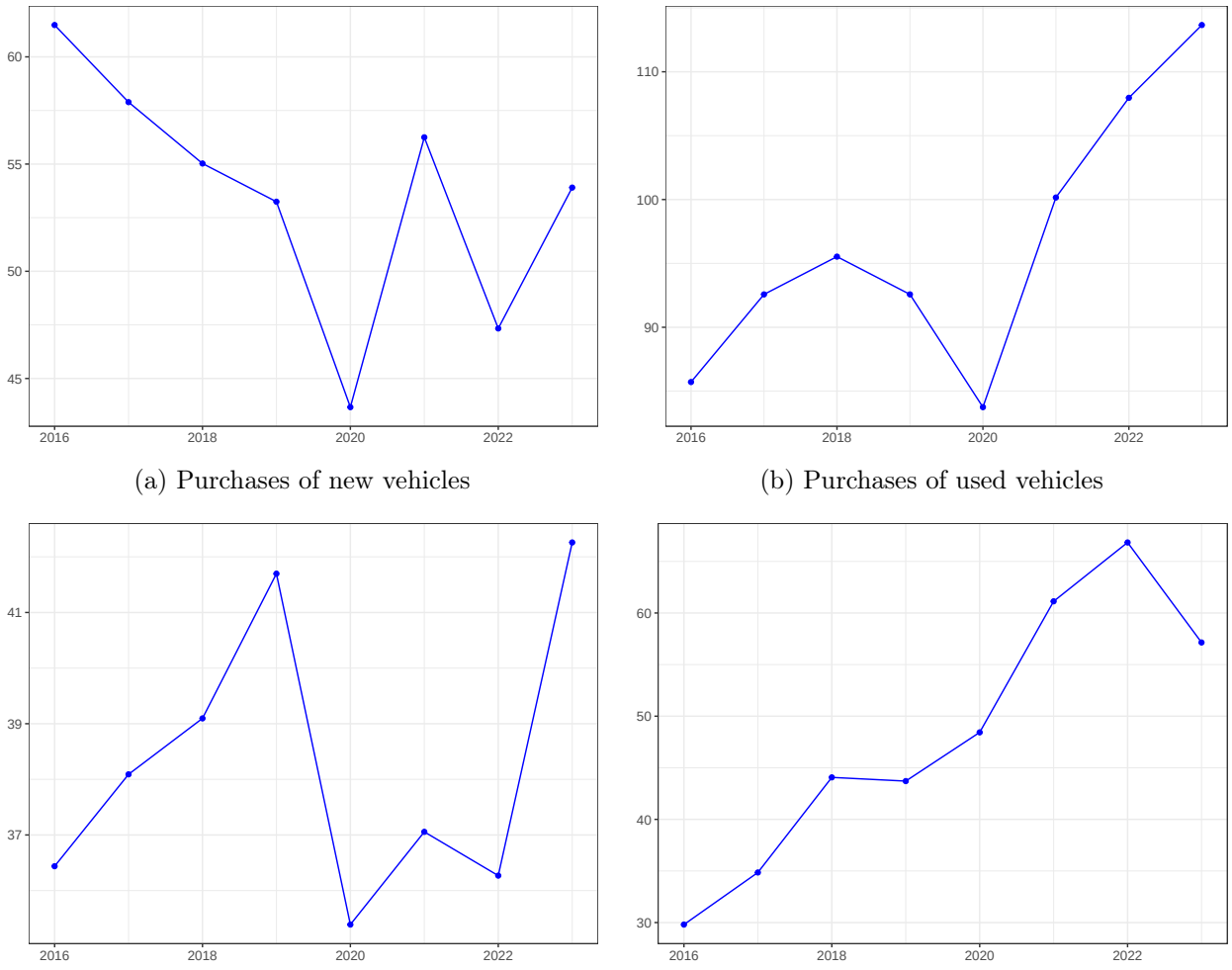
Appendix

A Tables and figures

Figure A1: Main trends for commercial vehicles



(a) Purchases of new vehicles

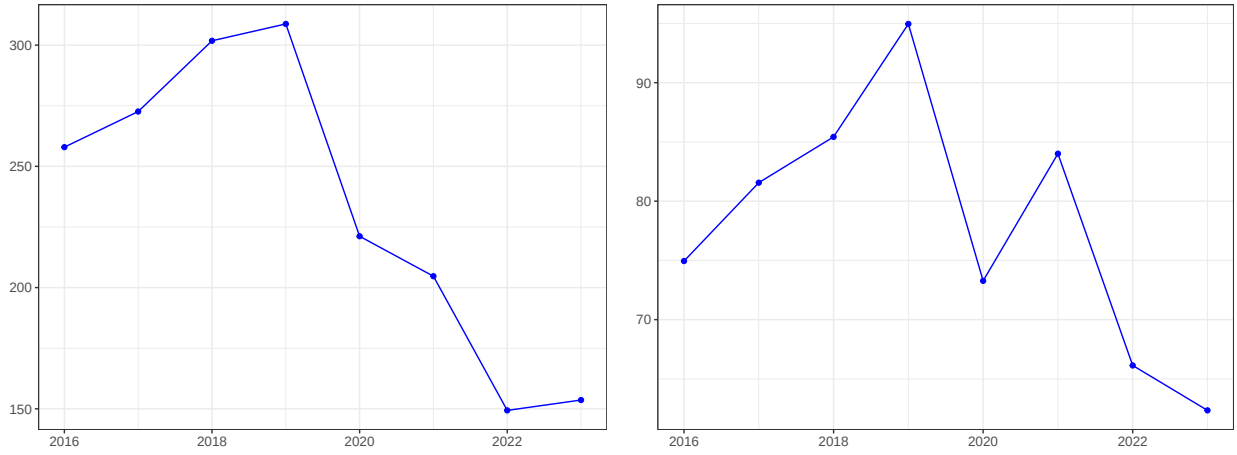
(b) Purchases of used vehicles

(c) Acquisitions through financial leasing

(d) Long-term rentals

Note: This figure shows the annual number of transactions for the four main motor vehicle acquisition arrangements. Only commercial vehicles are included. Values on the y-axis are in thousands.

