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CONSUMPTION DURING THE COVID-19 PANDEMIC: EVIDENCE FROM ITALIAN CREDIT CARDS

by Simone Emiliozzi*, Concetta Rondinelli* and Stefania Villa*

Abstract

This study analyzes high-frequency data on credit cards to identify the impact of the COVID-19 pandemic on Italian consumer transactions. Using an event study approach, it finds that during the national lockdown total transactions fell by over 50%. The decline was particularly severe in high-contact sectors such as restaurants and travel, reflecting the impact of containment measures. The analysis uncovers a strong heterogeneity also in the responses of different regions, with larger contractions recorded in the Northern regions due to early government restrictions. Overall, this dataset can be particularly useful given the publication lag of official data on household consumption both at the national and regional level.

JEL Classification: D12, E21.

Keywords: consumption, transaction data, COVID-19.

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Contents

1. Introduction	5
2. Credit-cards transaction data	7
2.1 A preliminary look at the data	8
3. The event study approach	12
4. The effects of the COVID-19 pandemic on credit-card transactions	15
4.1 Exploring the expenditure categories	15
4.2 Exploring the regional dimension	18
5. Conclusions	19
References	21
Appendix	24

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1 Introduction¹

This paper uses a confidential dataset of daily data of a representative sample of transactions from credit cards and international circuit debit cards (Visa and Mastercard) to assess the impact of the first wave of COVID-19 pandemic on domestic transactions in Italy via an event study analysis.² The timeliness of these data helps to overtake the publication lag of official data on household consumption released by the national office of statistics (Istat).

To track economic activity in a timely manner due to the rapid evolution of the pandemic, novel sources of data, in particular high frequency data, have immediately been used (see Aruoba et al., 2009; Delle Monache et al., 2020; Locarno and Zizza, 2020; Eraslan and Götz, 2021; Baumeister et al., 2021; Lewis et al., 2022, among others). In particular, a growing number of papers have been relying on transaction data which provide the timeliness and granularity needed to investigate the economic impact of the COVID-19 pandemic on consumption (Baker et al., 2020; Bounie et al., 2023, 2020; Carvalho et al., 2021; Chen et al., 2021; Chetty et al., 2020; Barlas et al., 2021; Kapetanios et al., 2022, among others).

The pandemic has dramatically impacted the Italian economy since the end of February 2022,³ earlier than elsewhere in Europe.⁴ The diffusion and magnitude of the shock observed during the COVID-19 pandemic were larger than anything seen in the post-WWII; the health crisis rapidly spread over goods and labour markets, eventually reaching every sector of the economy worldwide. In this context, transactions at national level of ATM withdrawals and POS payments, registered in the clearing and settlement system – BI-COMP – managed by the Bank of Italy (see Ardizzi et al., 2019, for details), although very useful, showed two main limitations. First, these data provide information on transactions at the aggregate level, without distinguishing among expenditure categories which have been differently affected during the first wave of the pandemic. Second, the timing of government restrictions occurred before in the Northern regions, thus requiring a dataset with a regional dimension which is not available in BI-COMP.

¹The views expressed in this paper are solely due to the authors' and do not necessarily reflect the views of the Bank of Italy or the Eurosystem. Thanks to Paolo Del Giovane, Monica Martinez-Bravo, Alessandro Mistretta, Stefano Neri, Giordano Zevi, Roberta Zizza, Francesco Zollino and seminar participants to the workshop on payments data with Bank of Israel for useful comments, Guerino Ardizzi and Giuseppe Bruno for explaining us the features of the dataset, Luca Bastianelli for excellent research assistance and Nexi Payments for providing the data. Data are confidential. Any errors are ours.

²Data are provided by Nexi Payments and collected within the Big Data project managed through the cooperation between the ECS Department (Economics, Statistics and Research) and the MPS Department (Market and Payment System Oversight) of the Bank of Italy.

³In the second quarter of 2020 Italian private consumption fell by 11.5 per cent on a quarter-on-quarter basis; income declined instead by 4.5 per cent only, as the government responded to the shock with a huge fiscal stimulus, including a range of broad-based fiscal measures for households and firms.

⁴See Figure 2 in Section 2 for the timeline of the events.

For these reasons, data on credit-cards transactions, which provide granularity both for product categories and territorial breakdown and are timely available, have been particularly useful to inspect the dynamics of transactions during the first wave of the Covid-19. In Italy credit-cards transaction data account for about 8 per cent of final consumption expenditure, excluding rents and bills. Despite the fact that the majority of Italian payments are made in cash (Rocco, 2019), the pandemic has been a game changer in payment habits, by fostering the use of card-based transactions (Ardizzi et al., 2020). This makes the use of credit-cards data a promising avenue to study the dynamics of consumption.

We contribute to the literature by proposing an event study approach (e.g. Jensen, 2007; Kleven et al., 2019, among others) to identify the causal effect of the pandemic on total transactions carried out with these payment instruments, as well as on transactions by expenditure categories and at the regional level. We enrich the econometric model with high frequency data on electricity consumption to control for a daily indicator of economic activity, differently from available literature (Galbraith and Tkacz, 2018; Aprigliano et al., 2019; Aastveit et al., 2020; Carvalho et al., 2021; Hacıoğlu-Hoke et al., 2021). To isolate the pure effect of the first wave of the Covid-19 pandemic, the analysis is conducted over the sample January 2015 – September 2020, as from autumn 2020 onward government restrictions have been imposed with different intensity across regions, thus weakening the identification of the event study methodology.

Our main results can be summarized as follows. Despite the fact that the use of credit card transactions is still limited in Italy, these data proved to be very useful as a timely indicator of official data on consumption released in the framework of both national and regional accounts by Istat at the time of the first wave of the Covid-19 pandemic. In addition, we find large and statistically significant effects of the pandemic on total credit-cards transactions, which declined by more than 50 per cent in the period of the Italian national lockdown. Transactions for hotels and restaurants, travels and transport, fell by more than 80 percent at the beginning of March 2020, due to both the government interventions imposed to contain the spread of the virus and the fear of contagion which affected mainly high-contact activities. By contrast, transactions for food purchases sharply increased, due to people stockpiling supplies and to the substitution of outdoor with indoor dining. Finally, we observe an heterogeneous response of card transactions across regions: the fall was particularly severe in Lombardy, where the drop occurred in advance compared to other regions due to the different timing of the spread of the virus and of the government restrictions.

The paper is organized as follows. Section 2 presents some descriptive statistics of the dataset. Section 3 describes the empirical methodology used to analyze the effects of the pandemic on credit-card transactions. Section 4 reports the main results and Section 5

briefly concludes.

2 Credit-cards transaction data

The primary data used in the paper are daily data of cards and international circuit debit cards (Visa and Mastercard), managed by Nexi Payments, referring to the transactions made by cards issued in Italy at the point of sales of merchants located in Italy (acquiring side). Data include transactions at physical and virtual point of sales. The dataset consists of anonymized daily data on spending, detailed into ten categories. The ten expenditure categories are: 'cash in advance', 'clothing', 'food', 'home furniture', 'hotels and restaurants', 'retail', 'services', 'repairing works and other services', 'telephone & web & mobile devices', and 'travels and transport'.⁵ A regional dimension is also provided. Given the features of the dataset, it is not possible to identify the buyer in each transaction.

The estimation period used in the paper is January 2015-September 2020. We consider only the first wave of the pandemic to properly identify the causal effect of the Covid-19 pandemic via the event study analysis. The following waves, starting from autumn 2020 onward, have been indeed characterized by strong heterogeneity in the containment measures across Italian regions and vaccination rates.

Figure 1, which shows the evolution of the weekly level of total transactions, suggests three main considerations. First, we observe an upward trend in the series, due to the rise in the use of electronic payment instruments as opposed to cash in the sample considered.⁶ Second, a clear seasonal pattern emerges with the week including Christmas being the one with the highest amount of transactions recorded every year. Third, and more importantly, the fall in total transactions during the national lockdown due to the pandemic stands out as dramatic.

