Do we learn from errors? The economic impact of differentiated policy restrictions in Italy

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Abstract

This paper investigates the economic impact of the three tiers risk framework implemented in Italy against the COVID-19 pandemic during Autumn 2020. Exploiting a large-scale dataset encompassing daily credit card transactions mediated by a large Italian bank, we estimate a set of panel event study models to disentangle the impact of restrictions with low, medium and high stringency levels in terms of consumption reduction. We show that **space-time** differentiated policies tend to produce stronger welfare losses for progressively more stringent restrictions in specific sectors targeted by these policies such as Retail and Restaurants. However, when we compare provinces implementing the same level of policy stringency, we show that territories with higher income per capita and larger concentration of manufacturing and service activities experience both significantly worse economic and epidemiological performances. Overall, our results suggest that policy makers should properly account for local socio-economic characteristics when designing tailored restrictions entailing an equal and homogeneous impact across territories.

Keywords

economic consumption, COVID-19 pandemic, differentiated policy restrictions, sectors

Introduction

Full national lockdowns have been widely implemented as main strategies to shrink the transmission of the first wave of COVID-19 pandemic. These restrictions represent a necessary immediate response to an unprecedented global health emergency (Chinazzi et al., 2020; Kraemer et al., 2020; Bourdin et al., 2021; Galeazzi et al., 2021). However, the adoption of such generalized policy packages disrupts local socio-economic systems, sparking a vivid debate on the trade-off between the containment of virus contagion and economic repercussions (Guan et al., 2020; Mitja et al., 2020; Saltelli et al., 2020; Verschuur et al., 2021). Indeed, restrictions can contribute to save human lives, but at the same time they generate significant detrimental effects on the aggregate demand and supply, with individuals reducing consumption and workers decreasing their labour offer. Current estimates highlight how stringent restrictions have decreased aggregate GDP by 4.3% at world level in 2020, forcing national governments to significantly raise public debt by 20% in advanced economies to face an unprecedented financial crisis. Moreover, they have generated employment losses for 114 million full time equivalents (FTEs), with a reduction of worked hours by 5.2% and 16.7% during the first and second term of 2020 (ILO, 2020; IMF, 2020; World Bank, 2021). The economic inefficiency connected with non optimal levels of production and consumption thus represents a negative externality of restrictions implemented against the pandemic, leading to relevant welfare losses.

As horizontal full lockdowns are not economically sustainable in a long term perspective, several studies at the intersection of epidemiology and economics analyse the impact of alternative restrictions on contagion and welfare loss, aiming to identify an adequate balance between saved lives and forgone consumption (Thunstrom et al., 2020; Farboodi et al., 2021; Iwamoto, 2021). Although a strong trade-off between the epidemiological and economic dimensions emerges, such contributions highlight that uniform restrictions do not represent the optimal policy. Better results both in terms of contagion and consumption reduction can be in fact achieved through targeted restrictions by people age (Acemoglu et al., 2020), and through a massive usage of available technologies such as antibody

tests, test-tracing apps and vaccines (Chernozhukov et al., 2021b; Alvarez et al., 2021; Droste and Stock, 2021; Eichenbaum et al., 2021; Guimaraes, 2021).

Based on such empirical evidence and lessons learned from earlier national lockdowns, alternative health risk management approaches have been adopted worldwide to face new waves of contagion, and differentiated policies have been applied in Australia (Moloney and Moloney, 2020), Canada (Long et al., 2021), France (Allain-Dupre et al., 2020), Germany (Hattke and Martin, 2020), Italy (Guaitoli and Pancrazi, 2021), Spain (Greer et al., 2021) and United Kingdom (Morrissey et al., 2021).

Differentiated policies represent the main attempt of national governments to take decisions based on evidence related to the analysis of almost real-time data, strengthening the "science-policy" nexus (Warren et al., 2021). Nonetheless, several limitations affect extant evidence on the impact of these tailored restrictions. First, available analyses studying the impact of alternative policies tend to focus on restrictions differentiating according to the age or the infectious status of the population (Acemoglu et al., 2020; Fabbri et al., 2021; Makris, 2021), completely neglecting targeted restrictions towards business sectors that may constitute heterogeneous channels of virus transmission and consumption reduction (Ascani et al., 2020, 2021; Ferraresi et al., 2021). Second, extant literature mainly analyses the effects generated by differentiated policies on the epidemiological dimension, showing their capability to shrink the contagion, but disregarding their economic impact (Guaitoli and Pancrazi, 2021; Bonfiglio et al., 2022). Third, despite the effort to demonstrate the spatially uneven socio-economic effects of lockdowns (Adams-Prassl et al., 2020; Blundell et al., 2020; Bonaccorsi et al., 2020; Tisdell, 2020; Hacıoglu-Hoke et al., 2021), only limited empirical research investigates whether differentiated policies still generate heterogeneous impacts in terms of contagion and economic contraction, depending on local socio-economic characteristics of territories, or if alternatively restriction policies entail equal effects among areas implementing them with similar levels of stringency (Guaitoli and Pancrazi, 2021).

Against this background, our paper first investigates the economic impact of **space-time**

differentiated policies in Italy implemented in the last term of 2020. We evaluate the extent to which such differentiated policies were able to limit human activities consistently with the intensity of the pandemic, avoiding to generate disproportionate welfare losses in terms of consumption reduction. Then, we compare epidemiological and economic performances of territories adopting restrictions with similar stringency levels to understand whether local socio-economic characteristics may have driven the effects produced by these policies in terms of contagion and consumption reduction.

We focus on the Italian case, as it constitutes an ideal candidate to study the impact of **space-time** differentiated policies, since starting from the 6th of November 2020, Italy implemented a three tiers risk framework, according to which Italian regions were classified as "low", "medium" or "high" risk territories, depending on the local severity of the contagion. We build on a panel event study approach to investigate the local impact of restrictions with different levels of stringency at province level, exploiting a large-scale novel and unique dataset encompassing daily transactions performed through credit and debit cards mediated by a major Italian bank.

Our analysis reveals that high risk provinces experienced a significant reduction of economic consumption in the Accommodation, Restaurants and Retail sectors and when we consider the full sample of sectors, consistently with the higher stringency level of restrictions introduced in these territories with respect to low risk provinces. Similarly, in medium risk areas significant economic contraction is observed in the Restaurants and Retail sectors and when we consider the full sample of sectors.

However, when we compare the epidemiological and economic performances of territories adopting restrictions with similar stringency levels, we still find evidence of significantly different patterns based on local socio-economic characteristics. In particular, we show that territories displaying higher income per capita, and larger concentration of manufacturing and service activities were characterized at the same time by a stronger reduction in economic consumption and more severe contagion.

We mainly contribute to the debate on the impact of differentiated policies quantifying the

welfare loss associated with different stringency levels of restrictions. In this way, we highlight the capability of such tailored restrictions to diversify their effects according to the local intensity of infections, avoiding to disproportionately generate welfare losses in terms of consumption reduction in territories characterized by lower contagion. Furthermore, we provide some preliminary evidence that **space-time** differentiated policies were not entirely able to produce equal and homogeneous epidemiological and economic performances across territories implementing restrictions with similar intensity. In this way, our analysis may support policy makers to progressively refine the design of differentiated restrictions to produce better results along both the economic and epidemiological dimensions.

This paper is structured as follows: section 2 provides an overview of the impact associated with tailored restrictions. Section 3 introduces the policy framework adopted in Italy during Autumn 2020 and describes data and methods employed in the analysis. Section 4 displays results and policy implications, while the paper concludes by showing the main contributions of this research.

Theoretical Background

The pressing need to resume economic activities, keeping under control the contagion, has stimulated a careful assessment of the economic and health impact associated with lockdown and reopening policies (Gatto et al., 2020; Inoue and Todo, 2020; Dall Schmidt and Mitze, 2022; Roe et al., 2022). Since long term horizontal lockdowns generate major economic disruption, milder restrictions, which allow to partially resume economic activities with a limited rebound of contagion, are instead suggested as alternative more sustainable solutions that may be applied to manage new waves of the pandemic (Bertuzzo et al., 2020). Indeed, empirical evidence suggests that horizontal lockdowns represent sub-optimal restriction strategies, as they abstract from specific characteristics of the local labour and economic structure, and do not equally balance healthcare risks and potential economic losses (Ferraresi et al., 2021; Guaitoli and Pancrazi, 2021).

For instance, territories characterized by higher specialization of economic activities and a higher concentration of labour force employed in essential sectors may experience higher contagion and mortality rates (Ascani et al., 2020, 2021). Territories whose production systems are more embedded in investment and export related supply chains may be subject to more severe economic losses during lockdown rather than regions specialized in essential sectors (Ferraresi et al., 2021). Furthermore, the magnitude of the reduction of the economic activity is affected also by the level of integration and the intensity of business linkages across sectors, with firms whose downstream sectors are more constrained by social distancing subject to more negative economic results (Inoue and Todo, 2020; Laeven, 2022).

Moreover, additional local factors such as temperature, income per capita and concentration of transportation infrastructures may significantly affect the spread of the contagion and economic losses (Guaitoli and Pancrazi, 2021). However, limited empirical evidence has been produced on the capability of policy makers to design specific regulations taking into account the local economic structure and other factors that may drive contagion and economic consequences of restrictions.

The main reason for this shortage of structured ex-post evaluations of the impact of differentiated policies, especially under the economic dimension, may be associated with the lack of precise and high frequency data, allowing to assess almost in real time the variation in consumption patterns of individuals. Indeed, while epidemiological information on the number of new infections and deaths are updated on a daily frequency, with an adequate level of spatial granularity, official data on the economic response of consumers are not released in real time, and are usually characterized by insufficient geographical detail. As a consequence, a common approach in the literature has been the adoption of simulation models in order to estimate the expected cost of social restrictions (Bekkers and Koopman, 2022; Bonet-Moron et al., 2020; Spelta et al., 2020; Capello and Caragliu, 2021).

Nonetheless, a growing stream of research is relying on transaction data to assess the contemporary effect of natural disasters, since they may provide an accurate representation of slow-

moving national accounts and they are collected at high time frequency, although they are not gathered through traditional, carefully designed, structured surveys (Carvalho et al., 2020). Consequently, some works based on this type of information are emerging to provide almost immediate evidence of the impact of restrictions and support regulators in taking timely corrective actions (Baker et al., 2020; Sheridan et al., 2020; Chen et al., 2021).

A large amount of evidence from these works shows that economic consumption data are able to properly capture the fast reaction of economic activities to restrictions, with expenditures from high-income households experiencing a stronger decline (Carvalho et al., 2020; Chetty et al., 2020; Chronopoulos et al., 2020; Cox et al., 2020). Entertaining, large Retail chains, Restaurants and Travel are the most negatively impacted sectors, with economic losses that are only partially compensated by a growth in online purchases (Bounie et al., 2020a; Alexander and Karger, 2020; Chen et al., 2021). Moreover, the economic reaction following these restrictions has been heterogeneous with respect to the age cohorts of the population and with respect to the different socio-economic characteristics of territories (Baker et al., 2020; Martin et al., 2020; Sheridan et al., 2020). Furthermore, high frequency transactions data in sectors directly related to transportation are employed as a proxy for human mobility in epidemiological models, thus constituting an alternative to the most widely used mobility data (Carvalho et al., 2020; Persson et al., 2021; Xiong et al., 2020).

All these contributions show the high potential of transaction data in explaining the economic impact of restrictions during the lockdown and the evolution of infections. However, the vast majority of extant studies focuses on the first wave of contagion, analysing the effects produced by generalized policy packages. On the other hand, Warren et al. (2021) highlights the need to assess how policy responses to new waves of COVID-19 pandemic benefit from past lessons.

Indeed, strategies adopted to control the contagion are still often designed according to preliminary, partial and limited analyses and tend to slowly evolve based on new emerging empirical evidence (Halperin et al., 2021). Many countries have implemented sub-optimal policies, disproportionately affecting socio-economically local territories, even though tailored restrictions

involve lower economic costs, resulting more effective to control the pandemic and limit the contraction of economic activities (Escandon et al., 2021). Therefore, there is an explicit need to demonstrate how carefully designed restrictions, targeting specific sectors which require close human interactions, are at the same time more sustainable and effective strategies than broad stay-at-home orders (Haug et al., 2020; Lai et al., 2020).

In the next sections, we show how high frequency credit card payment data can be employed to analyse the impact of **space-time** differentiated policies over the economic and epidemiological dimensions. In this way, we aim to contribute to the literature on the usage of real time transaction data to investigate the impact of restrictions during COVID-19 pandemic. Furthermore, we discuss the effectiveness of differentiated regional policies to reduce economic activities consistently with the local intensity of the contagion. Overall, we strengthen the science-policy relationship, providing robust empirical evidence that might support more carefully designed restrictions to deal with the COVID-19 pandemic.

Data and Methodology

Policy Description

This section aims to synthesize the strategy adopted by the Italian government to face the COVID-19 pandemic, providing an overview on the **space-time** differentiated restrictions adopted during Autumn 2020.[1]

After a summer period proceeded with almost no restrictions, new stringent policies were implemented in Autumn 2020 due to the resurgence of the contagion. Since the 6th of November a new framework with three tiers of progressively more stringent restrictions was applied in order to impose more carefully targeted limitations to human activities according to the severity of the

[1] We suggest to refer to Bull (2021) for a more complete and detailed description and timeline of the Italian government policy responses during the first half of 2020.

contagion at regional level. The risk status associated to each Italian region was based on a specific algorithm designed by the Italian national healthcare institute (Istituto Superiore Sanità (ISS)), taking into account different epidemiological variables observed during the two previous weeks (e.g. the basic reproduction number and the saturation level of local healthcare infrastructures). Based on such framework, Italian regions were divided in three different categories of risk (”low”, ”medium” and ”high”) and the risk status was updated on a weekly frequency. This risk management framework was held until the end of 2020 and also during 2021. In Appendix A, Tables A1 - A5 provide detailed information about the set of sectors closed in low, medium and high risk regions.[2]

Overall, we observe that in low risk regions the majority of restrictions applied to the Arts, Entertainment and Recreation sector, while Retail activities were closed only during the weekend with the exception of essential sectors. Cinemas and theatres were closed and online education was implemented in high schools and universities. More stringent restrictions in medium risk regions concerned mobility with individuals required to move only within the municipality. Moreover, restaurants were closed 7 days per week with food delivery allowed only until 10pm. Finally, in high risk provinces non essential business activities in the Wholesale and Trade sector were fully closed. Furthermore, mobility was forbidden at any hour with the exception of work and health reasons, while online education was implemented also in secondary schools. All the three risk tiers were subject to a 50% reduction of public transport capacity, while no explicit restriction involved the Accommodation and Human Health sectors.

Data

Our data come from a major Italian bank whose clients are distributed across the entire national territory. The average market share of the bank is around 22% both at province and regional level.[3]

[2] Additional information on the decree n. 275 implemented since 6th November 2020 is available at the following link: https://www.salute.gov.it/portale/nuovocoronavirus/homeNuovoCoronavirus. jsp?lingua=english.
[3] We compute the market share as the ratio between the number of clients of the bank (at province or regional level) and the amount of population with age higher or equal to 18 years.

Furthermore, excluding Trentino Alto Adige, where the bank presence is around 8%, in all other regions the market share is at least 14% with values above 30% for Aosta Valley, Lombardy, Piedmont, and Veneto (see Appendix B for more details on the geographical presence across Italian regions and provinces).

We use aggregate daily records of the monetary value of transactions from cardholders making purchases in physical (offline) and digital (online) point-of-sales (POS). In our empirical analysis we refer to transactions at the level of Italian provinces on the vendor side. Since the location of the vendor is available only for physical transactions and not for vendors in online transactions, we use only offline transactions aggregated at province level from the vendor side for the rest of the empirical analysis.[4] However, due to the significant restrictions on human mobility, excluding online transactions could represent a limitation of our analysis. Appendix D provides additional details on the incidence of online consumption, showing different reasons why relying on physical transactions should still provide an accurate representation of the consumption behaviour of Italian territories during the COVID-19 pandemic. Main motivations are related to the limited penetration rate of online spending with respect to physical transactions and a high homogeneity in terms of incidence of online transactions across territories.

Finally, vendor information also contains details regarding its business classification, which we use to characterize transactions occurring in specific sectors of the economy.