Figure A2: Vehicle cancellations

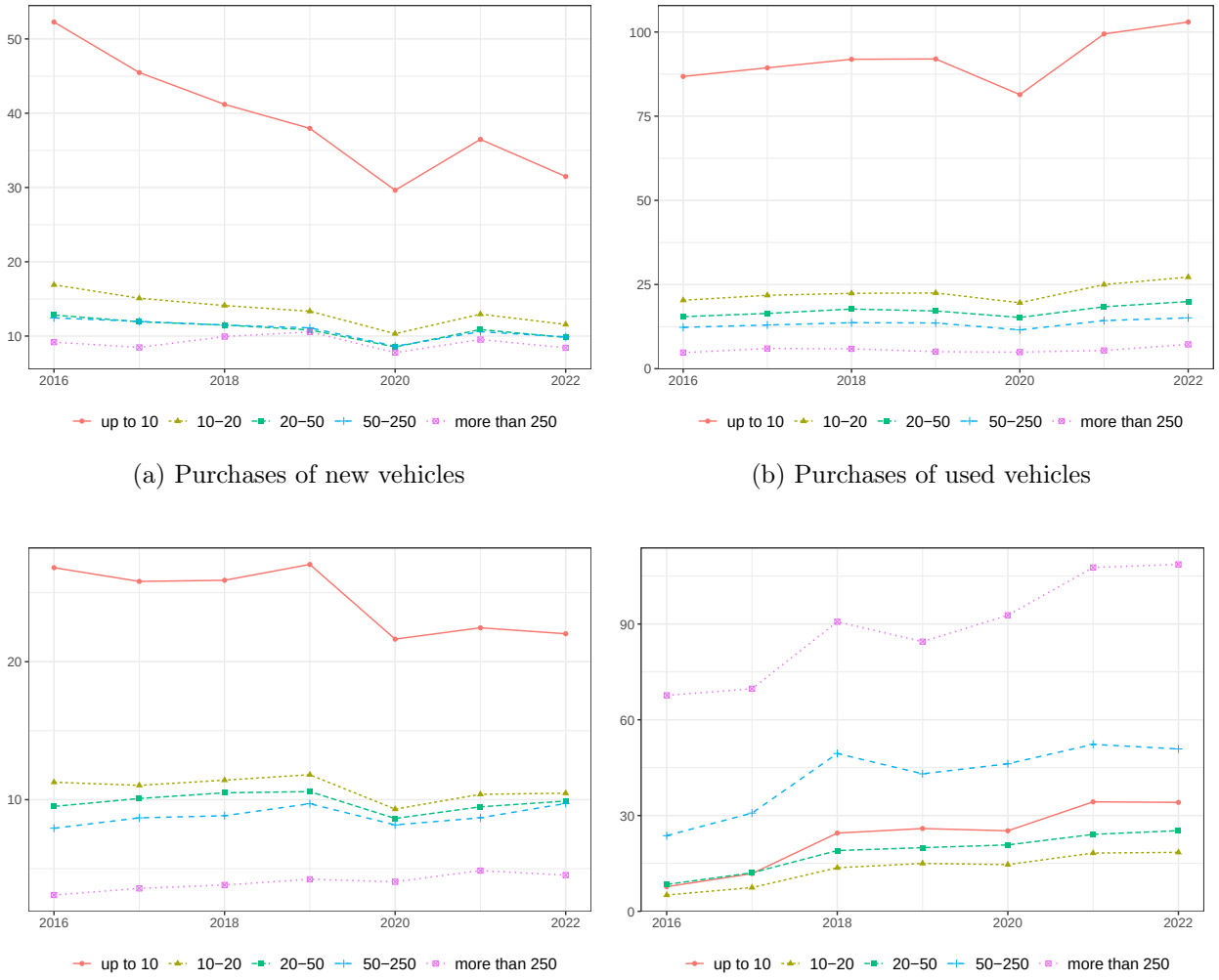


(a) Non Commercial Vehicles

(b) Commercial Vehicles

Note: This figure shows the annual number of cancellations for cars and commercial vehicles. Commercial vehicles include all vehicles in categories M, except for M1 and M1G, and N (i.e., buses and trucks). Values on the y-axis are in thousands.