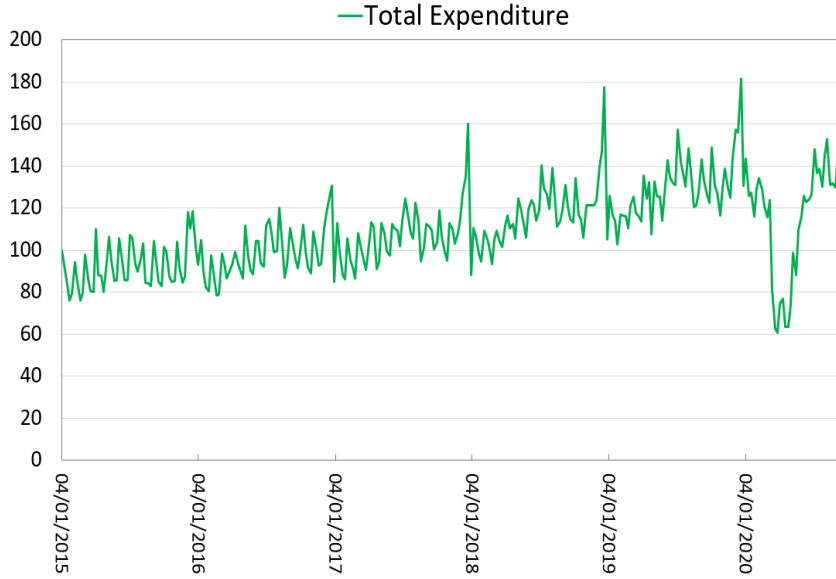
Throughout the paper we distinguish three main periods: (1) the pre-covid sample, between 1-22 February when the pandemic was not spread in Italy, consistently with sample period used in the event study analysis (see Section 3);⁷ (2) the most acute phase of pandemic between 23 February and 3 May, with the first day being the start of the lockdown in some municipalities in the North and the last day the end of the national lockdown, which started

⁵For a detailed description of the categories see Table A.1 in Appendix A.

⁶ECB (2020) finds that cashless means of payment are becoming increasingly important in euro area countries and that the trend towards cashless payments seems to have accelerated during the pandemic. Ardizzi et al. (2020) also find a large and persistent substitution effect from cash to card-based transactions, especially using contactless and e-commerce options, during the COVID-19 pandemic. They argue that the fear of infection has led to a new implicit cost associated to each payment instrument, thus affecting payment choices from the demand-side and boosting consumption with non-cash transactions.

⁷The main message is virtually unchanged when considering the period January 1 - February 22.

Figure 1: Weekly level of the total amount of transactions.



Note: Index from total expenditure from transaction data. The index is scaled to 100 for the week ending the 4 January 2015.

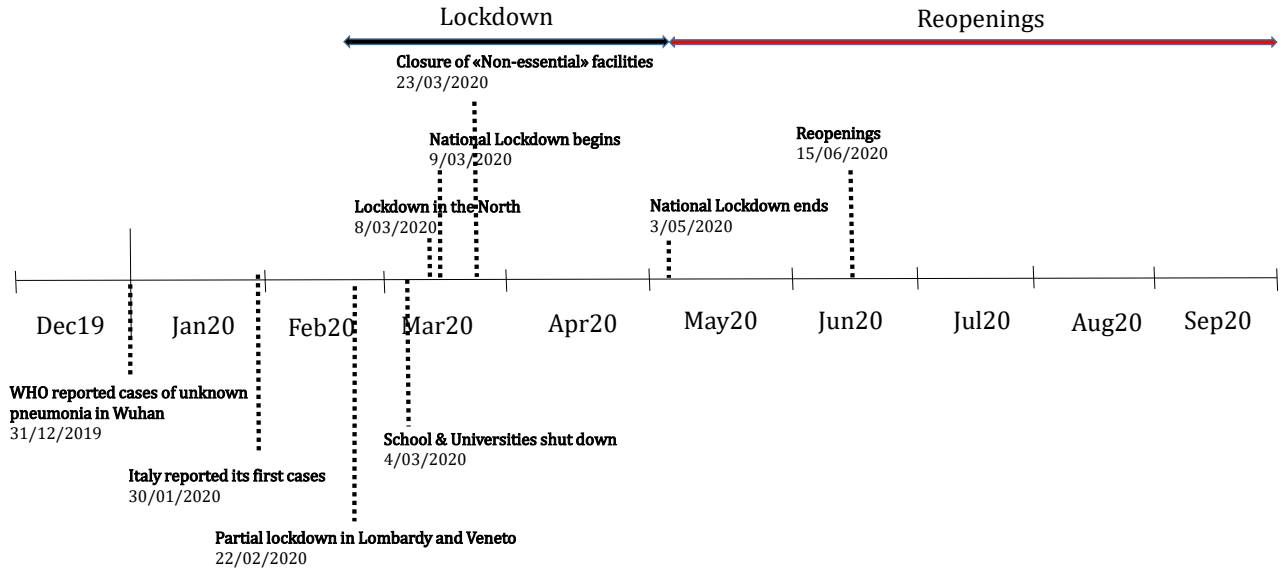
in 9 March as shown in Figure 2; and (3) the post-lockdown period, i.e. between 15 June and 30 September, when many restrictions have been temporarily lifted up by the government due to the slowdown of infections during the summer in 2020.

2.1 A preliminary look at the data

As evident from Figure 1, the amount of transactions in 2020 is bigger than the corresponding in 2019, due to the increasing trend observed in transaction data. Large differences emerge during the period 23 February – 3 May: transactions in 2020 are much lower compared to 2019, but the volatility is higher. In the last period 15 June – 30 September, the fall in transactions related to the pandemic is virtually undoing the trend in the use of cashless payment.

The perimeter of transaction data does not perfectly match the definition of household final consumption expenditures in national accounts mainly due to the fact that the former do not include rents, both imputed and actual (on this see also Hacıoğlu-Hoke et al., 2021); actual rents, in fact, are generally not paid by credit cards in Italy. Credit-cards transaction data account for about 8 per cent of consumption (excluded rents and bills) from national

Figure 2: Timeline for the first wave of Covid-19 pandemic in Italy



Note: The timeline summarizes the major events during the 1° wave of the Covid-19 pandemic in Italy analyzed in this paper.

accounts.⁸ Notwithstanding this, the year-on-year changes of the amount of credit-card transactions and those of domestic final consumption expenditure are remarkably similar during the first wave of the pandemic, as shown in Figure 3.⁹

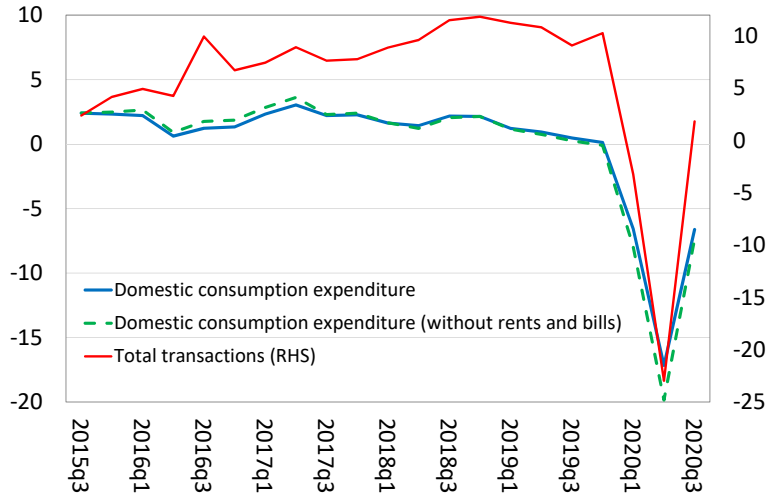
Figure 4 shows the average shares of spending by categories in the three periods of analysis. Two developments are striking: first, the share of food has more than doubled, from 20 to 40 per cent during the national lockdown, returning to around 20 per cent in the third period.¹⁰ This is in line with worldwide evidence of long queues outside supermarkets with people stockpiling supplies and with the substitution of outdoor with indoor dining. At the same time, the share of expenditures, such as clothing, hotels and restaurants, travels and transport, considerably fell as the restrictions have been imposed in the national territory. These shares returned to “normal” levels during the summer.

⁸Data on POS payments represent almost 10 per cent of total consumption, while ATM withdrawals about 4 per cent.

⁹The correlation between the year-on-year changes of credit-card transactions and those of final consumption expenditure is equal to 0.92 over the whole period 2015Q3-2020Q3, while it is weaker in the pre-pandemic sample. An appropriate measure of correlation should then take the increasing trend in total transactions into account.

¹⁰A similar picture emerges if the second period starts on 9 March instead of 23 February.

Figure 3: Year-on-year changes of domestic final consumption and total transactions.