The Variation of Economic Consumption

Daily Y-o-Y consumption variation is represented by the percentage variation of a rolling average of daily economic consumption over a time window of 7 days between 2020 and 2019. In formula:

$$Y - o - Y_{i,t,k} = \frac{Spending_{i,t,k} - Spending_{i,t-364,k}}{Spending_{i,t-364,k}} \quad (1)$$

[4] Only in Appendix C we aggregate data at the national level considering both offline and online channels to compare them with official statistics.

where $Spending_{i,t,k}$ is a rolling average of daily economic consumption over a time window of 7 days in province *i*, in sector *k* in day *t* and $Spending_{i,t-364,k}$ is the corresponding value obtained 364 days before (one year before, with correspondence of week days), coherently with Sheridan et al. (2020).[5]

Figure 1 shows the daily Y-o-Y consumption variation for a pool of sectors[6] in provinces implementing restrictions with different stringency levels. Overall, we observe similar trends in the Y-o-Y consumption variation of provinces exposed to restrictions with low, medium and high stringency levels in the weeks before the implementation of three tiers risk framework (16th October - 6th November 2020) across the analysed sectors. In particular, all sectors display decreasing patterns, suggesting a reduction in consumption connected with a progressive resurgence of the contagion. The only exception is represented by the Human Health sector, where the raise in consumption in the period 23rd October - 6th November 2020 can be explained by a growth in the purchase of private protection equipment such as masks and detergents and other expenditures strongly connected with the severity of the healthcare emergency.[7]

More heterogeneous patterns in the Y-o-Y consumption variation are observed in the period after the start of **space-time** differentiated restrictions. When we consider all sectors, high risk provinces experience on average a consumption reduction by −20.5%, while medium and low risk areas account for a reduction around −6.1% and −1.5%, respectively (see Table 1). Similar values are obtained when we focus only on the Retail sector. The strongest contraction of consumption activities

[5] Through this formulation, we ensure that each day is compared against the same day (e.g. Mondays are compared with Mondays) of the previous year. Furthermore, over the analysed time frame (16th October - 7th December), the Italian calendar does not display holidays that may occur on different days across different years, thus our results should be robust to potential confounding coming from alternating holidays.

[6] **We refer to a set of NACE sectors at 2 digits level of detail. In particular, we consider, All sectors, Retail (code 47), Accommodation (code 55), Restaurants (code 56), Human Health (codes 86, 87, 88) and all sectors with the exclusion of only Retail activities.**

[7] The Human Health sector includes economic consumption occurred in the Healthcare sector. Transaction data in this sector may be able to properly map private spending in the private healthcare, while they may be less representative of consumption in the public healthcare sector, due to alternative more widespread payment systems with respect to credit and debit card. Furthermore, as more generally shown by Schmidt (2008) and Desdiani et al. (2022) intergovernmental transfers from central to provincial governments, allowing local governments to rely on sufficient resources to deliver their services in the human health sector, may also matter during the COVID-19 pandemic.

is achieved by the Accommodation sector, with an average drop in consumption ranging between −82.8% and −48.9%, although the main reduction in consumption was already achieved before the start of differentiated policies. Also the Restaurants sector experiences a large contraction in Y-o-Y consumption variation in all provinces before the 6th of November 2020. Low risk provinces exhibit a consumption reduction between −37.5% and −25.0% during the period of **space-time** differentiated policies, whereas medium and high risk territories are subject to a further drop, reaching a −58.8% and −72.1% of average consumption reduction.

Human Health represents the only sector displaying consumption growth during the analysed period, with provinces adopting restrictions with a high stringency level subject to higher economic variation. Note how these two patterns suggest that expenditures in this sector are strongly related to the pandemic intensity. Finally, when the Retail sector is excluded, high risk provinces feature the largest drop in consumption (−23.3%).

The Econometric Specification

Our analysis aims to estimate the impact of the three tiers risk framework implemented in Italy since the 6th of November 2020 (see Panel A in Figure 2 for the risk classification of Italian regions over the analysed time frame). To disentangle the economic impact generated by restrictions with increasing stringency levels (low, medium, high), we rely on a standard two ways fixed effects (TWFE) panel event study with a dynamic specification, as described by Borusyak and Jaravel (2017) and de Chaisemartin and D'Haultfœuille (2022) in recent reviews of panel event study approaches. Similar statistical models have been recently applied also by Askitas et al. (2021), Chernozhukov et al. (2021a) and Isphording et al. (2021) to investigate the impact of alternative non pharmaceutical interventions on the spread of COVID-19. In formula:

$$Y_{i,t} = \alpha + \sum_{\substack{e=-5,\\ e\neq -1}}^{3} \beta_e * Medium_{i,t}^{e} + \sum_{\substack{e=-5,\\ e\neq -1}}^{3} \gamma_e * High_{i,t}^{e} + \eta X_{i,t} + \delta_i + \delta_t + \mu_{i,t} \quad (2)$$

where index t refers to the considered day, subscript i denotes the underlying province, δ_i are provinces fixed effects, and δ_t are time fixed effect. Furthermore, $Medium_{i,t}^{e} = 1\{t \in week_e \ \& \ Restriction\ level_i = Medium\}$ is an indicator equal to 1 when province i is observed in a day t belonging to a week which is exactly e periods (weeks) away from the start of the medium treatment. Consistently, $High_{i,t}^{e} = 1\{t \in week_e \ \& \ Restriction\ level_i = High\}$ is an indicator equal to 1 when province i is observed in a day t belonging to a week which is exactly e periods away from the start of the high treatment. Our model is thus defined in relative time, since such indicators are expressed in terms of the number of weeks before or after the start of the treatment, irrespective at which week in calendar time the event takes place.[8]

$Y_{i,t}$ is our dependent variable, representing the daily Y-o-Y variation of economic consumption defined as in section 3.3. Finally, $X_{i,t}$ is a vector of time varying control variables and $\mu_{i,t}$ is the idiosyncratic component. In terms of time varying regressors we consider those factors that may confound the impact of differentiated policies on the consumption variation. As a consequence, we take into account *lagged new daily cases* representing the daily number of new infected individuals in each province expressed as a percentage of the local resident population. We lag such variable by 14 days since main policy decisions were based on the contagion patterns observed during the previous two weeks. Furthermore, we consider also *lagged total daily cases* representing the cumulative amount of infections experienced by each province since the beginning of the pandemic. We plug into the model also squares of such variables in order to properly account for non linearities associated to different COVID-19 waves in late 2020. Furthermore, in line with Guaitoli and Pancrazi (2021), we consider the average *temperature* experienced by provinces in the ten days before the observed day, as seasonality may influence the intensity of the pandemic and consequently the

[8] **Panel B in Figure 3 further clarifies that our model is defined based on relative time. For instance, for the province of Ancona experiencing a medium restriction level since the 15th of November, the 16th of October (day t) is 5 weeks far from the start of the treatment. Thus, $Medium_{i=Ancona,t=16\ October}^{e=-5} = 1$. Conversely, for the province of Arezzo, experiencing a medium restriction level since the 10th of November, the 16th of October (day t) is 4 weeks far from the start of the treatment. Thus, $Medium_{i=Arezzo,t=16\ October}^{e=-4} = 1$.**

possibility to resume economic activities.[9] Since physical contacts and social interactions simultaneously affect both the spread of the virus and consumption behaviour, we take into consideration the total amount of *mobility* of provinces, computed as the sum of inner loops (e.g. people moving within the provinces) and people entering or exiting the considered province, expressed as a percentage of local population. Finally, we consider a set of controls for macro regional unobserved time trends obtained by interacting time fixed effects with NUTS 1 dummies. Table 2 shows sources and descriptive statistics for the dependent variable across different analysed sectors and for time-varying controls.

Under this specification the coefficients β_e and γ_e for values of $e < 0$ allow to test for parallel pre-treatment trends. Conversely, the coefficients β_e and γ_e for values of $e \geq 0$ capture the impact of the medium and high treatment at different exposure lengths, respectively. Observing the values of these coefficients over multiple weeks after the start of the treatment allows us also to assess the persistency of policy effects and how the policy impact unfolds over time. Within this empirical setting, β_e and γ_e can be interpreted as the percentage by which, on average, the economic consumption was higher or lower in a medium or high risk province, with respect to a low risk province, in a day belonging to a week that is e weeks away from the start of the treatment.

Consistently with panel event study applications shown by Callaway and Sant'Anna (2021) and Sun and Abraham (2021), we consider a setting where our control group is constituted by never treated units, represented by all provinces classified as low risk since the 6th of November until the end of our analysed period (7th of December).[10] Units under medium treatment are all provinces classified as medium risk, after having previously been classified as low risk. Units under high

[9] Data related to temperature for Italian provinces are collected from the official website of the "Ministry of Agricultural, Food and Forestry Policies" (MiPAAF). Such information is available at the following link: https://www.politicheagricole.it/flex/FixedPages/Common/miepfy700_riferimentiAgro.php/L/IT?parm1=0085&%20parm2=1210&%20parm3=stnd&%20name=P&%20period=06m&%20nomeParam=Temperatura%20Minima.

[10] Considering a setting where the control group is constituted by never treated units allows us to solve under-identification problems because the control group can be used to estimate the year effects independently of the causal effect of treatment (Borusyak and Jaravel, 2017).

treatment are all provinces classified as high risk, after having previously been classified as low risk (see Panel B in Figure 2 for the geographical distribution of provinces classified as low, medium and high risk areas for our empirical analysis). For both provinces under medium and high treatment, we exclude weeks in which such provinces may have changed again risk level after having been classified as medium or high risk (see panel A in Figure 3 for further details). In this way, we ensure that all provinces included into the analysis are subject to the same pre-treatment period (a baseline without differentiated policies between the 16th of October 2020 and the 6th of November 2020 and a period in which they were classified as low risk areas), thus avoiding that the impact of medium and high restrictions might be affected by different policies implemented before the start of the treatment.

Consistently with a broad literature on panel event studies (Gallagher, 2014; Ujhelyi, 2014; Bailey and Goodman-Bacon, 2015; Deryugina, 2017; Sun and Abraham, 2021) we omit the event week −1, corresponding to 1 week prior to the start of medium or high treatment, as it represents the closest lag from the treatment. Overall, Panel B in Figure 3 clarifies our empirical setting showing our control group and the time variation of our $Medium_e$ and $High_e$ indicators among treated units.

Although differentiated policies in Italy started on the 6th of November, we analyse Italian provinces from the 16th of October in order to have three weeks of observations before the start of tailored containment restrictions. Furthermore, we stop our period of observation on the 7th of December, thus excluding from our analysis the time frame 8th December 2020 - 31st December 2020 for two main reasons. First, the government implemented on the 8th of December 2020 a policy package providing cash-back for household consumption to stimulate private demand, thus significantly affecting the purchasing behaviour of individuals with respect to the analysed period. Second, during weekends and holiday days of Christmas period, stricter uniform restrictions were implemented across territories, regardless the local severity of the pandemic.

We start estimating the model described in Equation 2 separately for a set of economic sectors that were significantly affected by restrictions with different stringency levels. In particular, we focus on the Retail, Restaurants, Accommodation and Human Health sectors. Furthermore, we consider the

case where we account for total consumption across all economic sectors and the case where we exclude only the Retail sector. In Appendix E we estimate also a model with a combined full sample of sectors (rather than split the sample by sectors), including as further controls also interaction effects composed of sector-time dummies (relative to a baseline sector). This gives us the opportunity to statistically test for differences in effect size across sectors.

Assessing the Relevance of Province Specific Socio-economic Variables

In a second step, we investigate whether local socio-economic characteristics, measured before the start of the pandemic, affect economic and epidemiological performances of Italian territories implementing the same level of policy stringency. We first identify three sets of comparable provinces adopting the same level of policy stringency. We do this based on our main dimension of analysis, constituted by the risk tier associated to Italian provinces based on the three tiers risk framework (e.g. low, medium and high risk areas). Low risk provinces are composed by territories adopting restrictions with a low stringency level over the whole analysed period of differentiated policies (6th of November - 7th of December). Medium (high) risk provinces are territories either immediately classified as medium (high) risk provinces, or provinces implementing restrictions with medium (high) stringency level after having been classified as low risk areas on the 6th of November 2020. Moreover, we exclude the baseline period before the 6th of November and other following weeks where such provinces may have switched to a different risk status with respect to the one employed in our analysis. In this way, we ensure to compare territories implementing the same level of policy stringency over a period in which they are subject to the same treatment. Figure 4 shows the set of provinces classified as low, medium and high risk areas for the analysis described in this section.[11]

[11] **Since in this case we compare territories with the same level of policy stringency, the analysis takes into account the whole set of Italian provinces as shown in Figure 4. The set of territories included in this analysis is thus slightly different from that described in section 3.4 and highlighted in panel B of Figure 2, where we compare territories applying restrictions with different stringency levels. Indeed in section 3.4, to increase the internal validity of our analysis, we exclude territories with different pre-treatment periods (e.g. territories immediately classified as medium or high risk areas, without having been previously classified as low risk areas on the 6th of November).**

Then, within each risk tier r (low, medium, high) we define two different categories of territories ($Positive\ Performances_r$ and $Negative\ Performances_r$) to investigate whether local socio-economic characteristics may represent channels of effects of restrictions over the economic and epidemiological dimensions. We identify such categories based on average province performances in terms of daily contagion ($Cont_{i,r}$) and consumption variation ($Cons_{i,r}$). In formula:

$$Cont_{i,r} = \frac{\sum_{t=1}^{T_{i,r}} Daily\ Cases_{i,t}}{T_{i,r}} \quad (3)$$

$$Cons_{i,r} = \frac{\sum_{t=1}^{T_{i,r}} Y - o - Y_{i,t}}{T_{i,r}} \quad (4)$$

where $Daily\ Cases_{i,t}$ are daily COVID-19 positive cases observed in province i at day t expressed as a percentage of the local population, $Y - o - Y_{i,t}$ is the daily consumption variation observed in province i at day t defined as in Equation 1, and $T_{i,r}$ is the total number of days that province i is subject to the level of restriction r.

We define $Cont_r^{50}$ and $Cons_r^{50}$ as the median values of the distribution of contagion and consumption variation, respectively, for all provinces subject to a specific level of restriction r. Then, the $Positive\ Performances_r$ category is composed by provinces with performances below or equal to $Cont_r^{50}$ in terms of contagion and above or equal to $Cons_r^{50}$ in terms of consumption variation. They represent territories experiencing positive performances both under the healthcare and economic dimensions. The $Negative\ Performances_r$ category includes provinces with performances above $Cont_r^{50}$ in terms of contagion and below $Cons_r^{50}$ in terms of consumption variation. They represent territories experiencing negative performances both under the healthcare and economic dimensions. More in detail:

$$Positive\ Performance_r = \{prov_i : Cont_{i,r} \leq Cont_r^{50}\ \&\ Cons_{i,r} \geq Cons_r^{50}\} \quad (5)$$

$$Negative\ Performance_r = \{prov_i : Cont_{i,r} \geq Cont_r^{50}\ \&\ Cons_{i,r} \leq Cons_r^{50}\} \quad (6)$$

Finally, through a set of t-tests we check whether within each tier of provinces with the same level of

policy stringency, the two categories feature statistically different socio-economic characteristics. In this way, we study whether factors underlying the two categories may represent relevant drivers of the impact of restrictions over the economic and epidemiological dimensions.

In the following, we motivate the set of province specific socio-economic characteristics that we consider in our analysis as potential drivers of the heterogeneous epidemiological and economic behaviour of territories implementing the same level of policy stringency. Specifically, since restrictions might have been associated with the exacerbation of socio-economic disparities (Bonaccorsi et al., 2020, 2021; Polyakova et al., 2020), we consider Income per capita and Inequality[12] in the distribution of income as drivers potentially affecting the outcome of the policy. Moreover, as the severity of the pandemic might have been influenced by demographic characteristics, we include in the analysis Population and Population Density (Sheridan et al., 2020).

We consider also a Telework index representing for each province a proxy of the portion of individuals that could work with a telework approach, since the level of contagion and economic consumption might have been affected by the extent to which employees could work from remote limiting contacts with other individuals.[13]

In addition, we consider the percentage of citizens with fast Internet Connection[14] and Accessibility[15] as two additional factors representing the capability of each province to be connected with other

[12] Inequality in the distribution of income at province level is computed as the Gini index of the income per capita in year 2019 of municipalities belonging to the corresponding province.