Figure A3: Operations by firm sizes



(a) Purchases of new vehicles

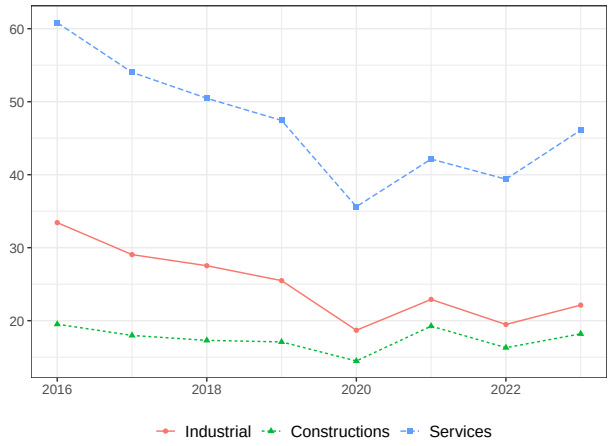
(b) Purchases of used vehicles

(c) Acquisitions through financial leasing

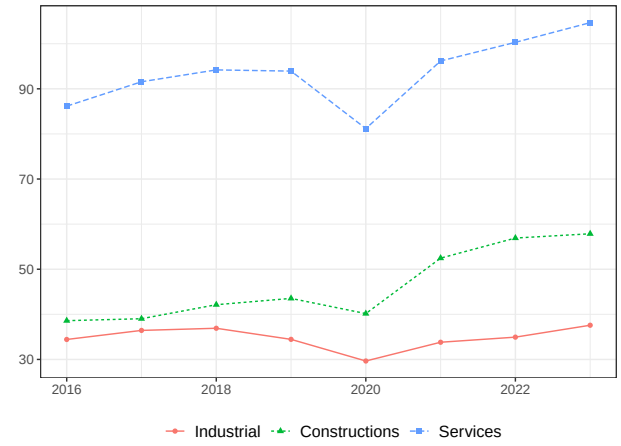
(d) Long-term rentals

Note: This figure shows the annual number of transactions of motor vehicles by acquisition arrangement and firms' number of employees. Both cars and commercial vehicles are included. Values on the y-axis are in thousands.

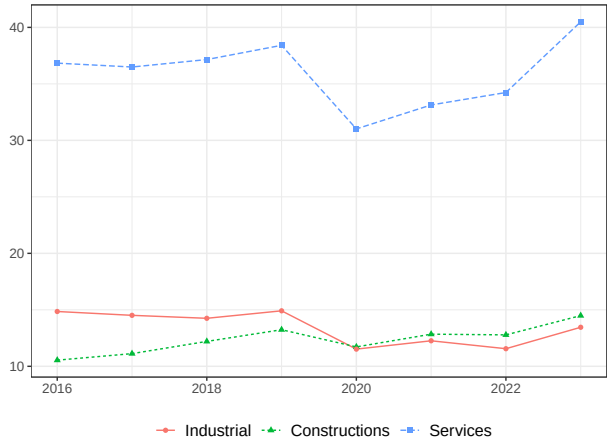
Figure A4: Operations by macrosector



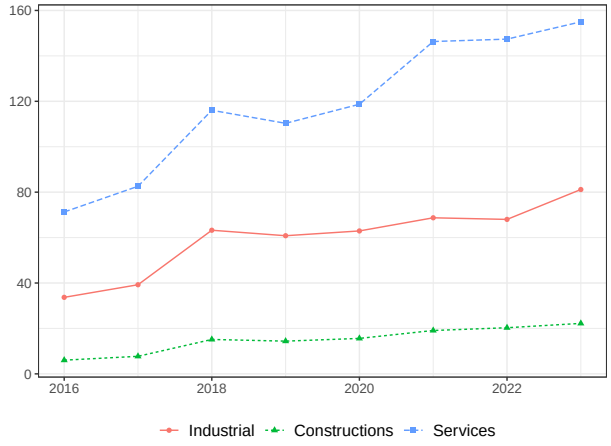
(a) Purchases of new vehicles



(b) Purchases of used vehicles



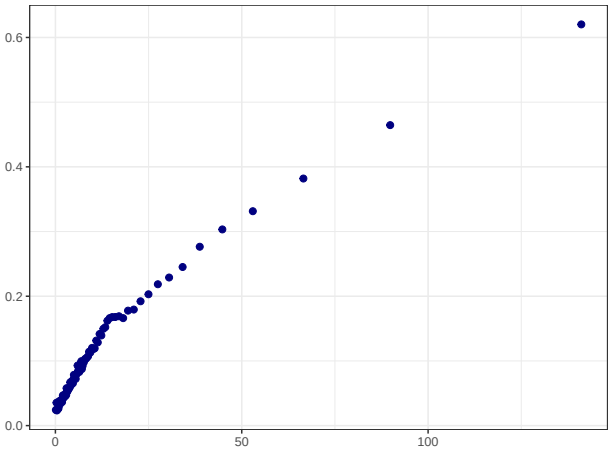
(c) Acquisitions through financial leasing



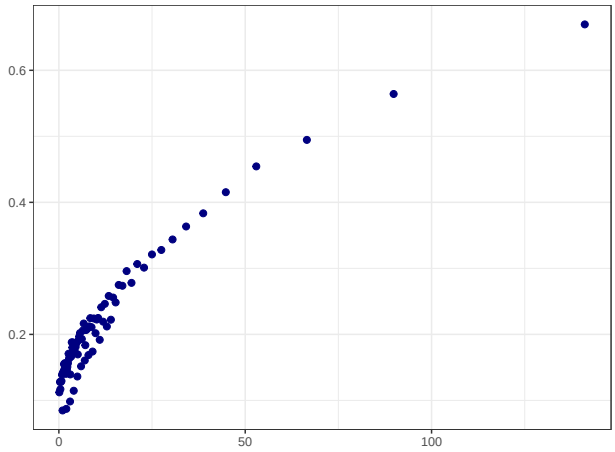
(d) Long-term rentals

Note: This figure shows the annual number of transactions of motor vehicles by acquisition arrangement and economic sector. Both cars and commercial vehicles are included. Values on the y-axis are in thousands.