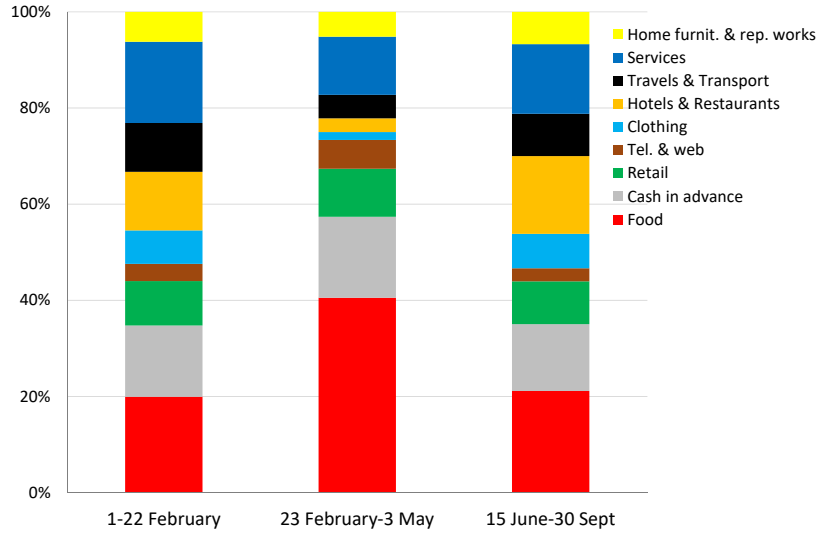


Note: Our calculations from transaction data and Istat national accounts – nominal series.

A similar picture emerges from Figure 5, which shows the year-on-year (henceforth, y-o-y) weekly growth rates of the total value of credit-card transactions (left panel) and of relevant expenditure categories (right panel). The three vertical dotted lines in each chart show the week of the quarantine imposed in the North, the starting week of the national lockdown, and the first week of the lifting, respectively. Several considerations are in order. First, the sharp decline in transactions started even before the national closures were implemented. People started to reduce transactions for clothing, hotels and restaurants already towards the end of February, and concomitantly to stockpile food. Second, the lowest y-o-y growth of total transactions was recorded in mid-April (13-19 April), with a value of -52 per cent compared to the same week of the previous year. Third, the sharpest drop has been recorded by transactions for 'clothing' and 'hotels and restaurants', both with a y-o-y weekly growth rate of -98 per cent; the restrictive measures introduced by the Italian government to contain the spread of the virus caused a paralysis of the accommodation facilities. Fourth, the highest increase in food transactions was recorded in the second week of April, 6-12 April (Easter occurred on April 12), with a value of 68 per cent.¹¹ These results are in line with studies for other countries (e.g. Bounie et al., 2023; Carvalho et al., 2021; Chen et al., 2021; Hacıoğlu-Hoke et al., 2020) showing that expenditures on essential items (mainly

¹¹Note that the value of the y-o-y growth rate of food transactions recorded in the third week of April (-4 per cent) is due to the fact that the previous year this week included Easter, hence the yearly comparison is partly distorted.

Figure 4: Average shares of expenditure categories



Note: Our calculations from transaction data over three samples in 2020: 1-22 February, 23 February-3 May, 15 June-30 September.

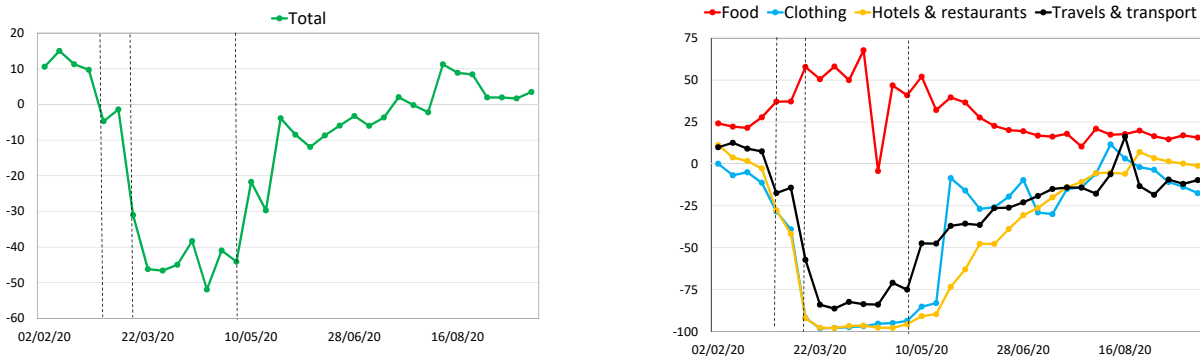
food) increased during the lockdown. The dispersion of the year-on-year weekly growth rates across expenditure categories has indeed increased during the lockdown (see Figure A.1 in Appendix A).

Figure 6 reports the shares of expenditure on the various categories of goods and services in the national accounts (COICOP)¹² and the corresponding shares for transactions over the period 2015-2019. The figure shows that the shares of COICOP in the national accounts are in line with those retrieved from credit-card transactions for home expenditure and retail & services, while they are higher for food and travels & transports, mainly due to the fact that most of transactions for these categories are still made by cash. Finally, for other categories such as hotels & restaurants and clothing, the shares in credit card transactions are higher compared to those in national accounts, being these items generally paid by electronic payments (see, e.g., Rocco, 2019).

The dataset provides information also at the regional level. Compared to regional ac-

¹²There are twelve divisions in Classification of Individual Consumption According to Purpose (COICOP): food and non-alcoholic beverages (1); alcoholic beverages, tobacco and narcotics (2); clothing and footwear (3); housing, water, electricity, gas and other fuels (4); furnishing, household equipment, and routine household maintenance (5); health (6); transport (7); information and communication (8); recreation, sport and culture (9); education services (10); restaurants and accommodation services (11); other goods and services (12). In order to make a meaningful mapping between COICOP and expenditure categories in our dataset, we merge: (i) home furniture and repairing works in the latter dataset to represent home expenditure; and (ii) health, recreation & sport & culture, education services, other goods and services in the former dataset to map retail and services. For a comparison between households' consumption patterns in the national accounts and in the Household Budget Survey (Istat), see Bassanetti et al. (2014).

Figure 5: Year-on-year growth rates of the value of total transaction and of relevant categories



Note: Weekly transaction data. The first vertical dotted line represents the outbreak of COVID-19 in Northern Italy, while the second and third vertical lines represent the first and last week of the national lockdown, respectively. Note that the value of the y-o-y growth rate of food transactions recorded in the third week of April is affected by the different timing of Easter compared to the previous year.

counts released by Istat, credit-cards transaction data are available about one year in advance. Figure 7 shows the average shares of total transactions by regions over the sample January 2015 – February 2020. The figures distinguishes six groups of regions: (i) those with a share larger than 10 per cent of total transactions: Lombardy and Lazio, which represent together 36 per cent of total transactions; (ii) regions with a share between 6 and 10 per cent: Emilia Romagna, Veneto, Tuscany and Piedmont, which account together for almost 32 per cent of total transactions; (iii) regions with a share between 4 and 6 per cent: Campania, Apulia and Sicily; (iv) regions with a share between 2 and 4 per cent: Friulia Venezia Giulia, Liguria, Marche, Sardinia and Trentino; (v) Abruzzo, Calabria and Umbria, with a share between 1 and 2 per cent; (vi) Aosta Valley, Molise and Basilicata with a share of less than 1 per cent of total transactions.¹³ This is consistent with Rocco (2019) who shows that Southern regions generally use credit card payments less often than Northern ones.

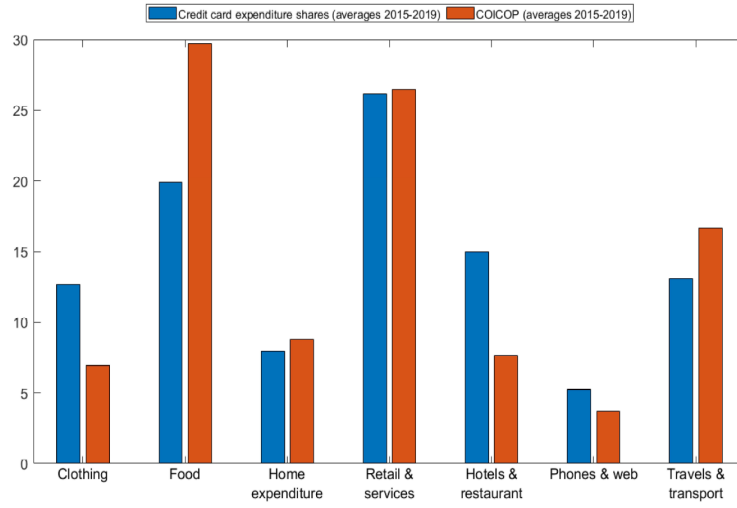
3 The event study approach

In order to investigate the impact of the first wave of the pandemic on credit-card transactions we adopt an event study approach based on sharp changes of transactions around the beginning of the pandemic starting on the 23rd of February, 2020. The usefulness of such approach comes from the fact that we identify the causal effect of the pandemic and related mobility restrictions on transactions.