[13] We compute the Telework index as the weighted sum of the percentage of workers employed in each sector k ($Employees_{i,k}$) in each province i and a coefficient representing the share of workers that might work from remote in sector k ($Telework\ share_k$) estimated by Espinoza and Reznikova (2020). In formula:

$$Telework\ Index_i = \sum_k Employees_{i,k} * Telework\ share_k$$

Information on the number of employees in specific sectors at province level are obtained by aggregating firm level data collected from the ORBIS Bureau Van Dijk database. Specifically, we consider the average number of employees in the years 2018-2020 at firm level. Overall, our estimates of the telework index are in line with those of Dingel and Neiman (2020).

[14] Internet Connection represents the percentage of individuals reached by Internet Connection with a speed higher or equal to 100 Mbps disclosed by national authority guaranteeing communication (AGCOM) in year 2019.

[15] Accessibility is disclosed by the national statistical office (ISTAT) and provides information on the travel times, expressed in minutes, from the centroid of each municipality to the three closest infrastructures for four categories: ports, airports, railway stations and motorway toll booths. The indicator is then aggregated at province level. It is referred to year 2013 (the last available year at the moment of writing).

territories from a digital and physical perspective.

Furthermore, the geographical concentration of specific economic sectors may require stronger face-to-face interactions and direct contacts among people. As a consequence, in line with Ascani et al. (2020), we consider an indicator of economic specialization to understand whether the level of concentration of economic activities may have significantly affected contagion and consumption variation of provinces even in presence of restrictions with the same stringency level.[16]

Nonetheless, even territories characterized by similar specialization profiles, may hide significant differences in terms of the local economic structure, depending on the economic sector mix. For this reason, we consider in our analysis the share of workers employed in the Primary, Manufacturing and Service sectors in each province.[17]

Finally, since the Italian government defined a set of essential sectors that may stay open during the lockdown, while freezing all other economic activities, we consider the portion of individuals employed in essential sectors with respect to the total number of employees at province level.[18]

Table 3 shows sources and descriptive statistics for the set of above-mentioned specific socio-economic characteristics of Italian provinces.

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[16] In particular, for each province *i*, we define a measure of sectoral specialization computed as the ratio between the relevance of the considered sector *k* in the underlying province and the relevance of such sector in the overall national economy. In formula:

$$Specialization_{i,k} = \frac{\frac{Number\ of\ employees\ in\ sector\ k\ in\ province\ i}{Number\ of\ employees\ in\ province\ i}}{\frac{Number\ of\ employees\ in\ sector\ k\ at\ national\ level}{Number\ of\ employees\ at\ national\ level}} \quad (7)$$

We compute a synthetic measure of economic specialization for each province as the median value of the specialization index computed at sectoral level:

$$Specialization_i = median\left(Specialization_{i,k}\right) \quad (8)$$

[17] We compute the share of workers employed in the Primary, Manufacturing and Service sectors in each province as the ratio between the total number of employees in the Primary, Manufacturing and Service sectors in each province and the total corresponding values computed at national level (average over years 2018-2020).

[18] For the identification of the essential sectors, we rely on the DPCM of the 22nd of March 2020. The detailed list of essential sectors defined by the DPCM n.76 published by the Italian Government on the 22nd of March 2020 is available at the following link: https://www.gazzettaufficiale.it/eli/id/ 2020/03/26/20A01877/sg. We use the final version of essential sectors updated on the 25th of March. For information on the number of individuals employed in specific sectors, we rely on the ORBIS Bureau Van Dijk database, where we consider the average number of employees in the years 2018-2020 at a level of detail of 4 ATECO digits (coherently with the most granular level of detail at which essential sectors were defined).

Results

The Economic Impact of Restrictions

This section shows the impact of restrictions with different stringency levels in Italian provinces, based on the local intensity of the contagion. Table 4 and Figure 5 display the results of the panel event study TWFE described in Equation 2.

Overall, we obtain heterogeneous impacts of alternative containment restrictions across sectors. When we take into account all sectors of local economy, we find evidence of a significant welfare loss in terms of reduction of economic consumption in high risk provinces with respect to territories implementing restrictions with a low stringency level, with an average treatment effect on treated (ATT) ranging between −16.2% and −12.5%. This means that on average, in a day belonging to week 1, a high risk province experiences a variation of economic consumption (computed considering consumption across all sectors) that is 16.2% lower with respect to a low risk province. Such effect is smaller after the immediate implementation of the high stringency policy (week 0), while it is higher over weeks 1-3.

Conversely, we find lower welfare losses from spending decrease for areas implementing restrictions with a medium stringency level, with an ATT between −5.6% and −4.0%. The absence of significant coefficients in the weeks before the start of differentiated policies (the only exception is week −5 for high risk provinces) highlights that the parallel trend assumption holds, suggesting that consumption patterns of analysed provinces do not tend to display statistically significant differences before the start of the treatment.

Such evidence is confirmed when we focus only on the Retail sector. This result highlights the relevance of this sector for local economy. Indeed, we obtain still negative and significant ATTs for provinces adopting high stringency level restrictions, with a contraction of economic consumption between −21.7% and −11.0%. We confirm a lower immediate effect of the policy in week 0, with the

magnitude of the consumption reduction that is higher during week 1 and 2. We find that also territories implementing restrictions with a medium stringency level are characterized by an economic loss between −7.7% and −6.7% (excluding week 0 for which we do not find a significant contraction of economic consumption). Notice how the magnitude of the reduction of economic activity is statistically different also between medium and high risk areas. This result is coherent with the stringency of restrictions adopted in these provinces. Indeed, the former were forced to close not essential sectors only in the weekend, while the latter had to close such business activities for 7 days per week.

When we take into account the Accommodation sector, we find evidence of a significant reduction of economic activities in areas characterized by high stringency level restrictions with welfare losses between −24.3% and −11.3%. Interestingly, notice how the effect of restrictions is immediately significant even at week 0. On the other hand, we show that territories adopting restrictions with a medium stringency level experience significant reduction of economic consumption only one and two weeks after the start of the treatment (week 1 and week 2). Such evidence may be explained by the heterogeneity of mobility restrictions across territories with different levels of policy stringency. Indeed, high risk areas forbid intra-municipality movements with the exception of work and health reasons, medium risk provinces allowed individuals only to flow within the local administrative unit, while low risk territories permitted even mobility across regions.

Significant welfare losses in all weeks of treatment are displayed by the Restaurants sector with an ATT between −28.8% and −12.2% for medium risk areas and between −22.0% and −11.2% for high risk provinces. This evidence is consistent with the fact that both in medium and high risk provinces, restaurants and bars were closed 7 days per week and food delivery was allowed until 10pm, whereas low risk provinces kept bars and restaurants open until 6pm. In addition, notice how restrictions with the same stringency level produced a similar contraction of the economic activity in medium and high risk territories, with ATT coefficients that are not statistically different for the two

groups of provinces. We provide also evidence of a lower immediate impact with restrictions that display a stronger magnitude of economic consumption reduction in the following periods with effects that tend to remain stable over weeks 1-3 since the start of the treatment, thus suggesting that the regulation is not reducing its effectiveness over time.

The Human Health sector is subject to weakly significant contraction of consumption in areas with a high stringency level only at week 3 (−22.2%), while we do not find evidence of welfare losses in medium risk areas. This finding is in line with the absence of restrictions directly targeting this sector in all low, medium and high risk provinces.

Finally, when we exclude the Retail sector, we confirm a significant welfare loss in high risk provinces, with a contraction of consumption between −11.3% and – 5.1% (with the exception of week 3). However, as strong differences between high and low risk areas were related to the Retail sector, notice how the magnitude of the consumption reduction is lower when we exclude the Retail sector with respect to the case in which we consider all sectors or we just focus on the Retail sector. On the other hand, we show relevant welfare losses for medium risk territories only at week 1 with a small magnitude (−4.3%). Considering that low and medium risk provinces mainly differ for restrictions concerning restaurants, local mobility and retail activities, it is reasonable to obtain significant ATT coefficients for medium risk provinces in the Accommodation, Restaurants and Retail sectors, with lower evidence of welfare loss when consumption aggregates across larger groups of sectors are considered.

Since ATT coefficients do not tend to be statistically significant in the weeks before the start of the treatment, we confirm that our results do not suffer from different behaviours of treated and control territories in the period before the implementation of the three tiers risk framework. These results suggest that restrictions with a high stringency level tend to generate welfare losses that are significant with respect to provinces characterized by restrictions with a low stringency level. Similarly, we find evidence of significant consumption reduction in medium risk areas in those sectors where the level of policy stringency is different with respect to low risk provinces.

Furthermore, we show that differentiated policies tend to display a lower immediate impact, with an increase in the reduction of economic consumption over the following weeks, suggesting persistency of the effects.

To check the robustness of our results, we estimate Equation 2 by combining the full sample of sectors (results are reported in Appendix E). In particular, by including within the same model the economic variation of the Retail, Restaurants, Accommodation and Human Health sectors, we have the possibility to study the significance of the different economic behaviours of the underlying sectors. Overall, we confirm that a stronger welfare loss is achieved by provinces subject to restrictions with a high policy stringency with a contraction of consumption between −16.5% and –7.6% (see Table E3 and Figure E1). Notice how the reduction of economic activities tends to be persistent over the whole period of restrictions with a high stringency level. Furthermore, a negative and significant consumption reduction is experienced also by medium risk territories, with an ATT between −10.0% and −2.6%. Sectoral dummy variables suggest that welfare losses in the Restaurants and Accommodation sectors are significantly higher than in the Retail sector (−15.0% and −23.6%, respectively), while the Human Health sector experiences larger consumption variation (46.9%), corroborating that the pandemic contributed to extra consumption in this sector. Such result tends to be confirmed also over time for the different analysed weeks, with interactions between weeks and sectors remaining significant and confirming a persistent contraction of economic activities in the Restaurants and Accommodation sectors with respect to the Retail sector.

The Heterogeneous Epidemiological and Economic Performances of Provinces with Similar Policy Stringency

In this section, we analyse whether the differentiated policies adopted by the Italian government during Autumn 2020 were able to produce homogeneous results in terms of contagion containment and consumption variation across provinces implementing restrictions with the same stringency level.

Following the methodology described in section 3.5, we divide Italian provinces with respect to our main dimension of analysis represented by the three risk tiers (e.g. low, medium and high risk provinces).

Based on Equations 5 and 6, within each risk tier we identify provinces ($Positive\ Performances_r$) with positive epidemiological and economic performances (e.g. displaying above the median consumption variation and below the median contagion) and provinces ($Negative\ Performances_r$) with negative epidemiological and economic performances (e.g. displaying below the median consumption variation and above the median contagion). We then compare through a set of t-tests the socio-economic characteristics of these two categories of provinces. Factors underlying the two categories may indeed represent channels of effects of restrictions over the economic and epidemiological dimensions.

Figure 6 shows the geographical distribution of these two categories of territories for low, medium and high risk provinces when we consider economic consumption across all sectors. In low risk territories, we identify a strong concentration of provinces with negative healthcare and economic performances in Veneto, while areas with positive results are spread in Sardinia and the Centre of Italy (Panel A). These territories tend to display significantly different socio-economic features, with provinces characterized by negative economic and epidemiological performances experiencing significantly higher levels of income per capita, population, population density, opportunity to implement a telework approach and larger concentration of manufacturing and service activities (see Table 5). Such result suggests that specific local socio-economic factors still drive contagion and economic patterns, even in case of tailored restrictions. Furthermore, it highlights the key role of the local labour market structure in explaining the epidemiological and economic behaviour of territories.

Focusing on the concentration of manufacturing activities, our result is coherent with Ascani et al. (2021) who show how industrial districts may experience higher excess mortality rates due to systematic interdependencies, direct face-to-face contacts and coordinated interactions among workers. Furthermore, given that manufacturing firms are usually characterized by business linkages

that cross local administrative boundaries (Boschma and Iammarino, 2009; Cainelli et al., 2014; Kemeny and Storper, 2015), such evidence is consistent with Ferraresi et al. (2021) who highlight that export and investment oriented value chains may be more penalised by restrictions during the pandemic.

As for the service sector, we find results in line with Guaitoli and Pancrazi (2021) who show that in Italy during Autumn 2020 restrictions with the same level of stringency generated significantly higher contagion in provinces with a larger share of population employed in service sectors. This might be justified by physical vicinity of workers with a large number of customers. Furthermore, our empirical evidence corroborates findings from a rich stream of literature highlighting the vulnerability and low resilience of service sectors to the pandemic (Alexander and Karger, 2020; Bounie et al., 2020a; Carvalho et al., 2020; Chetty et al., 2020; Hacıoglu-Hoke et al., 2021). Differently from Ascani et al. (2020), who show how, during the lockdown period, territories with higher concentration of essential sectors were subject to a stronger pandemic intensity, we do not find significant evidence of stronger contribution of essential sectors to the resurgence of the contagion. Indeed, areas characterized by higher levels of essential sectors tend to experience higher economic consumption, but better performances also in terms of pandemic intensity. Our finding is more in line with Ferraresi et al. (2021) who show the absence of a significant trade-off between contagion and economic losses in the re-opening of essential sectors. Furthermore, this result might be explained by the fact that differently from the lockdown period, the resumption of economic activities was not limited to essential sectors in low restriction areas, thus reducing the relevance of such sectors in explaining infections dynamics, since also other business activities may have significantly contributed to the severity of the contagion.

Although differentiated policies should define a trade-off between healthcare and contagion performances, we find even a higher number of provinces in the two categories of territories characterized at the same time by both positive or negative healthcare and economic performances for the case of medium risk provinces (Panel B). Territories characterized by negative results in both

the two dimensions are widespread across the Centre and North of Italy, with some exceptions in the South with the provinces of Bari and L'Aquila. Areas with positive performances are localized in Abruzzo, Apulia, Basilicata, Liguria, Marche, Sicily and Tuscany. Although in this case socio-economic differences across the two categories are slightly less marked, we confirm that areas with better performances display significantly lower income per capita, population, accessibility, opportunity to telework, and concentration of manufacturing and service sectors (see Table 5).

We finally show the results for the tier adopting restrictions with a high stringency level. Interestingly, we still find a strong geographical separation of provinces with negative and positive performances in terms of contagion and consumption variation (see Panel C). The former are concentrated in the North of Italy, especially in Lombardy, Piedmont and Trentino Alto Adige. The latter are mainly localized in the South of Italy in Calabria and Campania, with some exceptions in Lombardy. Again, the two categories display significantly different socio-economic characteristics, corroborating the idea that across all stringency levels, territories with negative economic and epidemiological performances feature higher income per capita (see Table 5). Furthermore, the two categories are characterized by different levels of internet connection, with better performing territories experiencing wider access to a fast broadband. Finally, also the concentration of manufacturing and service activities are relevant drivers of epidemiological and economic patterns, consistently with the evidence shown for low and medium risk provinces.

Overall, these results suggest that **space-time** differentiated policies continue to produce heterogeneous results in terms of infections and economic contraction, with results mainly driven by the local economic structure.

Conclusions

This paper analyses the economic impact of differentiated policies, constituting the main strategy adopted to tackle new waves of contagion during Autumn 2020 in Italy. In this way, we contribute to

study to what extent new policies implement lessons learned from past experience supported by real evidence. In particular, we investigate the capability of alternative restrictions to impose carefully tailored stringency levels that avoid to disproportionately affect territories characterized by lower pandemic intensity.

We show that economic consumption is reactive to restrictions with different stringency levels. Specifically, we observe that high risk territories exhibit a stronger welfare loss in terms of economic consumption across almost all sectors of local economy with respect to low risk territories. In particular, we estimate that the economic contraction induced by restrictions with a high stringency level ranges between −16.2% and −12.5% when we consider consumption across all sectors, while it reaches even larger drops in the Accommodation (between −24.3% and −11.3%) and Restaurants (between −22.0% and −11.2%) sectors.

Conversely, medium risk territories experience a significant contraction of economic consumption, only in those sectors where they introduce more stringent restrictions, with respect to low risk territories. More in detail, a significant economic impact is generated in the Accommodation, Restaurants and Retail sectors, with welfare losses ranging between −28.8% and −6.7% across the different sectors.