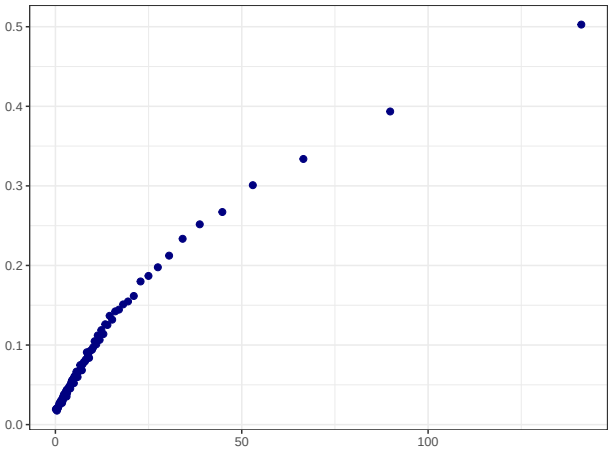
Figure A5: Vehicles acquisitions and firm's size (number of employees)



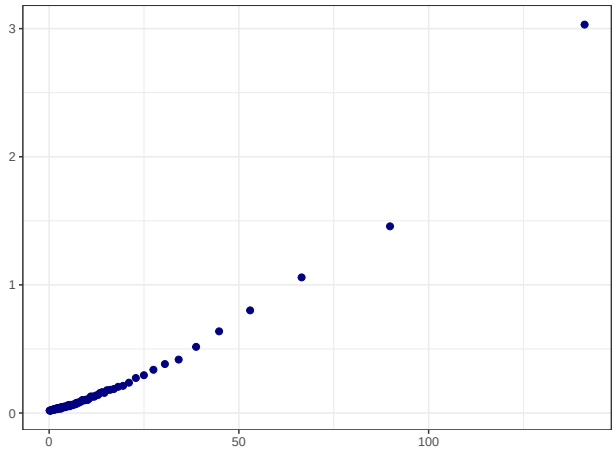
(a) Purchases of new vehicles



(b) Purchases of used vehicles



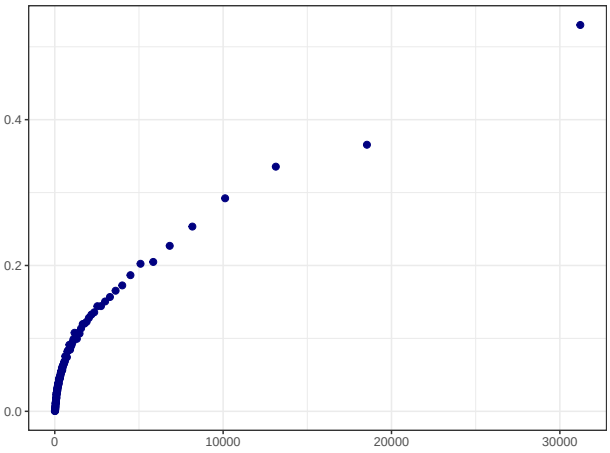
(c) Acquisitions through financial leasing



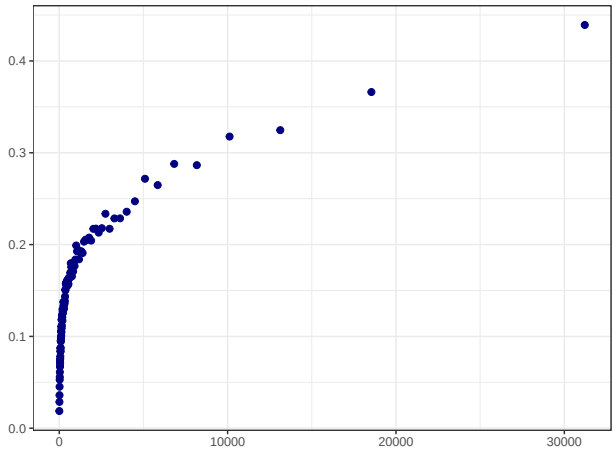
(d) Long-term rentals

Note: This figure displays the binscatter plots of the average number of motor vehicle acquisitions by firms' number of employees. We divide the support of the distribution of the covariate variable into 100 bins and use the marginal empirical quantiles of the covariate to space the bins. We trimmed the covariate at 99^{th} percentile of the distribution.