The basic model is specified as follows:

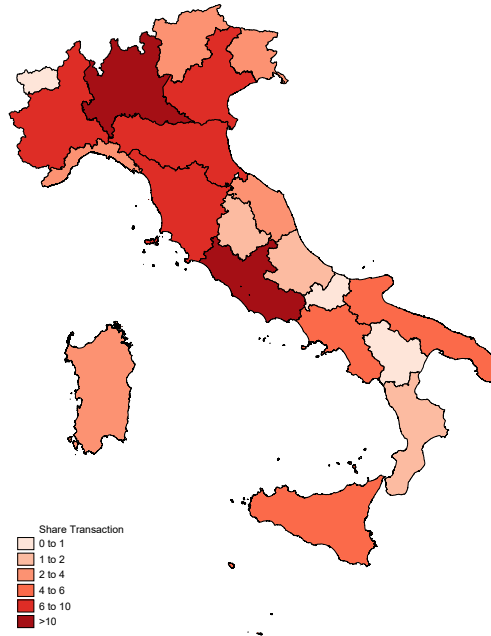
¹³The heatmap is virtually unchanged when considering the sample March – September 2020. Therefore during the pandemic the shares of total transactions have not changed across regions.

Figure 6: Comparison between credit card transaction shares and National Accounts.



Note: Our calculations from nominal expenditure categories of transaction data and National Accounts (COICOP).

Figure 7: Heatmap for total transactions by regions (in percentage).



Note: Our calculations from transaction data over January 2015 - February 2020.

$$\log(tran_t) = \delta_t(t > t^*) + \beta X_t + \epsilon_t \quad (1)$$

where $tran_t$ is total daily transactions. The model includes a fixed effect for every day around the event δ_t ; t^* in equation (1) is February 1, 2020, so we capture the time period immediately before and including the pandemic.¹⁴ In order to isolate the effect of the pandemic around 23 February, the event study approach also controls for seasonal effects and growth in the economy using daily dummies; in our baseline specification X_t includes weekday fixed effects, year fixed effects, holidays fixed effects and a linear trend. Estimates are carried out at a daily level but results are presented at a weekly level due to the volatility of daily coefficients estimated.

As a robustness check, we also control for a daily indicator of economic activity. The only data available at a daily frequency and at a regional level for our period of interest in Italy is electricity consumption. As noted by Fezzi and Fanghella (2021), electricity consumption data, available in real-time and at a daily frequency, can be used to track the impact of economic shocks on GDP. Other series more related to the pandemic, like the stringency index or the number of COVID-19 cases, have a shorter time horizon, as they are available since the outbreak of the pandemic.

The data allow us to explore the heterogeneous dimension of transactions as an outcome variable, studying not only aggregate expenditure, but also sub-categories. In this respect the outcome variable of equation (1), i.e. total daily spending aggregated at the weekly level, is alternatively replaced by food and drinks, clothing and footwear, home furniture, hotels and restaurants, retail, travel and transport, services. As shown in Figure 5, the expenditure sub-categories were affected by the pandemic recession in different moments, with different intensity, calling for a category-by-category analysis.

As already mentioned in Section 2 the richness of transaction data allows us to exploit also the regional dimension, although at the expenses of a detailed breakdown by expenditure category. Keeping in mind that the epidemic spread out across the Italian regions with different timing and extent, we estimate the following equations:

$$\log(tran_{it}) = \delta_{it}(t > t^*) + \beta X_{it} + \epsilon_{it} \quad (2)$$

where $tran_{it}$ is total daily transactions aggregated at the weekly level for each of the $i = 1, \dots, 20$ Italian regions.

¹⁴For a broad discussion on the estimation window, event window and post-estimation window, see MacKinlay (1997). Note that results are virtually unchanged if we consider January 15 as t^* , i.e. the period following Christmas vacations, instead of February 1.

4 The effects of the COVID-19 pandemic on credit-card transactions

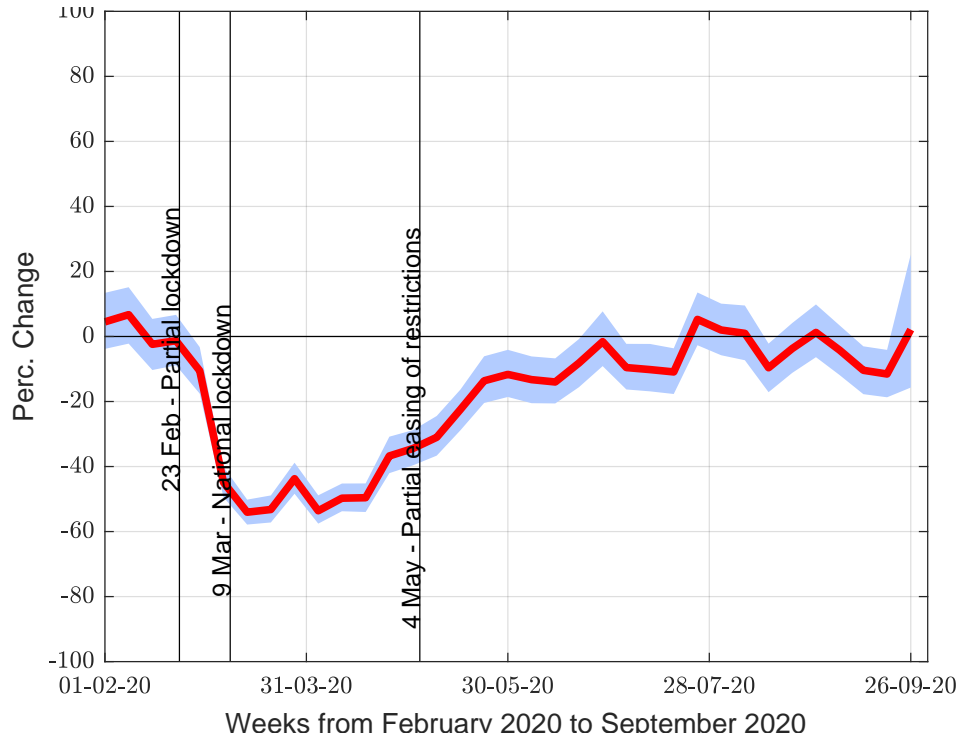
This section presents the estimation results. Section 4.1 investigates the effects of COVID-19 on transactions by exploiting the expenditure categories at the national level, while Section 4.2 focuses on the regional dimension of the dataset, by analyzing the heterogeneous impact of the pandemic across Italian regions.

4.1 Exploring the expenditure categories

Figure 8 reports the estimates of the average effect of COVID-19 on transactions for daily total spending aggregated at a weekly level. The relevant coefficient δ_{post} of equation (1) measures the percentage change in transactions due to the event. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The figure also reports the three relevant dates analyzed throughout the paper: the partial lockdown imposed to the 11 Northern municipalities on February 23, the national lockdown in March 9 and its lifting in May 3, with some restrictions still in place, with the sample ending on September 30 (see Figure 2). At the beginning of February 2020, coefficients are close to zero. The coefficient becomes negative on 23 February, when a quarantine was imposed for 11 Northern municipalities, reaching a trough of almost 60 per cent at the beginning of March. The decline is long-lasting for the whole lockdown, with a strong attenuation only after mid June 2020. The recovery then remains relatively steady until the end of September. Therefore, during the lockdown household credit-card transactions halved as a result of COVID-19, as also depicted in Figure 5.