Furthermore, we show that **space-time** differentiated policies tend to have a lower immediate impact, with a stronger magnitude of consumption reduction over the following weeks, providing evidence of persistency of policy effects. These results point out that such differentiated policies diversify the magnitude of contraction of economic activities in coherence with the local level of pandemic severity and with the stringency level of restrictions imposed by the three tiers risk framework, avoiding to produce an indiscriminate and generalized reduction of business activities. The main implication is that **space-time** differentiated policies can thus be a valid alternative to national lockdowns, with one-size fits all approaches risking to disrupt local socio-economic systems.

In a second step, we provide some preliminary evidence on the capability of such differentiated policies to produce equal and homogeneous effects in terms of epidemiological and

economic results across territories adopting restrictions with similar levels of stringency. Based on the comparison of epidemiological and economic performances of such provinces, we still find that results are driven by local socio-economic characteristics. In this direction, we demonstrate that within sets of provinces adopting restrictions with the same stringency level, it is possible to identify two categories of territories displaying at the same time positive or negative performances in terms of contagion and economic consumption. These areas feature significantly different socio-economic characteristics, with provinces characterized by negative results, showing higher income per capita, and larger concentration of manufacturing and service sectors.

The significant spatial dimension of COVID-19 pandemic, producing uneven contagion and contraction of economic activities across territories adopting restrictions with the same stringency level, suggests how the local epidemiological and economic resilience and vulnerability of territories is still heterogeneous despite the implementation of **space-time** differentiated policies. As a consequence, specific socio-economic factors related to the local economic structure such as the concentration of business activities across different sectors should be properly accounted in the design of containment restrictions to increase the homogeneity of healthcare and economic performances of Italian territories, and avoid the exacerbation of differences across areas.

These findings can be useful also for other countries implementing similar differentiated policies against the pandemic to understand the potential impact of their restrictions in terms of welfare loss. Indeed, in Europe restrictions with different stringency levels represented a common approach to face the resurgence of the contagion during Autumn 2020, avoiding a horizontal national lockdown. However, still relevant differences exist among these countries and should be carefully considered before generalizing the results to a broader context.

In fact, European countries exhibit different profiles both regarding the epidemic dimension (e.g. the severity of COVID-19 contagion (Clark et al., 2020) and the dynamics of social interactions (Mossong et al., 2008)), and the socio-economic dimension (e.g. territorial divides (Rodrıguez-Pose, 2018), levels of penetration of online sales (Bounie et al., 2020b), and the propensity to

implement telework solutions (Espinoza and Reznikova, 2020)). Even stronger attention should be provided to extend such findings to Asian countries, since their policy approach made a larger use of available technologies such as contact tracing apps that contributed to design alternative restrictions with respect to the European context (Akinbi et al., 2021; Zhou et al., 2021).

Overall, we acknowledge that our analysis presents some limitations. First, due to restrictions to human mobility, online expenditures may constitute a relevant source of information to study consumption dynamics during the COVID-19 pandemic. Although physical consumption significantly correlates with consumption data disclosed by the national statistical office, and despite the limited penetration rate and high homogeneity of online transactions across territories, we believe that future research works might try to include online transactions in the empirical analysis to further refine the precision of results. Such studies may be particularly useful especially in specific sectors such as Accommodation, Retail or Human Health, where the portion of physical transactions is lower and probably less representative of consumption behaviour.

Furthermore, our analysed time frame is short, focusing on a narrow time window (16th of October - 7th of December 2020), where the Italian government started to implement differentiated policies across territories. Additional relevant insights for policy makers may come from similar analyses taking into account additional available instruments to tackle the pandemic such as the vaccine, starting being available since the first term of 2021. This type of studies may complement our findings, providing evidence on the effectiveness of combined and integrated policy packages against the COVID-19 pandemic.

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Tables

Table 1: Descriptive statistics for the daily Y-o-Y variation of economic consumption across different sectors and for different levels of policy stringency over the period 16th of October – 7th of December 2020. The set of provinces classified in low, medium and high risk level is shown in Figures 2 and 3. Consumption data are sourced from the major Italian bank dataset.

Sector	Restriction	Q1	Median	Q3	Mean	Std.Dev
All sectors	Low	-0.059	-0.007	0.043	-0.015	0.077
	Medium	-0.139	-0.047	0.021	-0.061	0.104
	High	-0.335	-0.207	-0.047	-0.205	0.170
Retail sector	Low	-0.010	0.037	0.084	0.034	0.071
	Medium	-0.079	0.013	0.086	-0.004	0.119
	High	-0.288	-0.221	-0.030	-0.180	0.166
Accommodation sector	Low	-0.679	-0.508	-0.372	-0.489	0.256
	Medium	-0.762	-0.677	-0.568	-0.643	0.193
	High	-0.925	-0.878	-0.772	-0.828	0.137
Restaurants sector	Low	-0.441	-0.358	-0.258	-0.343	0.137
	Medium	-0.759	-0.645	-0.432	-0.588	0.196
	High	-0.856	-0.762	-0.615	-0.721	0.146
Human Health sector	Low	0.217	0.374	0.601	0.452	0.317
	Medium	0.315	0.460	0.627	0.502	0.275
	High	0.445	0.722	0.855	0.666	0.325
No retail sector	Low	-0.157	-0.092	-0.031	-0.101	0.104
	Medium	-0.230	-0.150	-0.066	-0.151	0.107
	High	-0.289	-0.192	-0.085	-0.233	0.211

Table 2: Source and descriptive statistics for the dependent variable and time varying controls during the period 16th October 2020 – 7th December 2020. Data related to daily cases in Italy at province level are disclosed by the Italian Civil Protection Department. The database is freely accessible at the link: https://github.com/pcm-dpc/COVID-19. Data related to human mobility are available to researchers by application to the Facebook Data for Good Partner Program accessible at the link: https://dataforgood.fb.com/ tools/disease-prevention-maps/.

	Q1	Median	Mean	Q3	Source
All	−0.028	0.294	0.331	0.571	Italian bank dataset
Retail	−0.047	0.259	0.283	0.526	Italian bank dataset
Transport	−0.057	0.263	0.309	0.550	Italian bank dataset
Accommodation	−0.042	0.270	0.320	0.556	Italian bank dataset
Restaurants	−0.047	0.269	0.318	0.557	Italian bank dataset
Welfare	−0.055	0.242	0.287	0.498	Italian bank dataset
No Retail	−0.050	0.268	0.314	0.554	Italian bank dataset
Lagged new daily cases	$5.421*10^{-5}$	$1.762*10^{-4}$	$2.808*10^{-4}$	$4.258*10^{-4}$	Italian civil protection
Total Lagged new daily cases	0.0046	0.0082	0.0096	0.0389	Italian civil protection
Lagged new daily cases^2	$6.780*10^{-9}$	5.051^{-8}	$1.945*10^{-7}$	$2.035*10^{-7}$	Italian civil protection
Total lagged new daily cases^2	$2.139*10^{-5}$	6.752^{-5}	$1.350*10^{-4}$	$1.670*10^{-4}$	Italian civil protection
Temperature	7.50	10.25	9.89	12.50	MiPAAF
Mobility	0.2624	0.2939	0.2947	0.3326	Facebook

Table 3: Sources and descriptive statistics for the time fixed socio-economic characteristics of Italian provinces.

	Q1	Median	Mean	Q3	Source
Income per capita	16393	19176	18865	20938	MEF
Population	234715	385588	562073	610694	ISTAT
Income Inequality	0.1862	0.1911	0.1920	0.1973	MEF
Internet Connection	0.1042	0.12518	0.1299	0.1464	AGCOM
Accessibility	41.42	49.78	51.38	57.92	ISTAT
Telework	0.2282	0.2361	0.2370	0.2419	OECD & ISTAT
Population Density	106.03	176.09	270.26	280.00	ISTAT
Specialization Index	0.6529	0.7021	0.6962	0.7335	ORBIS
Primary Sector Share	0.0040	0.0072	0.0093	0.012	ORBIS
Manufacturing Sector Share	0.0027	0.0048	0.0093	0.0102	ORBIS
Service Sector Share	0.0029	0.0048	0.0093	0.0095	ORBIS
Essential Employees	0.4422	0.4890	0.4836	0.5331	ORBIS

Table 4: Panel Event study TWFE estimates based on Equation 2. "Medium Week" and "High Week" coefficients refer to coefficients β_e and γ_e of Equation 2. Standard errors are reported in parentheses. Full results with also NUTS 1 and week dummies interactions are available in Appendix E.

	Dependent variable: Daily Y-o-Y consumption variation					
	(All)	(Retail)	(Accommodation)	(Restaurants)	(Human Health)	(No Retail)
Medium Week −5	−0.004	−0.006	0.152	0.031	0.025	−0.006
	(0.022)	(0.021)	(0.126)	(0.039)	(0.045)	(0.031)
Medium Week −4	0.009	−0.001	0.135	0.064*	−0.008	0.020
	(0.016)	(0.015)	(0.102)	(0.038)	(0.034)	(0.024)
Medium Week −3	0.007	−0.008	0.152	0.071	0.026	0.026
	(0.011)	(0.011)	(0.102)	(0.047)	(0.040)	(0.018)
Medium Week −2	−0.002	−0.009	0.085	0.037*	−0.020	0.004
	(0.008)	(0.021)	(0.066)	(0.020)	(0.035)	(0.012)
Medium Week 0	-0.001	0.0003	−0.018	−0.122***	0.020	−0.006
	(0.009)	(0.010)	(0.033)	(0.016)	(0.028)	(0.012)
Medium Week 1	−0.056***	−0.067***	−0.134***	−0.288***	0.009	−0.043**
	(0.014)	(0.013)	(0.041)	(0.024)	(0.035)	(0.018)
Medium Week 2	−0.040**	−0.070***	−0.118**	−0.260***	0.030	−0.004
	(0.017)	(0.013)	(0.053)	(0.026)	(0.032)	(0.028)
Medium Week 3	−0.044**	−0.077***	−0.089	−0.220***	−0.022	−0.001
	(0.020)	(0.015)	(0.077)	(0.029)	(0.096)	(0.037)
High Week −5	0.049*	0.055	0.071	0.048	0.232	0.022
	(0.029)	(0.045)	(0.248)	(0.083)	(0.146)	(0.043)
High Week −4	0.077	0.067	0.090	0.020	0.097	0.065
	(0.056)	(0.048)	(0.172)	(0.062)	(0.120)	(0.056)
High Week −3	0.065	0.069*	−0.044	0.002	−0.081	0.032
	(0.047)	(0.041)	(0.097)	(0.064)	(0.094)	(0.057)
High Week −2	0.041	0.029*	0.035	0.085*	−0.068	0.045
	(0.027)	(0.017)	(0.060)	(0.048)	(0.061)	(0.039)
High Week 0	−0.041	−0.046	−0.113***	−0.112***	−0.016	−0.051***
	(0.027)	(0.039)	(0.044)	(0.032)	(0.071)	(0.019)
High Week 1	−0.162***	−0.201***	−0.210***	−0.211***	−0.053	−0.113***
	(0.024)	(0.022)	(0.060)	(0.039)	(0.083)	(0.018)
High Week 2	−0.159***	−0.217***	−0.172***	−0.220***	−0.153	−0.076***
	(0.020)	(0.019)	(0.065)	(0.045)	(0.140)	(0.029)
High Week 3	−0.125***	−0.110***	−0.243*	−0.213***	−0.222*	−0.133
	(0.041)	(0.030)	(0.125)	(0.056)	(0.122)	(0.082)
Total Mobility	0.043*	0.037**	0.077	0.067	−0.069*	0.050
	(0.024)	(0.016)	(0.066)	(0.041)	(0.041)	(0.046)
Temperature	0.010	0.0001	0.141**	0.058**	−0.011	0.036
	(0.017)	(0.019)	(0.062)	(0.024)	(0.040)	(0.023)
Daily Cases	−0.002	−0.0004	0.007	−0.002	0.005	−0.004
	(0.010)	(0.005)	(0.048)	(0.011)	(0.010)	(0.020)
Total Cases	0.016	−0.007	−0.098	0.027	−0.130**	0.056
	(0.021)	(0.020)	(0.110)	(0.036)	(0.056)	(0.037)
Daily Cases^2	0.002	0.0003	0.007	0.004	−0.002	0.005
	(0.003)	(0.003)	(0.009)	(0.004)	(0.003)	(0.005)
Total Cases^2	−0.014	0.003	0.021	−0.011	0.062*	−0.042
	(0.012)	(0.012)	(0.056)	(0.020)	(0.037)	(0.026)
R^2	0.452	0.501	0.230	0.591	0.156	0.270
R^2 adjusted	0.419	0.472	0.189	0.565	0.107	0.230
N. Observations	3,094	3,094	3,094	3,094	3,094	3,094
Time & Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time-NUTS 1 Interactions	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1; **p<0.05;***p<0.01

Table 5: P-values of t-tests on equal mean for a set of socio-economic characteristics of $Positive\ Performance_r$ and $Negative\ Performance_r$ provinces in case of low, medium and high policy stringency. Economic consumption is computed considering all sectors.

Variable	Low Restrictions	Medium Restrictions	High Restrictions
Income per capita	0.000***	0.000***	0.001***
Population	0.004***	0.086*	0.178
Income Inequality	0.211	0.537	0.583
Internet Connection	0.287	0.261	0.037**
Accessibility	0.135	0.011**	0.838
Telework	0.000***	0.000***	0.137
Population density	0.023**	0.161	0.197
Specialization Index	0.160	0.123	0.986
Essential Employees	0.120	0.150	0.663
Primary	0.365	0.640	0.924
Manufacturing	0.006***	0.001***	0.037**
Service	0.002***	0.007***	0.095*

Note: *p<0.1; **p<0.05; ***p<0.01

Figures

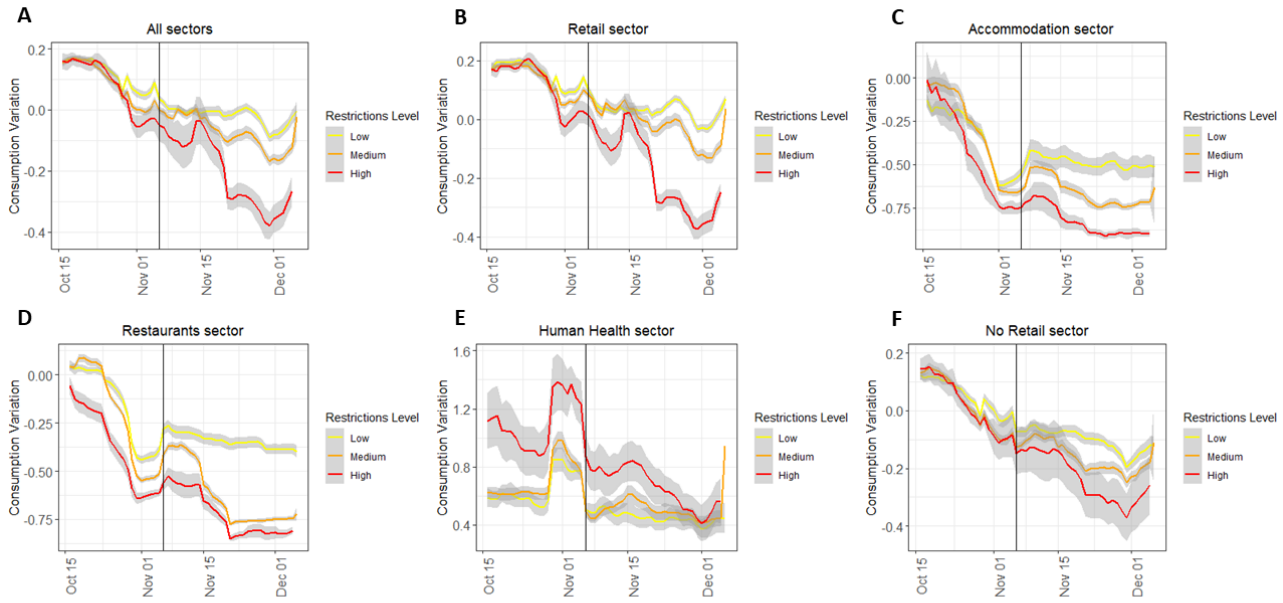

Figure 1: Daily Y-o-Y variation of economic consumption across different sectors over the period 16th of October - 7th of December 2020. The yellow line represents the average daily Y-o-Y variation of economic consumption of all provinces classified as low risk since the 6th of November until the end of our analysed period (7th of December). The orange and red lines represent the average daily Y-o-Y variation of economic consumption of all provinces classified as medium and high risk, after having previously been classified as low risk. Grey areas refer to 95% confidence intervals. The set of provinces classified in low, medium and high risk level is shown in Figures 2 and 3. Further details about the approach we use to classify provinces as low, medium and high risk are provided in section 3.4. Consumption data are sourced from a major Italian bank dataset.