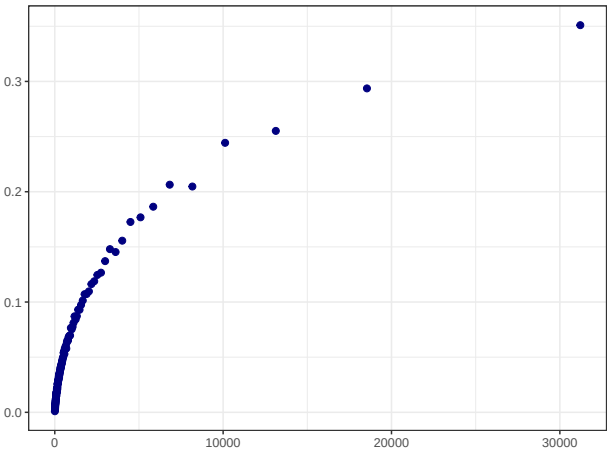
Figure A6: Vehicles acquisitions and firm's size (total assets)



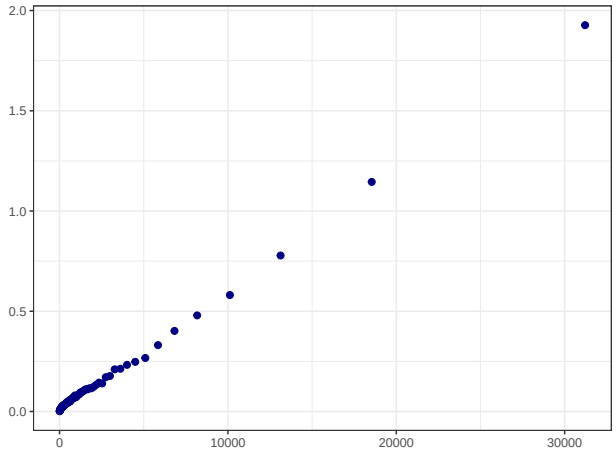
(a) Purchases of new vehicles



(b) Purchases of used vehicles



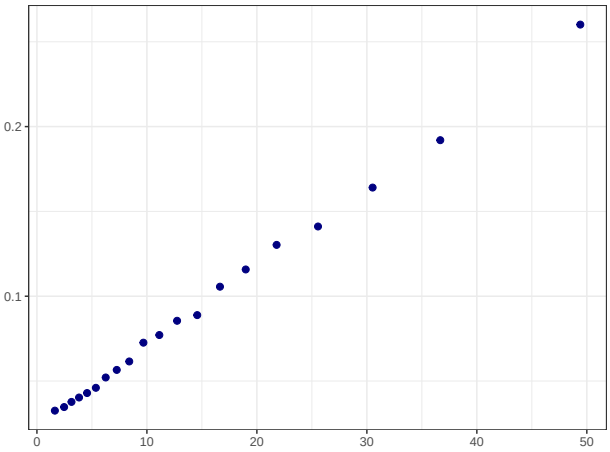
(c) Acquisitions through financial leasing



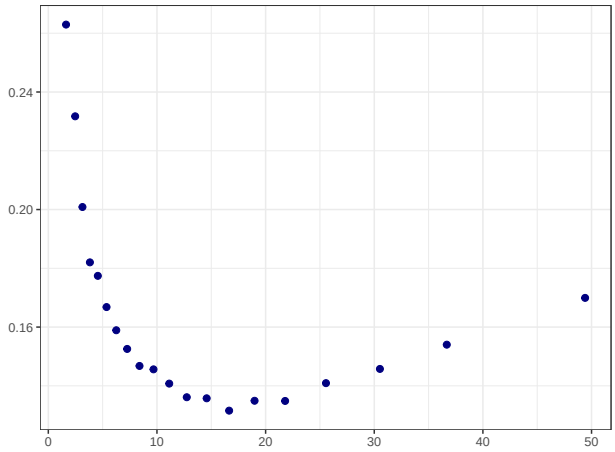
(d) Long-term rentals

Note: This figure displays the binscatter plots of the average number of motor vehicle acquisitions by firms' total assets. We divide the support of the distribution of the covariate variable into 100 bins and use the marginal empirical quantiles of the covariate to space the bins. We trimmed the covariate at 99^{th} percentile of the distribution.