Regressions are carried out also for the different expenditure categories. Figure 9 reports the results of the event study for the following categories particularly affected by the restrictive measures: food and drinks, clothing, hotels and restaurants, and travels and transport. The fall for credit-card transactions was sharp and large for clothing and hotels & restaurants which experienced the sharpest reduction, with a statistically significant decrease of -98 per cent for both, in the period of the lockdown. The transactions for travels and transports became broadly nil. The drop of transactions for these categories reflected on one hand the severe restrictive measures imposed by the Italian government to contain the spread of the virus and on the other hand the fear of contagion which affected social activities the most (Guglielminetti and Rondinelli, 2023). The recovery was also quite different: social related

Figure 8: Event study for total transactions, weekly pattern



Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

expenditures, like hotels & restaurants and travels and transport, came back to pre-COVID levels during the early summer of 2020 while decreasing again at the start of the autumn when a new wave of the pandemic occurred. Clothing recovered more quickly, as soon as the restrictive measures were lifted at the beginning of May.¹⁵

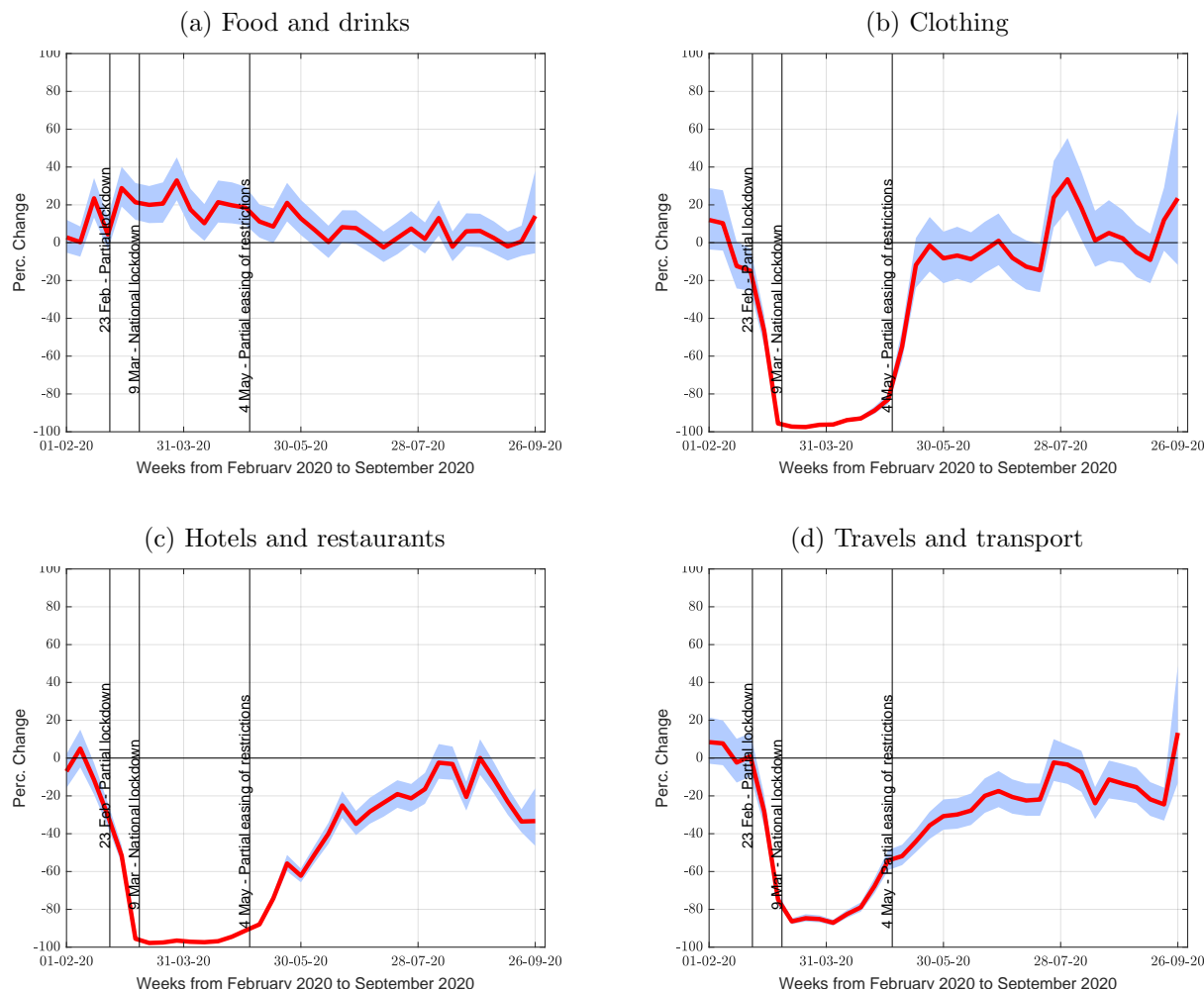
A different evolution was observed for food transactions, which increased during the lockdown, as households were more forced to stay at home and prepare their own meals. Likewise, Dunn et al. (2021) show for the US that the pandemic had a large effect on credit-card transactions for accommodations and restaurants, with a decline of around 80 and 70 per cent, respectively by the second week of March 2020.

Other results are reported in Appendix B. First, the event study conducted for services transactions (Figure B.1, panel c), the second largest category in the pre-COVID period, shows that the drop was sharp and large, reaching its minimum of -73 per cent at the beginning of March; purchases of services temporally recovered pre-pandemic levels at the

¹⁵The spike observed for clothing expenditure at the beginning of August 2020 is due to the postponement of summer sales, usually starting at the beginning of July, of about one month in almost all Italian regions.

end of July. It is also worth noting that home furniture suffered during the lockdown, but as long as the restrictions were lifted out, they returned well above pre-pandemic levels, likely as a consequence of the rise of the remote working arrangements (see, e.g. Guglielminetti et al., 2021). The recovery for withdrawals, which suppose a physical contact, remained depressed for longer time also as a consequence of the shift in preferences for holding cash (see Ardizzi et al., 2020).

Figure 9: Event study for relevant expenditure categories, weekly pattern



Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

Second, compared to the related literature (Dunn et al., 2021), we improve equation (1) by controlling for an indicator of economic activity available at a daily frequency and at a regional level, i.e. electricity consumption. Results are depicted in Figure B.2 in Appendix

B and corroborate those in Figure 8.

4.2 Exploring the regional dimension

This section exploits the regional dimension of our dataset and carries out the event study at regional level. This is an advantage compared to the dataset of ATM withdrawals and POS payments analyzed by Ardizzi et al. (2019), where only national aggregates are available.

Figure 10 shows the estimates of the average effect of COVID-19 on total transactions for daily data aggregated at a weekly level in Lombardy and Lazio, the regions with the highest shares of total transactions (see Figure 7).¹⁶ The main observations are the following. First, during lockdown the fall in expenditure was much more pronounced in Lombardy than in Lazio. On average, Northern regions experienced a larger decline in total transactions compared to the other regions. Second, the large drop in transactions occurred in Lombardy well before the national lockdown because of the different timing of the spread of the virus and the government restrictions, which initially were only adopted for Lombardy and Veneto. The quarantine was imposed to 11 Northern municipalities on February 23, while the national lockdown occurred two weeks later. The decrease in transaction (red line) in Lombardy is very steep immediately after February 23, while it is relatively smooth in Lazio. Third, the largest fall is recorded in Aosta Valley and Trentino (Figure B.3), plausibly due to the fact that the tourism from winter holidays collapsed. However, it should be noted that these two regions account for a small share of expenditure at a national level.