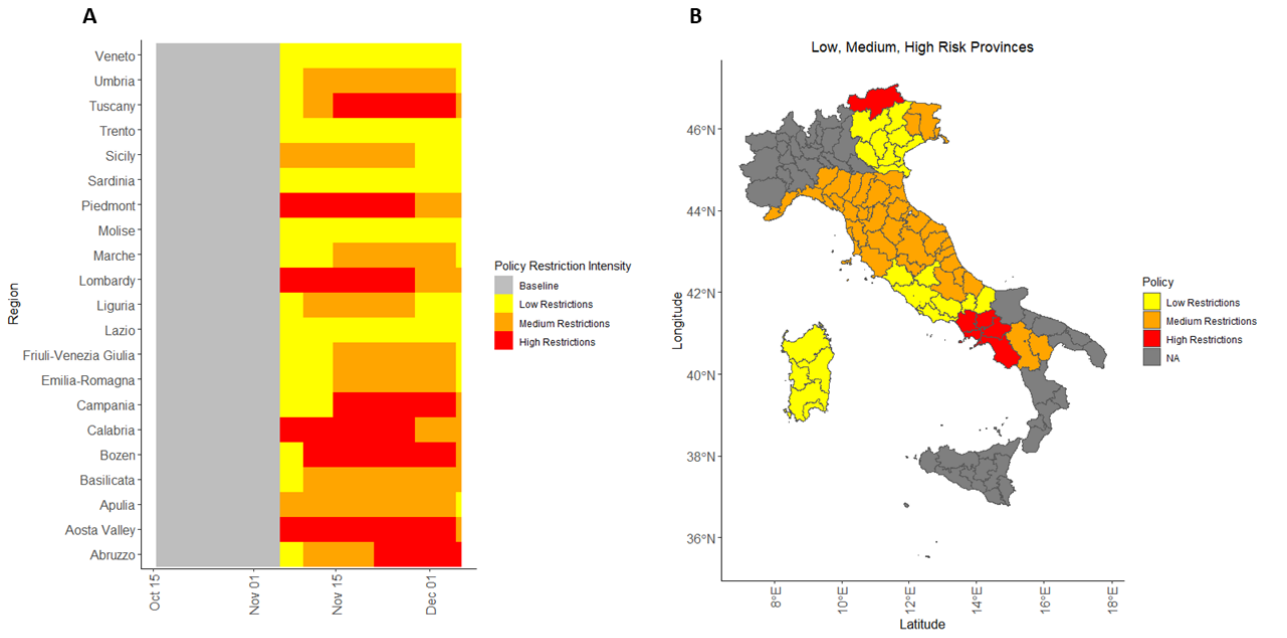

Figure 2: Panel A shows the time evolution of differentiated policies in Italy over the period 16th October - 7th December 2020 at regional level. Panel B shows the geographical distribution of provinces classified as ”low”, ”medium” and ”high” risk territories in our empirical analysis.

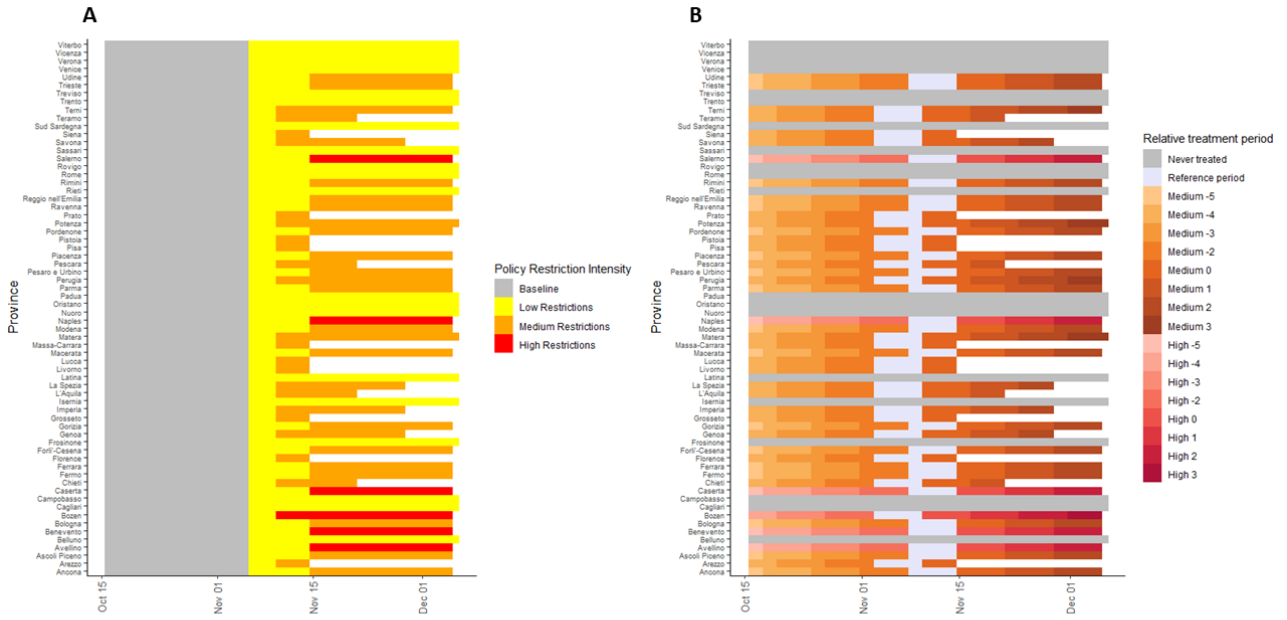

Figure 3: Panel A shows the time evolution of differentiated policies in Italy over the period 16th October - 7th December 2020 at province level. Panel B shows the time evolution of our $Medium_{i,t}^{e}$ and $High_{i,t}^{e}$ indicators.

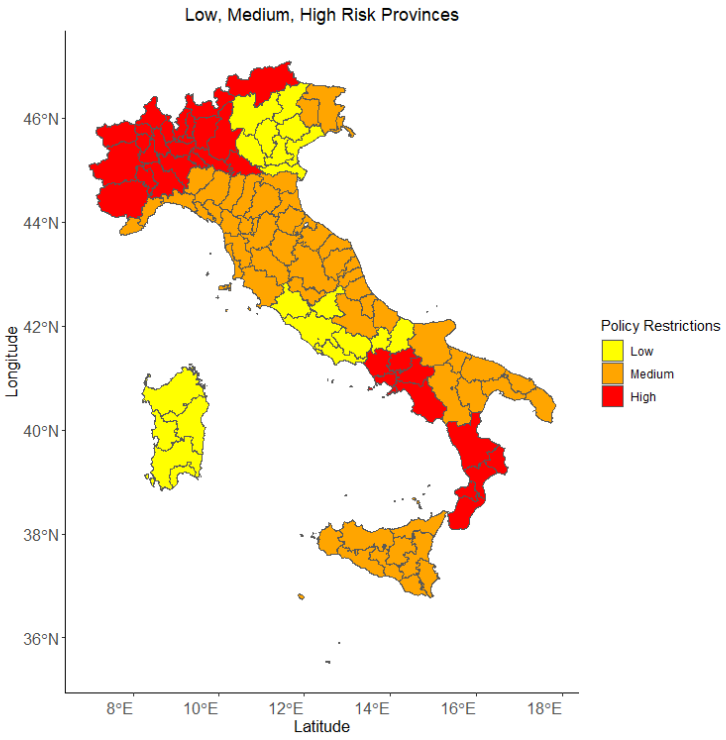

Figure 4: Geographical distribution of provinces classified as ”low”, ”medium” and ”high” risk territories in our empirical analysis to assess the relevance of province specific socio-economic variables based on the methodology described in section 3.5.

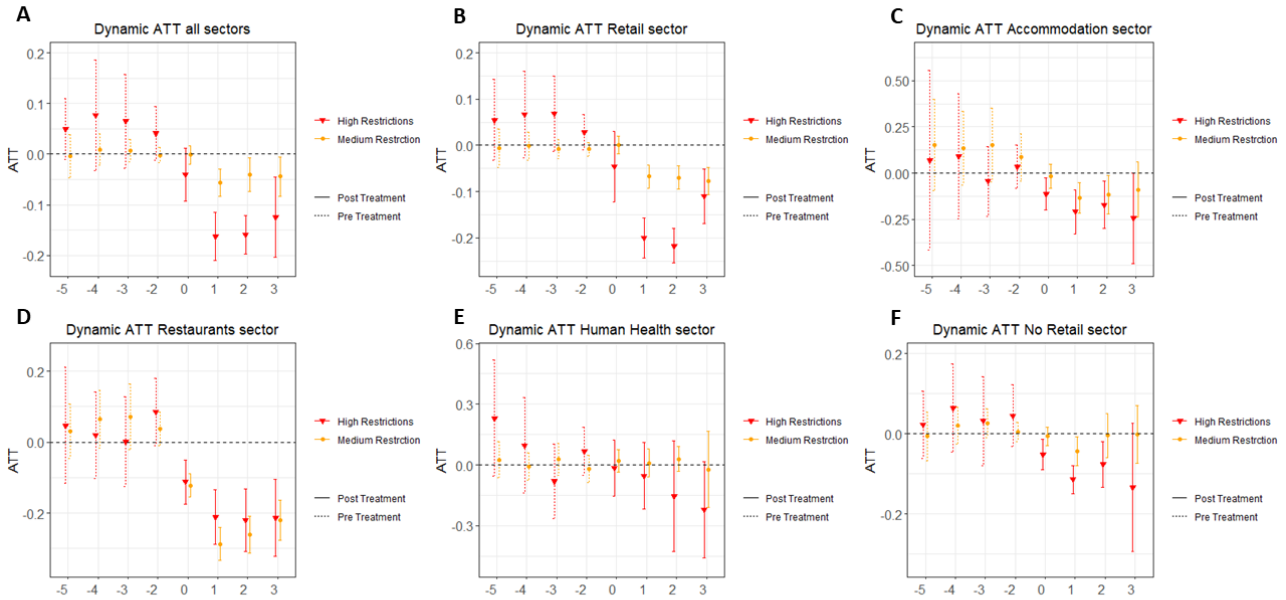

Figure 5: This figure shows the values of coefficients β_e and γ_e estimated through the panel event study TWFE described in Equation 2 with a 95% confidence interval. Models are estimated separately for different sectors.

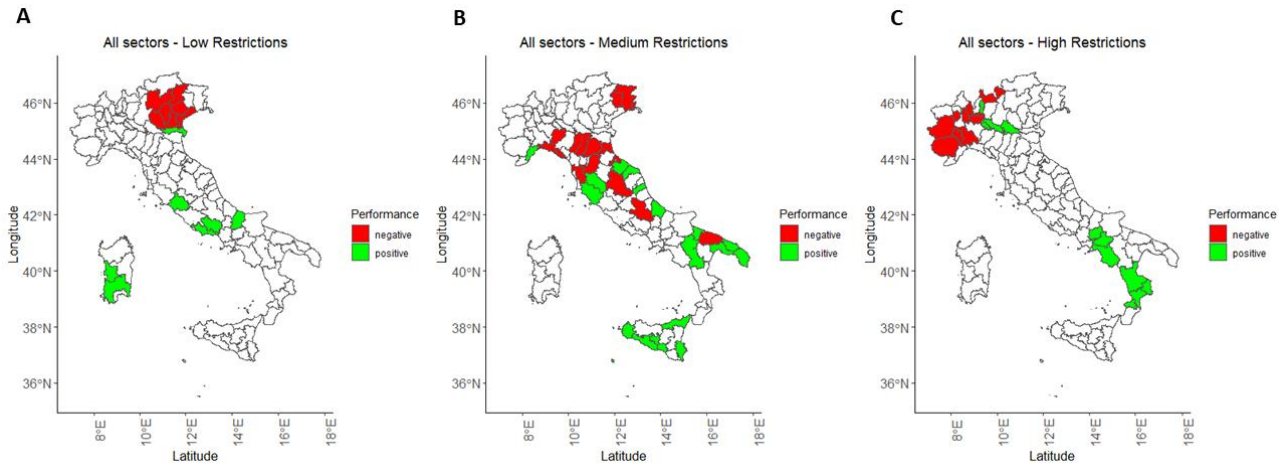

Figure 6: $Positive\ Performance_r$ and $Negative\ Performance_r$ provinces in case of low, medium and high policy stringency.

Appendix A: Sectors Closed for Alternative Policy Restrictions in Italy

This section aims to synthesize the set of sectors closed in correspondence of different levels of policy stringency implemented by the Italian government starting from the 6th of November 2020 with the DPCM n. 275.[19] Table A1 summarizes sectors closed in low risk regions. Table A2 summarizes sectors closed in medium risk regions. Tables A3, A4, A5 and A6 summarize sectors closed in high risk regions.

[19]Additional information related to the implementation of differentiated policy restrictions in Italy is included into the DPCM n. 275 and is available at the following link: https://www.gazzettaufficiale. it/eli/gu/2020/11/04/275/so/41/sg/pdf.

Appendix B: Geographical Presence of the Major Italian Bank

In this section we provide additional details about the geographical presence of the major Italian bank on the Italian territory. Unfortunately, national statistical offices do not disclose information related to the number of customers served by the different Italian banks. However, we have information about the number of our major bank clients at province level.

Figure B1 shows the geographical distribution of the bank clients expressed as a percentage of resident population with an age higher or equal to 18 years old at province and regional scale.[20] Overall, we observe a quite good homogeneity in the presence of the major bank over the whole Italian territory. The average market share at province level is almost 22% with a median equal to 19%, suggesting the high density of the bank across the italian peninsula (see Table B1). At regional level, we find the highest presence of the bank in Aosta Valley (37%), followed by Piedmont, Veneto and Lombardy that account for a market share above 30%. The only region with a presence of the bank below 10% is Trentino Alto-Adige, while for all other regions, the market share is at least 14%, corroborating the capillarity of the bank across Italian territories and the capability of our data to provide a representative overview of the whole country. At regional level the average and the median market shares are both around 22%.

[20] We normalize the number of clients with respect to the number of citizens older than 18 years old, as in Italy younger people do not tend to have a credit or debit card. Thus, this indicator should provide a fair proxy of the market share of the major Italian bank across territories.

Appendix C: Comparison against Official Statistics

This section compares credit card payment data (hereinafter, CCPD) and official statistics disclosed by national offices (ISTAT). Specifically, Figure C1 shows the relationships between the level of consumption reported in our sample and two relevant economic quantities, namely the Gross Domestic Product (GDP), as a measure of the aggregate output of an economic system, and income levels.

Consumption contributes as one of the components of GDP along with investments, public expenditures and net exports. We find that for year 2020 the share of total consumption of CCPD at province level displays a high and significant correlation (0.955, P-value $\simeq 0$) with the share of GDP at the same level of aggregation (the highest available resolution from official statistics). In addition, the correlation at province level between the share of CCPD total yearly consumption and income for year 2019, as disclosed by the Ministry of Economics and Finance (MEF), is 0.934 (P-value $\simeq 0$).

We also focus on the time-series properties of our transaction data (see Figure C2). To account for seasonality in the consumption levels, we analyse the year-over-year (Y-o-Y)[21] growth rates of quarterly total national consumption levels computed according to either CCPD or ISTAT over the time interval 2019-2020. To match official statistics[22], we present the aggregate consumption series of CCPD for both online and offline expenditures.

Figure C2-A highlights a reasonable matching between both temporal patterns, with a clearly evident downturn experienced in Q2-2020 at the outbreak of the pandemic. Although the length of

[21] Y-o-Y growth rates of quarterly total national consumption levels are defined as:

$$Y - o - Y_t = \frac{Spending_t - Spending_{t-4}}{Spending_{t-4}}$$

where $Spending_t$ is the total aggregate spending at national level during quarter t and $Spending_{t-4}$is the total aggregate spending at national level during the corresponding quarter of previous year. In this section, we use quarterly data since the highest temporal frequency at which consumption data are disclosed by ISTAT is three months. The rest of the analysis is rather based on daily transaction data, that is the highest time frequency we observe in the major Italian bank dataset.