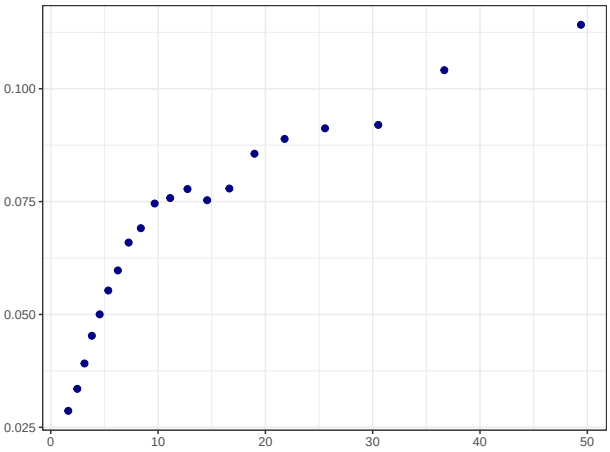
Figure A7: Vehicle acquisitions by age



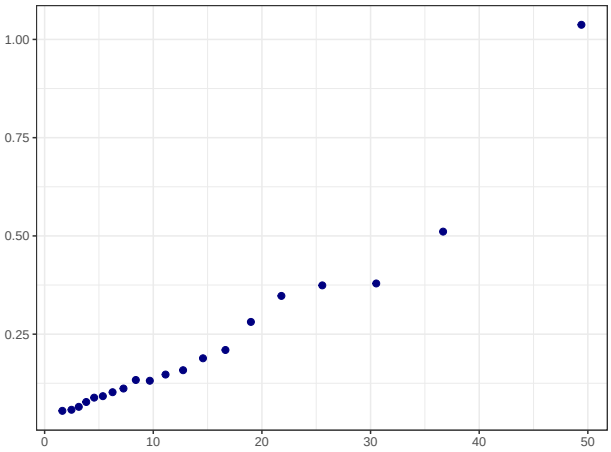
(a) Purchases of new vehicles



(b) Purchases of used vehicles



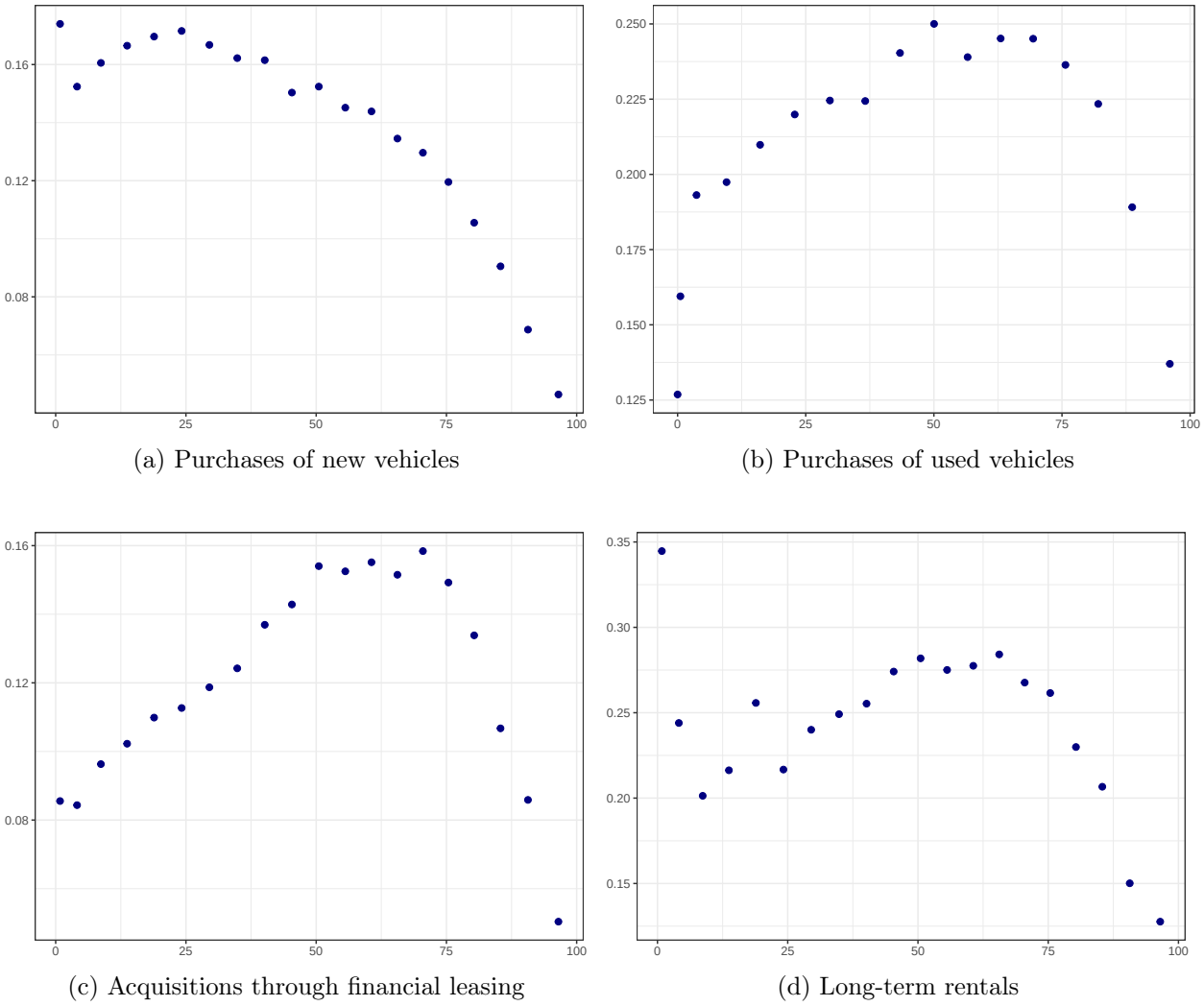
(c) Acquisitions through financial leasing



(d) Long-term rentals

Note: This figure displays the binscatter plots of the average number of motor vehicle acquisitions by firms' age (in years). We divide the support of the distribution of the covariate variable into 20 bins and use the marginal empirical quantiles of the covariate to space the bins.