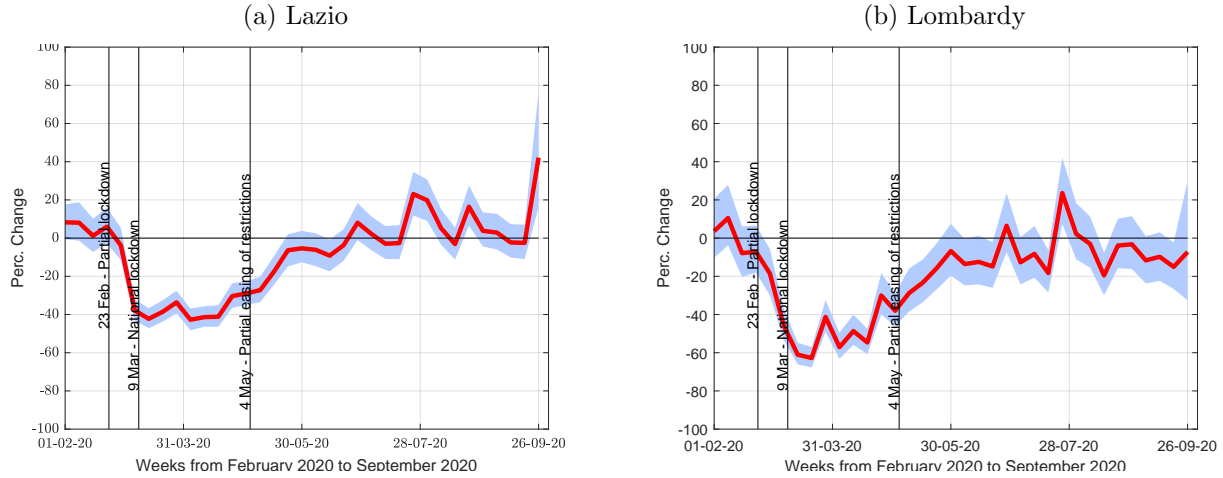
In order to provide a comparable measure of the fall of total transactions by regions, we compute the cumulative loss in transactions due to the COVID-19 regions by regions over the period February-September 2020. In particular, we calculate a counterfactual scenario in which the amount of total transactions, region by region, would grow at the same trend observed in the pre-pandemic years (2017-2019). Then, the difference between the counterfactual scenario according to equation (2) and the realized transactions is cumulated for each region over the period February-September 2020 and defined as the cumulative loss due to the pandemic. The cumulative loss is computed relative to the national loss.¹⁷ Figure 11 reports the shares of cumulative loss for each of the Italian regions. The figure distinguishes six groups of regions. As reported in Table B.2, the share of cumulative loss in Lombardy is by far the highest, with almost 22 per cent. Figure 11 resembles to a great extent Figure 7 reporting the shares of total transactions over the sample January 2015 - February 2020.¹⁸

¹⁶The results of the event study approach for all the other regions is reported in Appendix B, Figures B.3, B.4 and B.5.

¹⁷The national loss is equal to the sum of the losses at a regional level.

¹⁸The cumulative loss estimated at the regional level is in line with the official figures on final consumption obtained from the Regional Accounts, released with a one-year lag by Istat.

Figure 10: Event study for Lazio and Lombardy, weekly pattern



Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

5 Conclusions

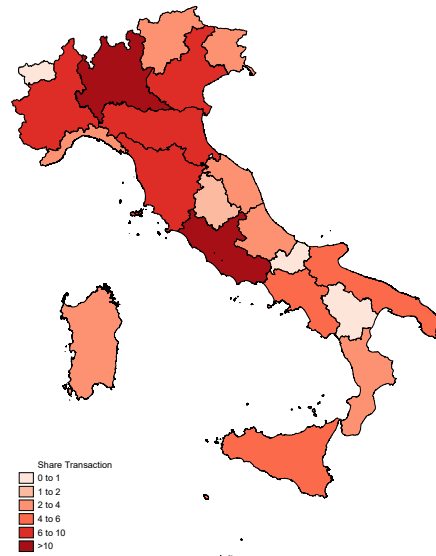
This work represents a first attempt to examine the information content of Italian transactions with credit cards and international circuit debit cards.

Overall, these high frequency data are proved to track well the dynamics of consumption in Italy at the time of the first wave of the Covid-19 pandemic. The use of traditional data on expenditure based either on national accounts or on surveys were found to be unsatisfactory during the COVID-19 pandemic (Carvalho et al., 2021; Chetty et al., 2020; Locarno and Zizza, 2020), due to the scarce details of expenditure categories and regional dimension as well as the timing of release.

Our estimates indicate that total credit-card transactions reduced by more than 50 per cent due to the first wave of pandemic, with heterogeneous effects across expenditure categories and regions. While transactions for food increased during the national lockdown, those for clothing, hotels and restaurants, travels and transports experienced a statistically significant decrease of almost 100 per cent, due to the measures adopted by the local governments to limit the spread of the disease and to the fear of contagion. The decline in credit-card transactions occurred before and was more intense in the Northern regions, especially in Lombardy, where government restrictions were adopted since 23 February 2020.

Extremely timely data are particularly useful in economic circumstances changing so

Figure 11: Cumulative loss of transactions (in percentage of the national loss) across regions over the sample February 2020 - September 2020.



quickly, due to a pandemic, a war or other extreme and rare events. An interesting avenue for future research would consist in using these high frequency data on credit cards to examine the effect of the dramatic rise of energy and food commodity prices and the Russian invasion of Ukraine.

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Appendix

A Data appendix

Table A.1 summarizes the data used for the analysis in the paper.¹⁹ In the rest of this Section we describe more in detail the main features of the dataset.

Table A.1: Macro-categories composition

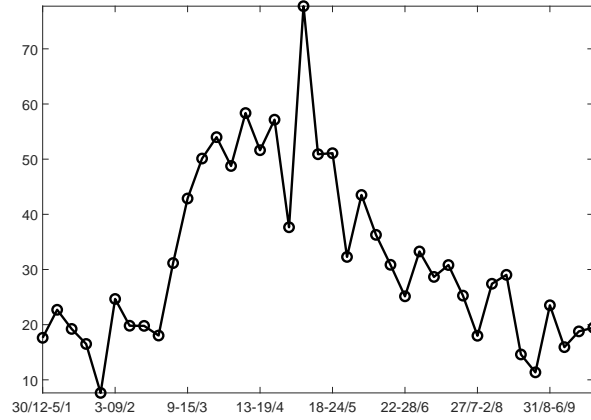
N.	Macro category	Category
1	Cash in advance	Cash withdrawals
2	Clothing	Clothing, footwear.
3	Food	Supermarkets, hypermarkets and superettes.
4	Home furniture	Home accessories, household goods, and appliances.
5	Hotels and restaurants	Hotels and restaurants.
6	Retail	Art and collecting, duty free, garden products and pets, giftware, jewelery, large scale non-food distribution, leather and luggage, musical products, other retail products, perfumes, photographic and optical goods, sanitary ware, sport goods, stationery and toys.
7	Services	Financial and insurance activities, health and beauty, health and sanitary services, home services, non-profit organizations, other services, photographic and reproduction services, personal services, public organizations, recreational activities and schools.
8	Repairing works and other services	Plumbing and hardware, construction products, products for shops and offices, other products and other services.
9	Phones, web, mobile devices	Internet, cable-TV, mobile phones services and Virtual Private Cloud (VPC).
10	Travels and transport	Travel agencies, fuels, flights, highway tolls, vehicle rental services, transport of people and goods, vehicle sales and services.

Note: This table illustrates the expenditure items included in each macro category.

We investigate the dispersion across expenditure categories shown in Figure 4 by using the interquartile range of weekly y-o-y growth rates in the spirit of Carvalho et al. (2021). The interquartile range is defined as the difference between the 75th percentile and the 25th

¹⁹The category "cash in advance" might be important to track the amount used to make expenditure in cash. However, the dynamics of transactions made for 'cash in advance' is virtually the same of that for the other expenditure categories.

Figure A.1: Dispersion of the year-on-year weekly growth rate across main expenditure categories.