[22] National Official data are available at the link: http://dati.istat.it/Index.aspx?QueryId= 12586#. We consider edition June 2021 of the dataset.

the series is short, we still notice a positive and significant relationship between the two series (correlation = 0.800, P-value = 0.017), with transaction data characterized by slightly higher volatility levels. Indeed, the OLS regression of ISTAT Y-o-Y growth rates against CCPD (online plus offline) Y-o-Y growth rates presents an elasticity equal to 0.153 (S.E.: 0.047), thus suggesting that the magnitude of variation is larger in the CCPD sample. Figure C2-A also supports another interesting aspect characterizing the COVID-19 pandemic relating to the diffusion of online consumption: note how data for Q2-2020 indicate the switching into online consumption occurred at the deployment of lockdown restrictions in Italy.

To have a better understanding of the matching across different economic activities, we also repeat the same analysis for some relevant sectors selecting among those that have been shown to be heavily affected by the spread of the pandemic, namely: Retail (Figure C2-B), Accommodation and Restaurants (Figure C2-C) and Human Health (Figure C2-D). Our findings show how in general the two samples exhibit similar temporal trajectories, with CCPD data that seem to be able to properly capture the impact of the pandemic since Q2-2020. Note also that the role of online expenditures in shaping the consumption curves is less evident in those sectors heavily restricted during the first wave of the pandemic, such as Accommodation and Restaurants.

Appendix D: Online Consumption Relevance

In the empirical analysis we aggregate the monetary value of daily transactions with respect to the province of vendors. As we have information about the province of vendors only for physical transactions, our study neglects consumption associated with online transactions. Due to the significant restrictions to human mobility, excluding online transaction could represent a limitation of our analysis. In this section, we provide additional details on the incidence of online consumption, showing different reasons why relying on physical transactions should provide an accurate representation of the consumption behaviour of Italian territories during the COVID-19 pandemic.

First, as disclosed by a study performed at European level by the Ministry of Foreign Affairs of Netherlands, in Italy online spending accounts for only 8% of overall transactions. Such value is quite low if compared with other European countries such as France, Germany and UK, where the penetration rate of online transaction reaches about 14%, 15% and 23%.[23]

Consistently, the national statistical office discloses the percentage of online sales sustained by Italian firms with more than 10 employees aggregated at country level for different sectors.[24] The incidence of online sales is equal to 12.9% when we consider all economic sectors, 9.5% for the Retail sector, 29.9% for the Accommodation sector and 5.6% in the Restaurants sector (information is not available for the Welfare sector). These values suggest how online transactions still represent a limited portion of overall spending.

Furthermore, we check the incidence of online transaction also in our dataset and their geographical distribution, to understand whether a high heterogeneity in the amount of digital consumption across territories may drive our results. As we do not have information on the vendor

[23] Information about the penetration rate of online sales across countries is obtained from a study performed by the Ministry of Foreign Affairs of Netherlands, and is available at the following link: https://www.rvo.nl/sites/default/files/2022/02/E-commerce-Italy-2021-The-most-promising-online-sectors-and-eye-catching-developments. pdf.

[24] Information about the percentage of online sales sustained by italian firms with more than 10 employees aggregated at country level for different sectors is disclosed by ISTAT and is available at the following link: http://dati.istat.it/?lang=it&SubSessionId=3db5dc01-dd7c-4dd7-9b76-679be21b0fb5.

province, for this check we aggregate consumption data with respect to the client province.

Table D1 shows that the higher values of the penetration rate of online transactions are achieved when we consider all sectors and in case we focus on the Retail or Accommodation sectors, as they account on average for the 20.7%, 19.3% and 16.7%. For all sectors and the Retail sector, the amount of online transactions is quite homogeneous across provinces (see Figure D1). Differently, for the Accommodation sector, highest values of such indicator are achieved by Sardinia and Sicily, probably due to the relevance of touristic flows in these two regions. A low incidence of online transactions is rather observed in the Restaurants and Human Health sectors and when we exclude the Retail sector. In these cases, the mean penetration rate of online transactions ranges between 1.6% and 5.8%. Overall, we observe that the incidence of online transactions tends to be stable across territories and should be properly accounted by province fixed effects. Furthermore, the differences across sectors should be properly taken into account both when we estimate separate models across sectors and when we estimate the full sample model with all sectors, due to the presence of sectoral dummies. The territorial heterogeneity in the Accommodation sector may be mitigated by the fact that it is likely that the main amount of online transactions is generated during the summer period, whereas our analysed time frame is usually characterized by lower touristic flows.

Finally, we remark that, as disclosed in Appendix C, offline transactions have a significant correlation with consumption data disclosed by the national statistical office across different sectors, suggesting a good capability of the main variable we use in the empirical analysis to properly map consumption dynamics in Italy, without relevant distortions.

For all such reasons, although online transactions may constitute a relevant source of information to study the consumption behaviour of Italian provinces during the COVID-19 pandemic, physical transactions should still represent a robust variable to study spending dynamics.

Appendix E: Full Results

In this section we show the full set of coefficients estimated through the panel event study described in Equation 2. Tables E1 and E2 display also coefficients for NUTS 1 - week interactions. Tables E3, E4, E5 and E6 show the full set of coefficients estimated Equation 2 when we combine the full sample of sectors in a single model. We display also coefficients for NUTS 1 - week and sector - week interactions. Figure E1 shows the estimates of the average treatment effects for medium and high risk provinces with respect to low risk territories when we combine the full sample of sectors in a single model.

Appendix F: Socio-economic Characteristics Distribution

In this section we show the distribution of socio-economic characteristics of provinces experiencing simultaneously positive economic and epidemiological results ($Positive\ Performance_r$) with respect to provinces displaying at the same time negative economic and epidemiological performances ($Negative\ Performance_r$) when we consider economic consumption in all sectors. More specifically, Figures F1, F2 and F3 display these results for the set of low, medium and high risk provinces, respectively.

Appendix Tables

Table A1: sectors closed in low risk regions.

Macro Sector	**ATECO Sector Code**	**Description**
Information and Communication	5914	Motion picture projection activities
Arts, Entertainment and Recreation	9004	Operation of arts facilities
Arts, Entertainment and Recreation	9101	Library and archives activities
Arts, Entertainment and Recreation	9102	Museums activities
Arts, Entertainment and Recreation	9103	Operation of historical sites and buildings and similar visitor attractions
Arts, Entertainment and Recreation	920002	Management of devices that allow cash winnings operating with coins or tokens
Arts, Entertainment and Recreation	93112	Swimming pools facilities
Arts, Entertainment and Recreation	9313	Fitness facilities
Arts, Entertainment and Recreation	93291	Discos, dance halls, night clubs
Arts, Entertainment and Recreation	93293	Game rooms and billiards
Other personal service activities	9604	Physical well-being activities
Additional Notes:	In addition to the above mentioned restrictions, mobility is forbidden between 10 p.m. and 5 a.m., while inter regional mobility is allowed. Retail activities are closed during the weekend, with the exception of essential sectors. Online education is implemented for high schools and universities. In the Transportation sector, public transport capacity is reduced by 50%. Restaurants and bars are opened until 6 p.m. Food delivery is allowed until 10 p.m.	

Table A2: sectors closed in medium risk regions.

Macro Sector	**ATECO Sector Code**	**Description**
Information and Communication	5914	Motion picture projection activities
Arts, Entertainment and Recreation	9004	Operation of arts facilities
Arts, Entertainment and Recreation	9101	Library and archives activities
Arts, Entertainment and Recreation	9102	Museums activities
Arts, Entertainment and Recreation	9103	Operation of historical sites and buildings and similar visitor attractions
Arts, Entertainment and Recreation	920002	Management of devices that allow cash winnings operating with coins or tokens
Arts, Entertainment and Recreation	93112	Swimming pools facilities
Arts, Entertainment and Recreation	9313	Fitness facilities
Arts, Entertainment and Recreation	93291	Discos, dance halls, night clubs
Arts, Entertainment and Recreation	93293	Game rooms and billiards
Other personal service activities	9604	Physical well-being activities
Additional Notes:	In addition to the above mentioned restrictions, mobility is forbidden between 10 p.m. and 5 a.m. and it is required to limit mobility to work and health reasons within the municipality. Retail activities are closed during the weekend, with the exception of essential sectors. Online education is implemented for high schools and universities. In the Transportation sector, public transport capacity is reduced by 50%. Restaurants and bars are closed 7 days per week. Food delivery is allowed until 10 p.m	

Table A3: sectors closed in high risk regions. Part I.

Macro Sector	**ATECO Sector Code**	**Description**
Wholesale and retail trade	47191	Department stores
Wholesale and retail trade	47199	Other non-specialized shops of various non-food products
Wholesale and retail trade	4751	Retail sale of textiles in specialised stores
Wholesale and retail trade	4753	Retail sale of carpets, rugs, wall in specialized stores
Wholesale and retail trade	4754	Retail sale of electrical appliances in specialised stores
Wholesale and retail trade	47591	Retail sale of furniture for the house
Wholesale and retail trade	47592	Retail sale of tools for the house and tableware
Wholesale and retail trade	47594	Retail sale of sew machines
Wholesale and retail trade	47596	Retail sale of musical instruments
Wholesale and retail trade	47599	Retail sale of other diverse articles for domestic use
Wholesale and retail trade	4763	Retail sale of music and recordings in specialised stores
Wholesale and retail trade	47642	Retail sale of accessories
Wholesale and retail trade	47711	Retail sale of packages for adults
Wholesale and retail trade	47714	Retail sale of clothing in skin
Wholesale and retail trade	47715	Retail sale of hats, umbrellas, gloves and ties
Wholesale and retail trade	47722	Retail sale of articles for trips
Wholesale and retail trade	4777	Retail sale of watches and jewelry in specialised stores
Wholesale and retail trade	47781	Retail sale of furniture for offices
Wholesale and retail trade	477831	Retail sale of art objects (including art galleries)
Wholesale and retail trade	477832	Retail sale of handicraft objects
Wholesale and retail trade	477833	Retail sale of holy furniture and religious articles

Table A4: sectors closed in high risk regions. Part II.

Macro Sector	**ATECO Sector Code**	**Description**
Wholesale and retail trade	477835	Retail sale of wedding favors
Wholesale and retail trade	477836	Retail sale of trinkets and costume jewelry
Wholesale and retail trade	477837	Retail sale of articles for the fine arts
Wholesale and retail trade	47785	Retail sale of of weapons and ammunition, military articles
Wholesale and retail trade	477891	Retail sale of of collectibles
Wholesale and retail trade	477892	Retail sale of of twine, ropes, sacks and packaging
Wholesale and retail trade	477894	Retail sale of adult items
Wholesale and retail trade	477899	Retail sale of other no alimentary products
Wholesale and retail trade	4779	Retail sale of second-hand goods in stores
Wholesale and retail trade	478902	Retail trade not in stores of autos, equipment for agriculture and equipment for gardening
Wholesale and retail trade	478904	Retail trade not in stores of costume jewelry
Wholesale and retail trade	478905	Retail trade not in stores of furniture for garden and domestic appliances and electrical equipment
Wholesale and retail trade	478909	Retail trade not in stores of other products
Wholesale and retail trade	47791	Other retail sale not in stores, stalls or markets
Information and Communication	5914	Motion picture projection activities
Arts, Entertainment and Recreation	9004	Operation of arts facilities

Table A5: sectors closed in high risk regions. Part III.

Macro Sector	**ATECO Sector Code**	**Description**
Arts, Entertainment and Recreation	9101	Library and archives activities
Arts, Entertainment and Recreation	9102	Museums activities
Arts, Entertainment and Recreation	9103	Operation of historical sites and buildings and similar visitor attractions
Arts, Entertainment and Recreation	920002	Management of devices that allow cash winnings operating with coins or tokens
Arts, Entertainment and Recreation	93112	Swimming pools facilities
Arts, Entertainment and Recreation	93113	Operation of multipurpose sports facilities
Arts, Entertainment and Recreation	93119	Operation of other sports facilities
Arts, Entertainment and Recreation	9312	Activities of sports clubs
Arts, Entertainment and Recreation	9313	Fitness facilities
Arts, Entertainment and Recreation	93291	Discos, dance halls, night clubs
Arts, Entertainment and Recreation	93293	Game rooms and billiards
Other personal service activities	9604	Physical well-being activities
Other personal service activities	960901	Activities related to clearing of cellars and garages
Other personal service activities	960902	Tattoo and piercing
Other personal service activities	960903	Marriage and meeting agencies
Other personal service activities	960904	Pet care services (excluding veterinary services)
Other personal service activities	960905	Other personal activities

Table A6: sectors closed in high risk regions. Part IV.

Macro Sector	**ATECO Sector Code**	**Description**
Additional Notes:	In addition to the above mentioned restrictions, mobility is forbidden at any hour and it is required to limit to work and health reasons within the municipality. Retail activities are closed 7 days per week, with the exception of essential sectors. Online education is implemented for secondary schools, high schools and universities. In the Transportation sector, public transport capacity is reduced by 50%. Restaurants and bars are closed 7 days per week. Food delivery is allowed until 10 p.m	

Table B1: Descriptive statistics for the geographical distribution of the Italian major bank clients expressed as a percentage of the population with age higher or equal to 18 years old. Data are sourced from the major Italian bank dataset.

Geographical Scale	Min	Q1	Median	Q3	max	mean	std.dev
Province	5.0%	13.63%	19.11%	27.3%	52.05%	21.7%	10.2%
Region	8.1%	15.9%	22.3%	26.1%	37.2%	21.8%	7.8%

Table D1: Descriptive statistics for geographical distribution of the incidence of online transactions at province level across different sectors. Data are sourced from the major Italian bank dataset.

Sector	Min	Q1	Median	Q3	max	mean	std.dev
All	12.4%	19.5%	20.3%	21.9%	28.8%	20.7%	2.4%
Retail	10.5%	16.6%	18.5%	19.3%	28.4%	19.3%	2.7%
Accommodation	11.5%	14.7%	16.6%	18.3%	25.5%	16.7%	2.7%
Restaurants	2.4%	3.9%	4.6%	5.6%	11.8%	4.9%	1.7%
Human Health	0.7%	1.2%	1.4%	1.8%	3.4%	1.6%	0.5%
No Retail	3.5%	5.0%	5.5%	6.4%	9.2%	5.8%	1.1%

Table E1: Panel Event study TWFE estimates by different sectors. Standard errors are reported in parentheses. Part I.

	Dependent variable: Daily Y-o-Y consumption variation					
	(All)	(Retail)	(Accommodation)	(Restaurants)	(Human Health)	(No Retail)
Medium Week −5	−0.004	−0.006	0.152	0.031	0.025	−0.006
	(0.022)	(0.021)	(0.126)	(0.039)	(0.045)	(0.031)
Medium Week −4	0.009	−0.001	0.135	0.064*	−0.008	0.020
	(0.016)	(0.015)	(0.102)	(0.038)	(0.034)	(0.024)
Medium Week −3	0.007	−0.008	0.152	0.071	0.026	0.026
	(0.011)	(0.011)	(0.102)	(0.047)	(0.040)	(0.018)
Medium Week −2	−0.002	−0.009	0.085	0.037*	−0.020	0.004
	(0.008)	(0.021)	(0.066)	(0.020)	(0.035)	(0.012)
Medium Week 0	-0.001	0.000	−0.018	−0.122***	0.020	−0.006
	(0.009)	(0.010)	(0.033)	(0.016)	(0.028)	(0.012)
Medium Week 1	−0.056***	−0.067***	−0.134***	−0.288***	0.009	−0.043**
	(0.014)	(0.013)	(0.041)	(0.024)	(0.035)	(0.018)
Medium Week 2	−0.040	−0.070***	−0.118**	−0.260***	0.030	−0.004
	(0.017)	(0.013)	(0.053)	(0.026)	(0.032)	(0.028)
Medium Week 3	−0.044**	−0.077***	−0.089	−0.220***	−0.022	−0.001
	(0.020)	(0.015)	(0.077)	(0.029)	(0.096)	(0.037)
High Week −5	0.049*	0.055	0.071	0.048	0.232	0.022
	(0.029)	(0.045)	(0.248)	(0.083)	(0.146)	(0.043)
High Week −4	0.077	0.067	0.090	0.020	0.097	0.065
	(0.056)	(0.048)	(0.172)	(0.062)	(0.120)	(0.056)
High Week −3	0.065	0.069*	−0.044	0.002	−0.081	0.032
	(0.047)	(0.041)	(0.097)	(0.064)	(0.094)	(0.057)
High Week −2	0.041	0.029*	0.035	0.085*	−0.068	0.045
	(0.027)	(0.017)	(0.060)	(0.048)	(0.061)	(0.039)
High Week 0	−0.041	−0.046	−0.113***	−0.112***	−0.016	−0.051***
	(0.027)	(0.039)	(0.044)	(0.032)	(0.071)	(0.019)
High Week 1	−0.162***	−0.201***	−0.210***	−0.211***	−0.053	−0.113***
	(0.024)	(0.022)	(0.060)	(0.039)	(0.083)	(0.018)
High Week 2	−0.159***	−0.217***	−0.172***	−0.220***	−0.153	−0.076***
	(0.020)	(0.019)	(0.065)	(0.045)	(0.140)	(0.029)
High Week 3	−0.125***	−0.110***	−0.243*	−0.213***	−0.222*	−0.133
	(0.041)	(0.030)	(0.125)	(0.056)	(0.122)	(0.082)
Total Mobility	0.043*	0.037**	0.077	0.067	−0.069*	0.050
	(0.024)	(0.016)	(0.066)	(0.041)	(0.041)	(0.046)
Temperature	0.010	0.0001	0.141**	0.058**	−0.011	0.036
	(0.017)	(0.019)	(0.062)	(0.024)	(0.040)	(0.023)
Daily Cases	−0.002	−0.0004	0.007	−0.002	0.005	−0.004
	(0.010)	(0.005)	(0.048)	(0.011)	(0.010)	(0.020)
Total Cases	0.016	−0.007	−0.098	0.027	−0.130**	0.056
	(0.021)	(0.020)	(0.110)	(0.036)	(0.056)	(0.037)
Daily Cases^2	0.002	0.0003	0.007	0.004	−0.002	0.005
	(0.003)	(0.003)	(0.009)	(0.004)	(0.003)	(0.005)
Total Cases^2	−0.014	0.003	0.021	−0.011	0.062*	−0.042
	(0.012)	(0.012)	(0.056)	(0.020)	(0.037)	(0.026)

Table E2: Panel Event study TWFE estimates by different sectors. Standard errors are reported in parentheses. Part II.