Figure A8: Vehicle acquisitions by leverage



(a) Purchases of new vehicles

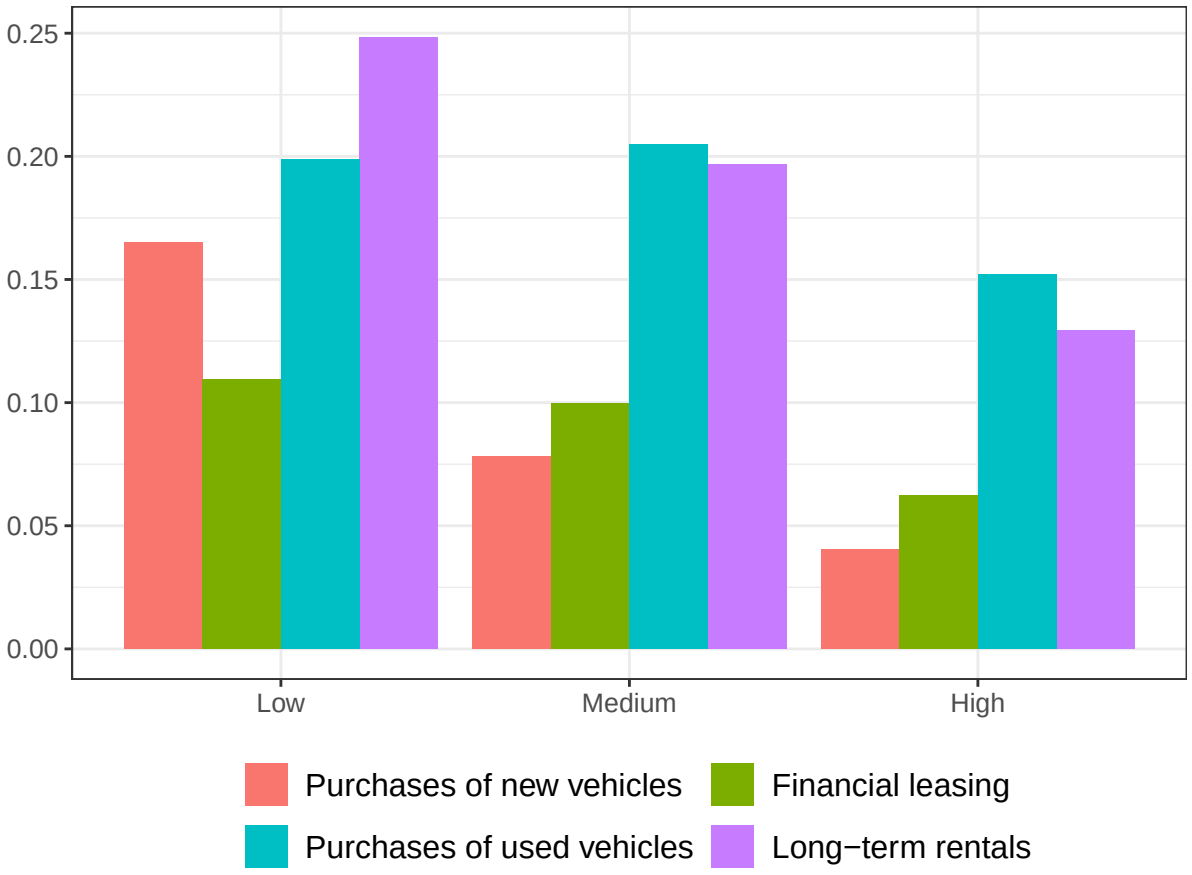
(b) Purchases of used vehicles

(c) Acquisitions through financial leasing

(d) Long-term rentals

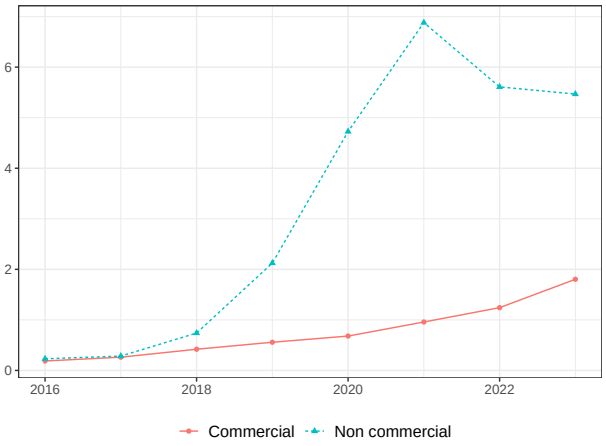
Note: This figure displays the binscatter plots of the average number of motor vehicle acquisitions by firms' leverage (defined as financial debt out to financial debt and equity). We divide the support of the distribution of the covariate variable into 20 bins and use the marginal empirical quantiles of the covariate to space the bins.

Figure A9: Vehicle acquisitions by riskiness

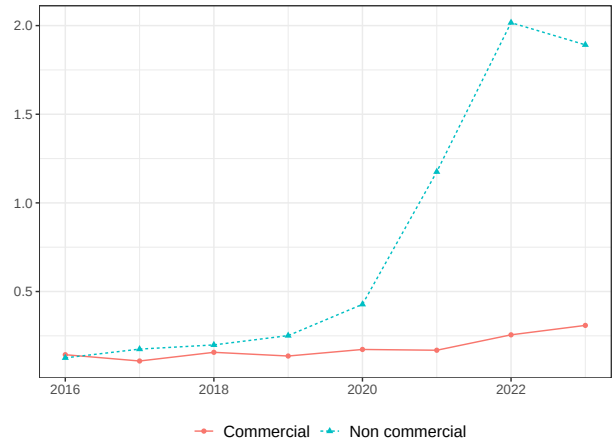


Note: This figure displays the average number of motor vehicle acquisitions by contractual arrangement and firms' riskiness. Riskiness is measured through a score variable classifying firms into three categories (low, medium, and high risk) according to the probability of default. The score is a discretization of the probability of default and it is computed by Cerved, the data provider.