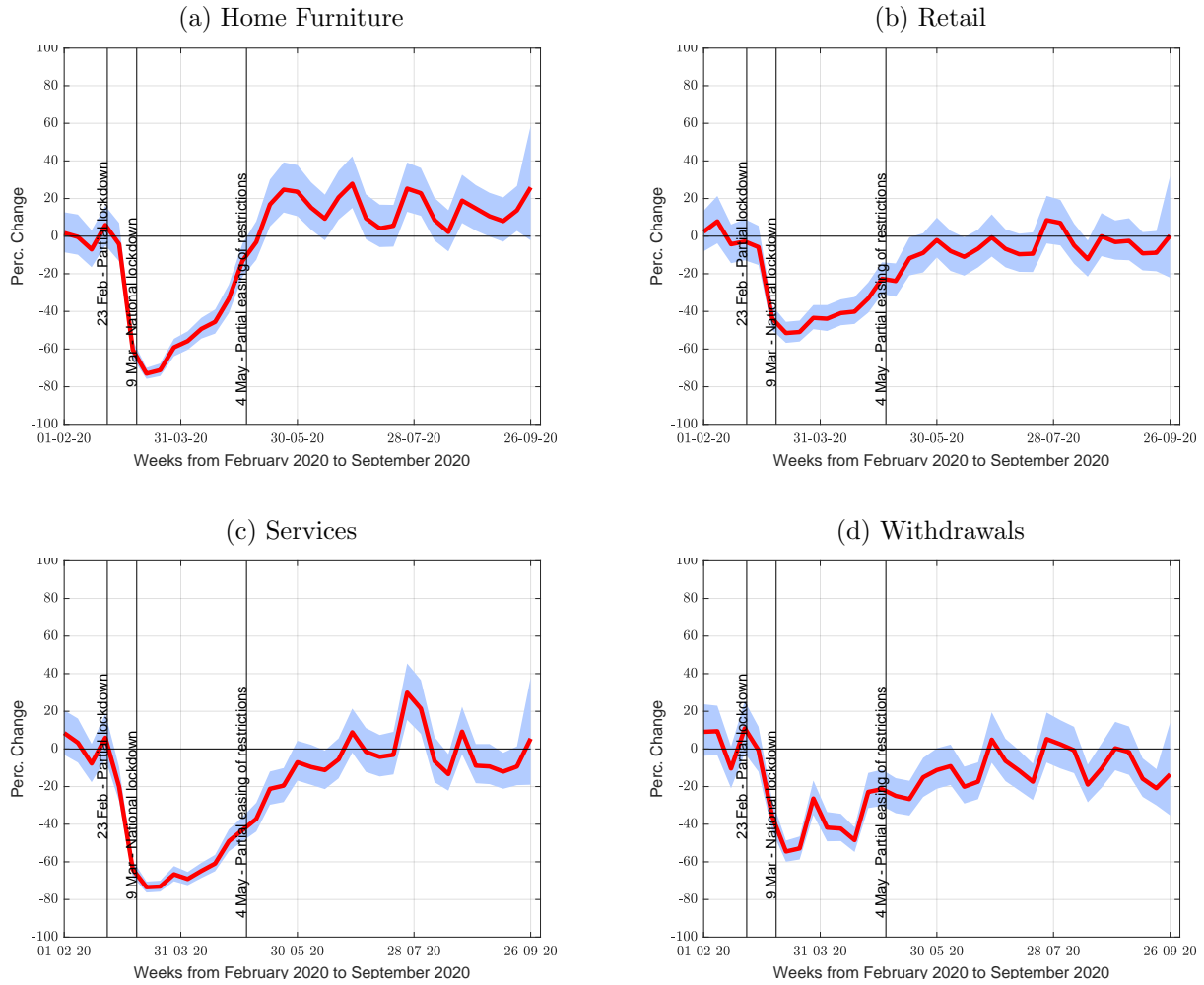


Note: The interquartile range is used as a measure of dispersion. The first vertical dotted line represents the outbreak of COVID-19 in Northern Italy, while the second and third vertical lines represent the first week of and after the national lockdown, respectively.

percentile. It has the advantage that outliers play a limited impact; an increase in its value represents a higher dispersion in the data. Figure A.1 shows that the dispersion across the main expenditure categories has increased during the national lockdown. It then gradually decreased during the summer, while showing a stable increasing trend in the final part of the sample, mainly due to the exponential increase in the number of contagions in Italy as well as in Europe at the very beginning of the second wave of the Covid-19 pandemic.

B Robustness exercises

Figure B.1: Event study for remaining relevant expenditure categories, weekly pattern



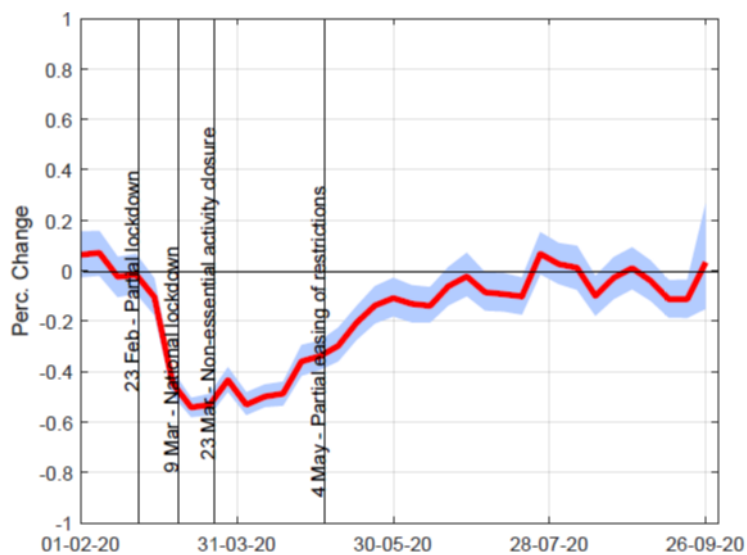
Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

Table B.2: Cumulative loss by regions in percentage of the national loss over the sample February-September 2020

Region	Cumulative loss (in %)
Abruzzo	2.07
Basilicata	0.57
Calabria	2.13
Campania	5.72
Emilia Romagna	8.64
Friuli Venezia Giulia	2.62
Lazio	12.33
Liguria	3.43
Lombardy	21.68
Marche	2.29
Molise	0.32
Piedmont	6.30
Apulia	4.60
Sardinia	2.67
Sicily	4.89
Tuscany	8.39
Trentino Alto Adige	2.02
Umbria	1.52
Aosta Valley	0.21
Veneto	7.61

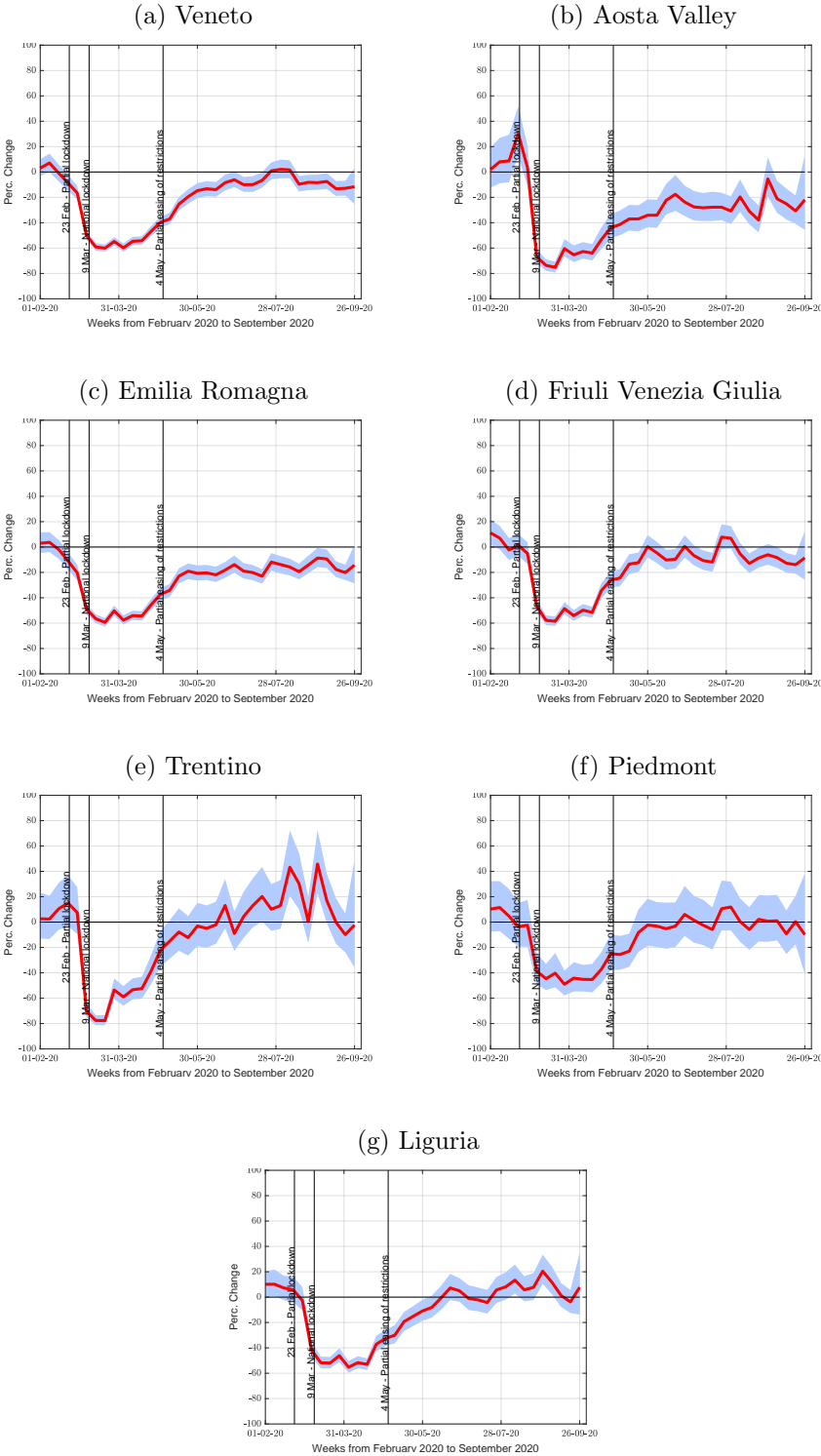
Note: The cumulative loss is computed as the difference between a counterfactual scenario in which total transactions grow with the same linear trend observed in the years 2017/2019 and actual transactions over the sample February-September 2020.