	Dependent variable: Daily Y-o-Y consumption variation					
	(All)	(Retail)	(Accommodation)	(Restaurants)	(Human Health)	(No Retail)
Islands*week2	0.004	−0.015	0.036	0.017	−0.056	0.035*
	(0.010)	(0.009)	(0.068)	(0.030)	(0.055)	(0.019)
North East*week2	0.013	0.005	0.157***	0.042**	0.016	0.029**
	(0.009)	(0.009)	(0.049)	(0.016)	(0.036)	(0.013)
North West*week2	0.027*	0.027	0.234***	0.066**	−0.035	0.028
	(0.016)	(0.016)	(0.080)	(0.030)	(0.067)	(0.022)
South*week2	−0.006	0.002	−0.113*	−0.058*	0.020	−0.019
	(0.014)	(0.011)	(0.060)	(0.032)	(0.070)	(0.028)
Islands*week3	0.014	−0.023	0.100	0.166***	−0.256*	0.076***
	(0.018)	(0.016)	(0.079)	(0.031)	(0.136)	(0.028)
North East*week3	0.025	0.018	0.149***	0.077***	0.031	0.044*
	(0.015)	(0.015)	(0.054)	(0.023)	(0.054)	(0.023)
North West*week3	−0.044**	−0.010	0.014	−0.174***	−0.078	−0.103***
	(0.019)	(0.023)	(0.134)	(0.065)	(0.058)	(0.031)
South*week3	−0.016	−0.026	−0.114*	−0.019	0.134*	−0.002
	(0.022)	(0.017)	(0.061)	(0.044)	(0.069)	(0.037)
Islands*week4	0.019	−0.025	0.134	0.157***	−0.097	0.088**
	(0.021)	(0.020)	(0.117)	(0.052)	(0.107)	(0.035)
North East*week4	0.013	0.007	0.176**	0.023	0.052	0.037
	(0.023)	(0.019)	(0.072)	(0.030)	(0.062)	(0.035)
North West*week4	−0.017	−0.0001	0.115	−0.145**	0.068	−0.058**
	(0.020)	(0.023)	(0.164)	(0.069)	(0.047)	(0.027)
South*week4	−0.023	−0.036**	−0.123	−0.038	0.049	−0.008
	(0.024)	(0.018)	(0.080)	(0.053)	(0.076)	(0.040)
Islands*week5	−0.040*	−0.091***	0.087	0.026	−0.0002	0.062*
	(0.022)	(0.023)	(0.160)	(0.059)	(0.095)	(0.033)
North East*week5	−0.030	−0.027	0.103	−0.085**	0.032	−0.022
	(0.026)	(0.025)	(0.094)	(0.039)	(0.063)	(0.033)
North West*week5	−0.036	−0.002	0.045	−0.221***	0.052	−0.104***
	(0.022)	(0.032)	(0.119)	(0.068)	(0.116)	(0.028)
South*week5	−0.017	−0.019	−0.302***	−0.101	−0.013	−0.021
	(0.022)	(0.017)	(0.091)	(0.065)	(0.086)	(0.038)
Islands*week6	0.010	−0.033	0.121	0.065	−0.094	0.088**
	(0.024)	(0.024)	(0.210)	(0.056)	(0.105)	(0.038)
North East*week6	−0.046	−0.050*	0.078	−0.065	0.014	−0.026
	(0.028)	(0.027)	(0.092)	(0.040)	(0.070)	(0.039)
North West*week6	−0.002	0.022	0.204	−0.253***	−0.046	−0.053
	(0.025)	(0.032)	(0.153)	(0.066)	(0.091)	(0.033)
South*week6	−0.026	−0.025	−0.291***	−0.104**	−0.023	−0.030
	(0.025)	(0.021)	(0.094)	(0.051)	(0.073)	(0.042)
Islands*week7	0.035	0.006	−0.054	0.017	0.060	0.077**
	(0.024)	(0.027)	(0.174)	(0.062)	(0.111)	(0.036)
North East*week7	−0.030	−0.042	0.081	−0.055	0.027	0.003
	(0.031)	(0.029)	(0.111)	(0.042)	(0.077)	(0.040)
North West*week7	0.049	0.084*	0.125	−0.230***	0.026	−0.018
	(0.040)	(0.043)	(0.135)	(0.059)	(0.052)	(0.046)
South*week7	−0.047**	−0.060***	−0.261**	−0.092	−0.140	−0.024
	(0.018)	(0.021)	(0.119)	(0.058)	(0.085)	(0.038)
Islands*week8	0.051*	0.019	−0.142	0.036	−0.033	0.095**
	(0.030)	(0.032)	(0.195)	(0.069)	(0.094)	(0.041)
North East*week8	−0.026	−0.045	0.089	−0.051	−0.011	0.013
	(0.033)	(0.031)	(0.128)	(0.046)	(0.080)	(0.043)
South*week8	−0.031	−0.035**	−0.318**	−0.048	−0.074	−0.024
	(0.022)	(0.017)	(0.143)	(0.065)	(0.157)	(0.043)
R^2	0.452	0.501	0.230	0.591	0.156	0.270
R^2 adjusted	0.419	0.472	0.189	0.565	0.107	0.230
N. Observations	3,094	3,094	3,094	3,094	3,094	3,094
Note:						*p<0.1; **p<0.05***p<0.01

Table E3: Panel Event study TWFE estimates when the combined full sample of sectors is used. In particular, we include in our analysis the Retail, Accommodation, Restaurants and Human Health sectors. Standard errors are reported in parentheses. Part I.

Dependent Variable:	
Daily Y-o-Y consumption variation	
Medium Week −5	0.059
	(0.037)
Medium Week −4	0.058*
	(0.033)
Medium Week −3	0.066*
	(0.036)
Medium Week −2	0.026
	(0.023)
Medium Week 0	−0.026**
	(0.012)
Medium Week 1	−0.100***
	(0.017)
Medium Week 2	−0.072***
	(0.020)
Medium Week 3	−0.039
	(0.030)
High Week −5	0.148
	(0.106)
High Week −4	0.109
	(0.071)
High Week −3	0.014
	(0.041)
High Week −2	0.081*
	(0.048)
High Week 0	−0.076***
	(0.028)
High Week 1	−0.144***
	(0.053)
High Week 2	−0.165***
	(0.061)
High Week 3	−0.144***
	(0.061)
Total Mobility	−0.00000
	(0.00000)
Temperature	0.005*
	(0.002)
Daily Cases	0.002
	(0.001)

Table E4: Panel Event study TWFE estimates when the combined full sample of sectors is used. In particular, we include in our analysis the Retail, Accommodation, Restaurants and Human Health sectors. Standard errors are reported in parentheses. Part II.

Dependent Variable:	
Daily Y-o-Y consumption variation	
week2	0.014
	(0.013)
week3	0.059***
	(0.020)
week4	0.094***
	(0.024)
week5	0.117***
	(0.034)
week6	0.151***
	(0.042)
week7	0.220***
	(0.048)
week8	0.243***
	(0.051)
Accommodation	−0.236***
	(0.033)
Restaurants	−0.150***
	(0.022)
Human Health	0.469***
	(0.044)
Islands*week2	−0.003
	(0.028)
North East*week2	0.040***
	(0.015)
North West*week2	0.068**
	(0.027)
South*week2	−0.035
	(0.032)
Islands*week3	0.024
	(0.020)
North East*week3	0.064***
	(0.019)
North West*week3	−0.078
	(0.059)
South*week3	−0.032
	(0.032)
Islands*week4	0.081**
	(0.033)
North East*week4	0.059**
	(0.024)
North West*week4	−0.030
	(0.061)
South*week4	−0.100**
	(0.044)
Islands*week5	0.094
	(0.061)
North East*week5	0.018
	(0.035)
North West*week5	−0.054
	(0.071)
South*week5	−0.160***
	(0.056)

Table E5: Panel Event study TWFE estimates when the combined full sample of sectors is used. In particular, we include in our analysis the Retail, Accommodation, Restaurants and Welfare sectors. Standard errors are reported in parentheses. Part III.

Dependent Variable:	
Daily Y-o-Y consumption variation	
Islands*week6	0.112*
	(0.066)
North East*week6	−0.005
	(0.042)
North West*week6	−0.079
	(0.098)
South*week6	−0.176***
	(0.062)
Islands*week7	0.092
	(0.081)
North East*week7	−0.027
	(0.050)
North West*week7	−0.079
	(0.107)
South*week7	−0.294***
	(0.077)
Islands*week8	0.070
	(0.082)
North East*week8	−0.034
	(0.052)
South*week8	−0.278***
	(0.083)
week 2*Accommodation	−0.050**
	(0.023)
week 3*Accommodation	−0.322***
	(0.033)
week 4*Accommodation	−0.464***
	(0.035)
week 5*Accommodation	−0.320***
	(0.040)
week 6*Accommodation	−0.343***
	(0.045)
week 7*Accommodation	−0.387***
	(0.045)
week 8*Accommodation	−0.357***
	(0.046)
week 2*Restaurants	−0.038***
	(0.014)
week 3*Restaurants	−0.330***
	(0.020)
week 4*Restaurants	−0.369***
	(0.026)
week 5*Restaurants	−0.300***
	(0.030)
week 6*Restaurants	−0.413***
	(0.033)
week 7*Restaurants	−0.421***
	(0.032)
week 8*Restaurants	−0.424***
	(0.033)

Table E6: Panel Event study TWFE estimates when the combined full sample of sectors is used. In particular, we include in our analysis the Retail, Accommodation, Restaurants and Welfare sectors. Standard errors are reported in parentheses. Part IV.

Dependent Variable:	
Daily Y-o-Y consumption variation	
week 2*Human Health	0.032
	(0.023)
week 3*Human Health	0.178***
	(0.046)
week 4*Human Health	0.174***
	(0.051)
week 5*Human Health	0.054
	(0.050)
week 6*Human Health	0.088
	(0.057)
week 7*Human Health	0.029
	(0.057)
week 8*Human Health	
	−0.002
	(0.058)
R^2	0.831
R^2 adjusted	0.825
N. Observations	12,376

Note: $*p<0.1$; $**p<0.05$; $***p<0.01$

Appendix Figures

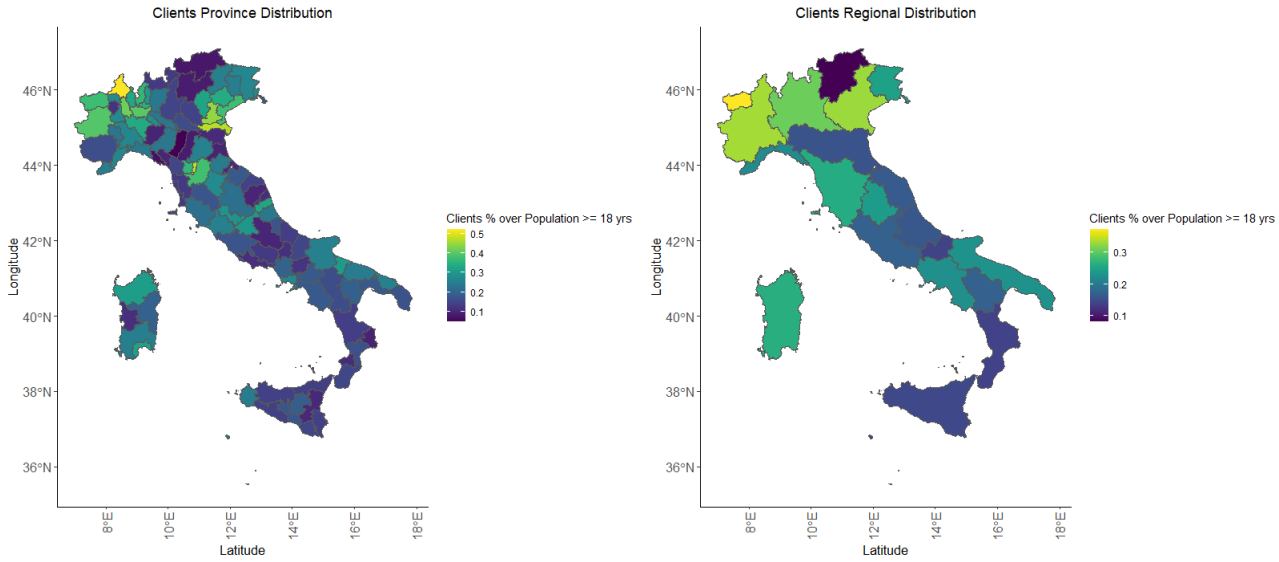

Figure B1: The figure shows the geographical distribution of the Italian major bank clients at province and regional level, expressed as a percentage of the local population with age higher or equal to 18 years old.

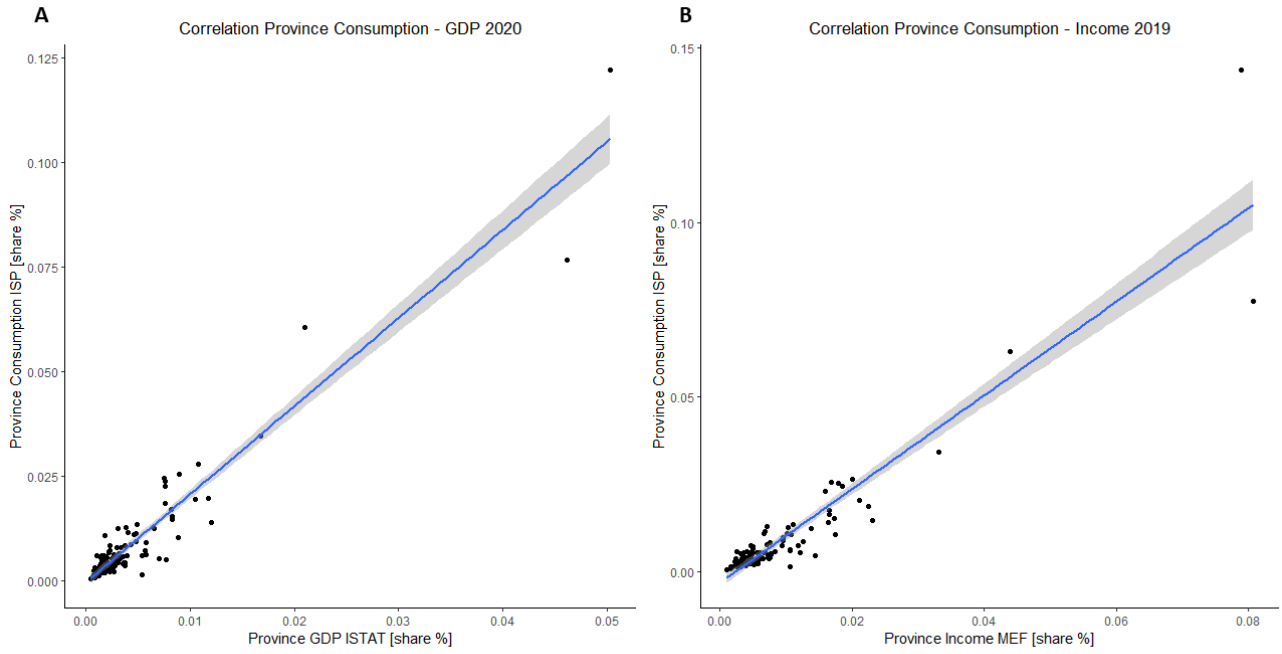

Figure C1: A: correlation between the share of CCPD total yearly consumption and GDP at province level in year 2020. Correlation is 0.955 (P-value $\simeq$ 0). B: Correlation between the share of CCPD total yearly consumption and Income (MEF) at province level in year 2019. Correlation is 0.934 (P-value $\simeq$ 0).