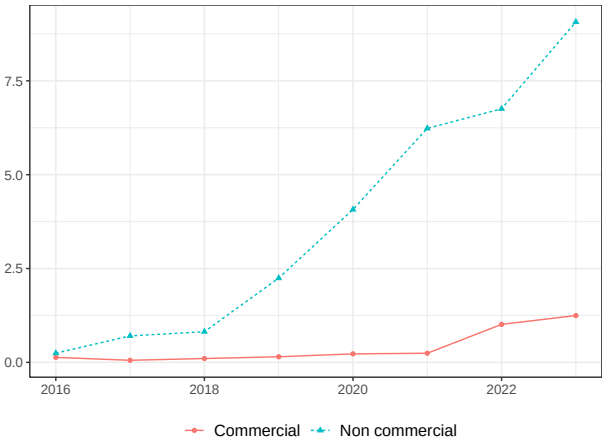
Figure A10: Green technology adoption: electric vehicles



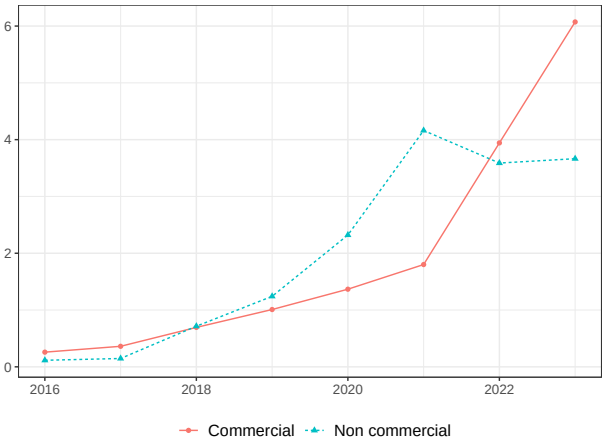
(a) Purchases of new vehicles



(b) Purchases of used vehicles



(c) Acquisitions through financial leasing



(d) Long-term rentals

Note: This figure reports the share of green motor vehicle acquisitions by contractual arrangement and type of vehicle. Green vehicles include only fully electric vehicles.

Table A1: Descriptive statistics: Cars

		Min	1	25	50	75	99	Max	Mean	St.dev.	Missing
Weight		733.00	1170.00	1795.00	2000.00	2290.00	3230.00	3500.00	2050.18	436.68	0
Horsepower		20.00	40.00	74.00	96.00	125.00	316.00	746.50	106.06	52.08	561
Engine displacement		435.00	875.00	1461.00	1598.00	1995.00	3606.00	64174.00	1788.95	570.47	47671
CO_2 emissions - ENEDC		0.00	34.00	109.00	125.00	148.00	267.00	999.00	132.20	39.78	83628
Nox emissions - ENEDC		0.00	0.00	0.02	0.04	0.06	0.24	9.30	0.05	0.07	325639
CO_2 emissions - WLTP		4.00	25.00	124.00	138.00	158.00	257.00	456.00	141.68	41.69	1327465
Nox emissions - WLTP		0.30	2.30	18.30	28.70	40.50	70.00	122.00	30.07	15.75	1322178
		N	Freq.								
Vehicle category	M1	2159216	91.8								
	M1G	191837	8.2								
Power supply	Fossil	1978989	84.2								
	Hybrid	324374	13.8								
	Electric	47690	2.0								
European standard	Euro 6	1785035	75.9								
	Euro 5	207841	8.8								
	Euro 4	178529	7.6								
		128505	5.5								
	Others	51143	2.2								

Note: This table reports summary statistics about the characteristics of cars in the sample. Cars include all vehicles in categories M1 and M1G.

Table A2: Descriptive statistics: Commercial vehicles

		Min	1	25	50	75	99	Max	Mean	St.dev.	Missing
Weight		500.00	1440.00	2040.00	3000.00	3500.00	28150.00	360000.00	5388.37	6641.47	896
Horsepower		20.00	46.00	70.50	88.00	110.00	387.00	998.00	118.90	87.84	1926
Engine displacement		22.87	999.00	1499.00	1997.00	2800.00	12902.00	66900.00	3330.05	3457.54	14514
CO_2 emissions - ENEDC		0.00	0.00	120.00	156.00	200.00	336.00	999.00	164.82	67.39	537579
Nox emissions - ENEDC		0.00	0.01	0.04	0.07	0.21	6.47	99.98	0.42	1.25	456867
CO_2 emissions - WLTP		28.00	108.00	140.00	168.00	228.00	368.00	445.00	185.01	59.32	1401814
Nox emissions - WLTP		1.90	7.00	32.00	42.05	52.29	109.00	132.30	44.51	19.23	1397621
		N	Freq.								
Vehicle category	N1	1435216	79.5								
	N3	221479	12.3								
	N2	60268	3.3								
	N1G	46230	2.6								
	M3	32623	1.8								
	N3G	5001	0.3								
	M2	2431	0.1								
		2278	0.1								
Power supply	Fossil	1752030	97.0								
	Hybrid	39762	2.2								
	Electric	13747	0.8								
		57	0.0								
European standard	Euro 6	1060585	58.7								
	Euro 5	294542	16.3								
	Others	247898	13.7								
	Euro 4	184895	10.2								
		17676	1.0								

Note: This table reports summary statistics about the characteristics of commercial vehicles in the sample. Commercial vehicles include all vehicles in categories M, except for M1 and M1G, and N (i.e., buses and trucks).