Figure B.2: Event study for total transaction controlling for electricity consumption, weekly pattern



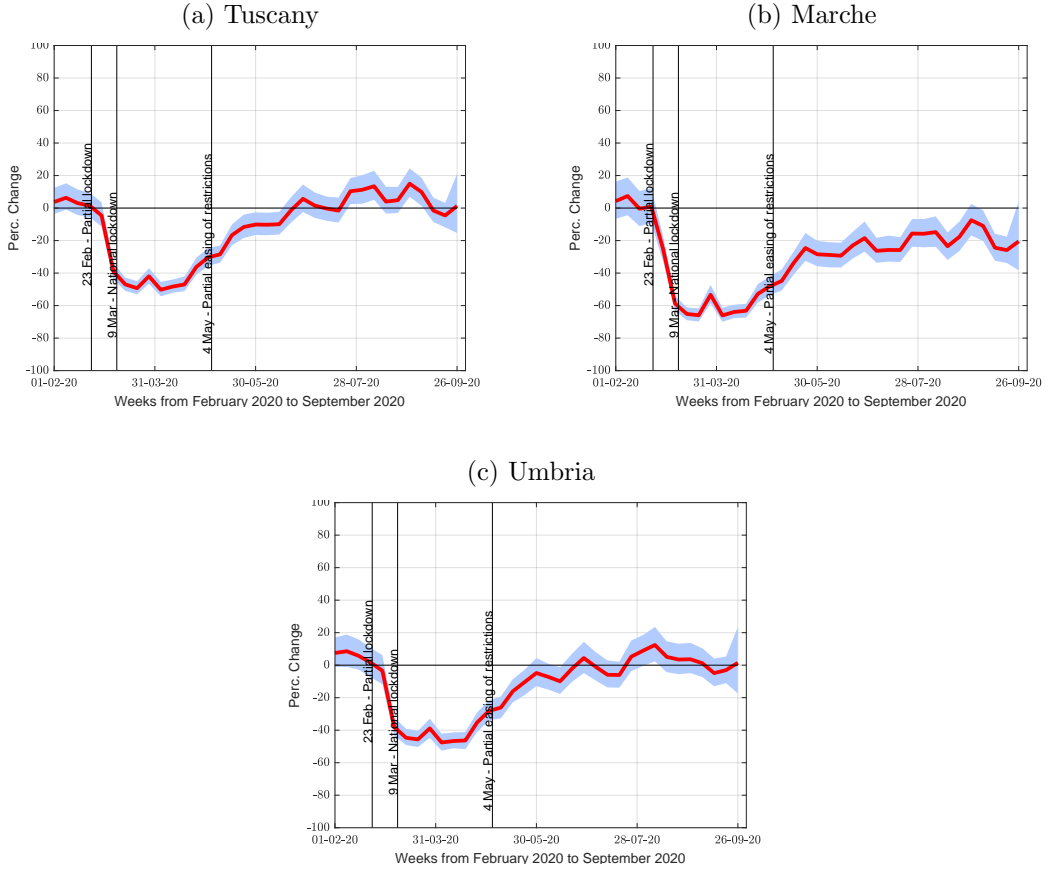
Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

Figure B.3: Event study for regions in the North of Italy, weekly pattern



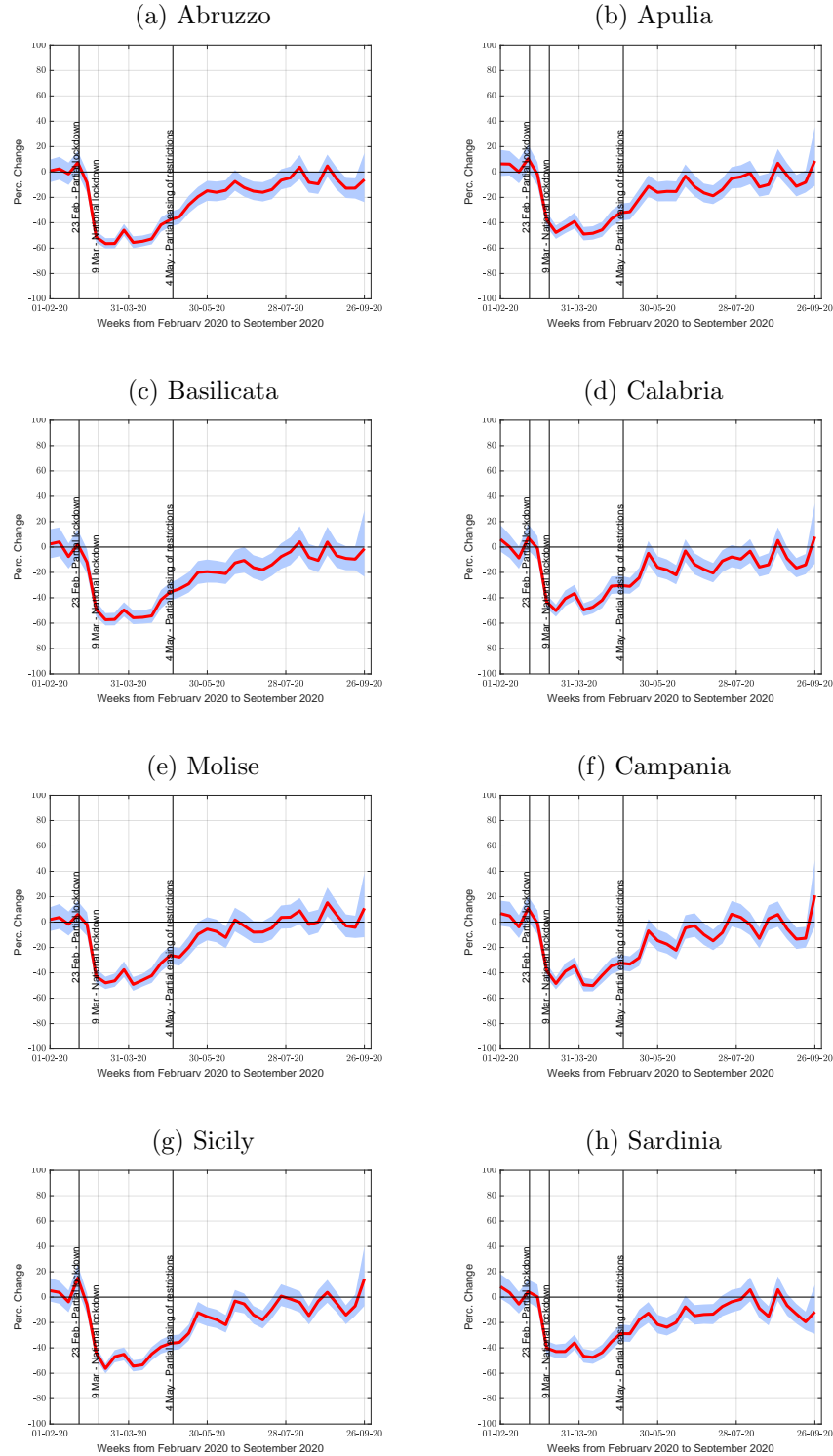
Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

Figure B.4: Event study for regions in the Centre of Italy, weekly pattern



Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.

Figure B.5: Event study for regions in the South of Italy, weekly pattern



Note: The estimates have been transformed from log scale to percentages by using the exponential of the point estimate minus one, multiplied by 100. The red line represents the difference between the predicted outcome when omitting the contribution of the event dummies (the counterfactual scenario, i.e the level of spending without COVID-19) and the level of spending realized in the data. The shaded area represents the 95 percent confidence interval bands.