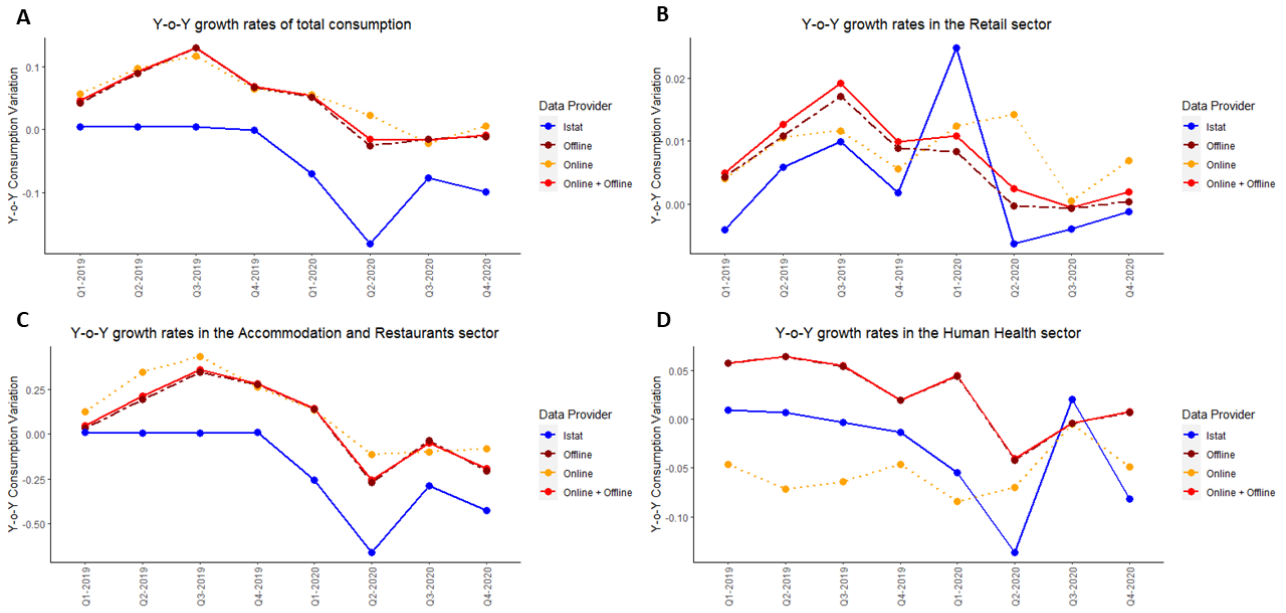

Figure C2: A: Correlation between the year-on-year (Y-o-Y) growth rates of total national quarterly consumption levels computed according to either CCPD or ISTAT over the time interval 2019-2020. For CCPD we show the offline (dark orange), online (orange), and offline plus online (red) time series. Correlation is 0.821 (P-value = 0.012), 0.683 (P-value = 0.061), and 0.800 (P-value = 0.017), respectively. We scale each CCPD curve multiplying it by the elasticity of CCPD consumption variation with respect to ISTAT consumption variation. This estimated elasticity is 0.159 (S.E.: 0.045), 0.116 (S.E.: 0.050), 0.153 (S.E.: 0.047) for offline, online, and offline plus online time series, respectively. Panels B-C-D: Correlation between the year-on-year growth rates of sectoral quarterly consumption levels computed according to CCPD and ISTAT, namely: Retail (panel B), Accommodation and Restaurants (panel C), Human Health (panel D). For each sector, we scale the CCPD curve multiplying it by the elasticity of CCPD consumption variation with respect to ISTAT consumption variation. We report the corresponding values of elasticity and correlation for the offline, online, and offline plus online time series, respectively. Retail sector elasticity is 0.021 (S.E.: 0.011), 0.012 (S.E.: 0.009), 0.023 (S.E.: 0.011), while correlation is 0.616, 0.463, 0.647 (P-values = 0.103, 0.247, 0.083); Accommodation and Restaurants sector elasticity is 0.390 (S.E.: 0.088), 0.230 (S.E.: 0.061), 0.379 (S.E.: 0.085), while correlation is 0.875, 0.839, 0.876 (P-values = 0.004, 0.009, 0.004). Human Health sector elasticity is 0.103 (S.E.: 0.046), -0.077 (S.E.: 0.064), 0.103 (S.E.: 0.047), while correlation is 0.673, -0.443, 0.667 (P-values = 0.067, 0.271, 0.071).

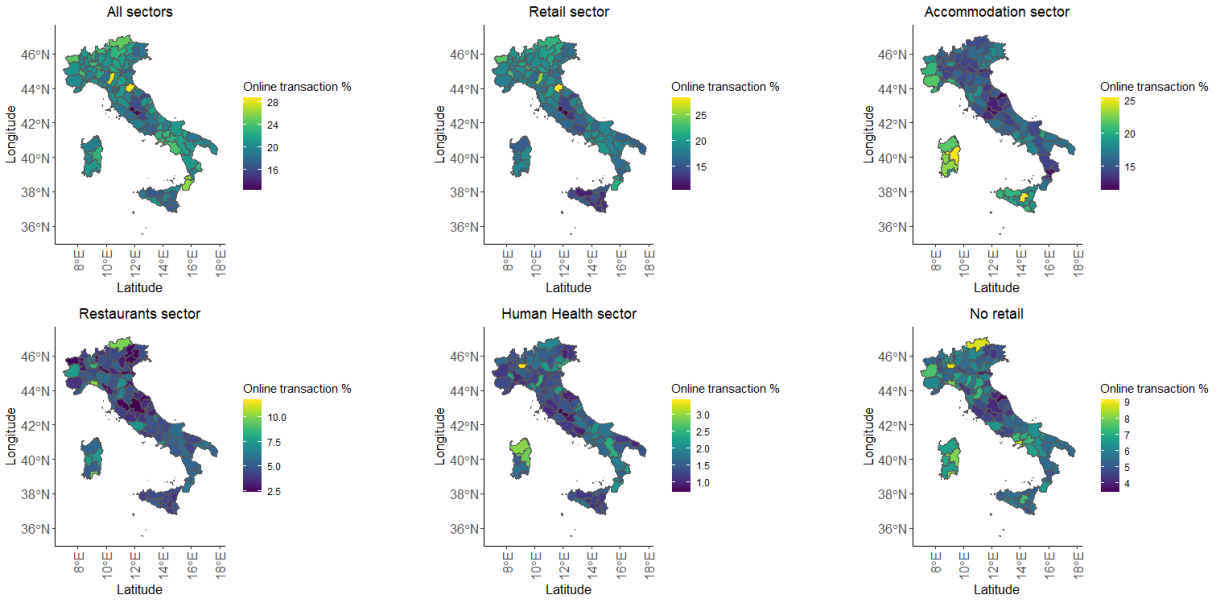

Figure D1: The figure shows the geographical distribution of the incidence of online transactions at province level across different sectors. Data are sourced from the major Italian bank dataset.

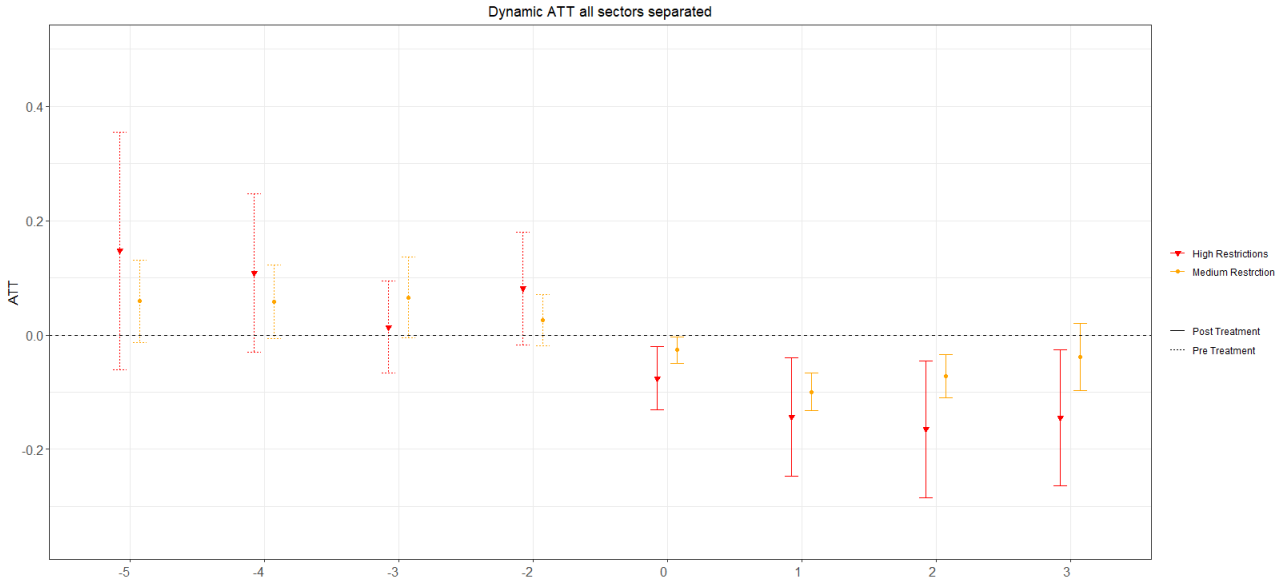

Figure E1: This figure shows the values of coefficients β_e and γ_e estimated through the panel event study TWFE described in Equation 2 with a 95% when the combined full sample of sectors is used. In particular, we include in our analysis the Retail, Accommodation, Restaurants and Human Health sectors.

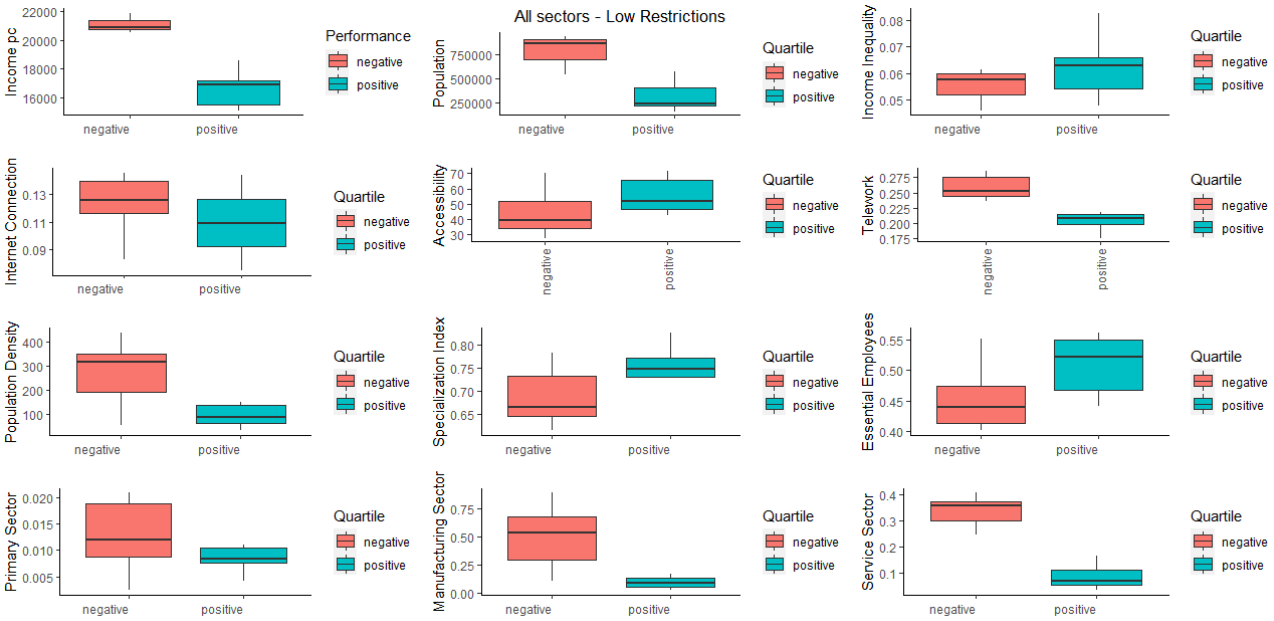

Figure F1: Distribution of socio-economic characteristics of low risk $Positive\ Performance_r$ and $Negative\ Performance_r$ provinces. The two groups of territories are identified considering aggregate consumption across all economic sectors.

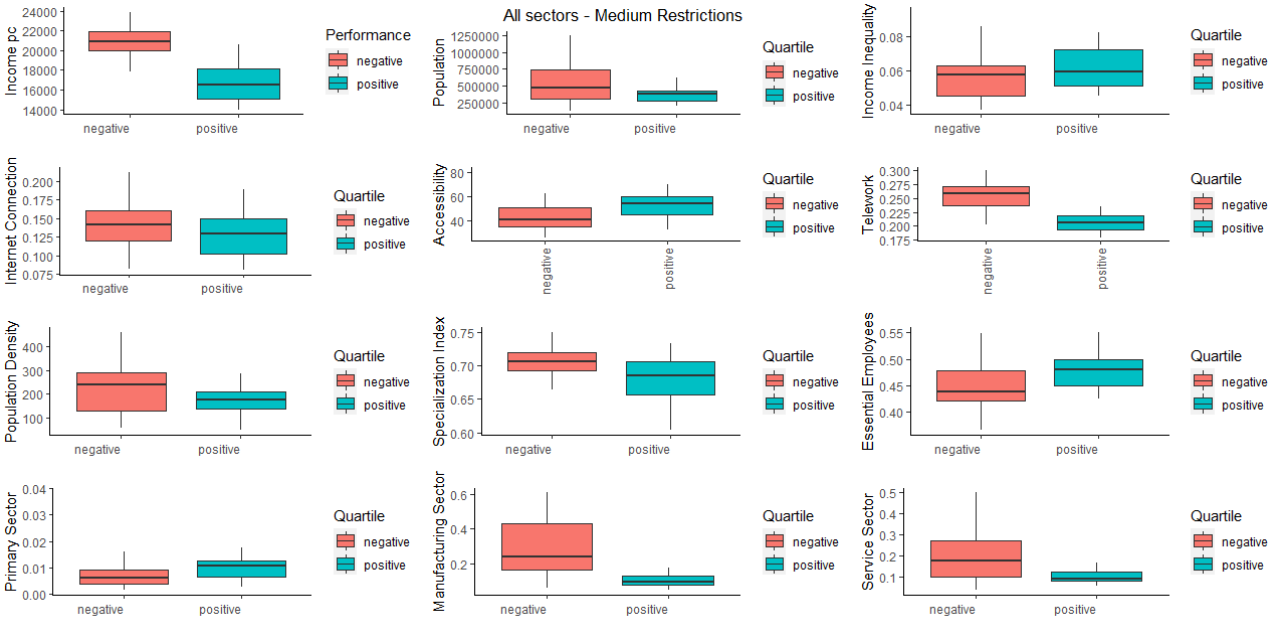

Figure F2: Distribution of socio-economic characteristics of medium risk $Positive\ Performance_r$ and $Negative\ Performance_r$ provinces. The two groups of territories are identified considering aggregate consumption across all economic sectors.

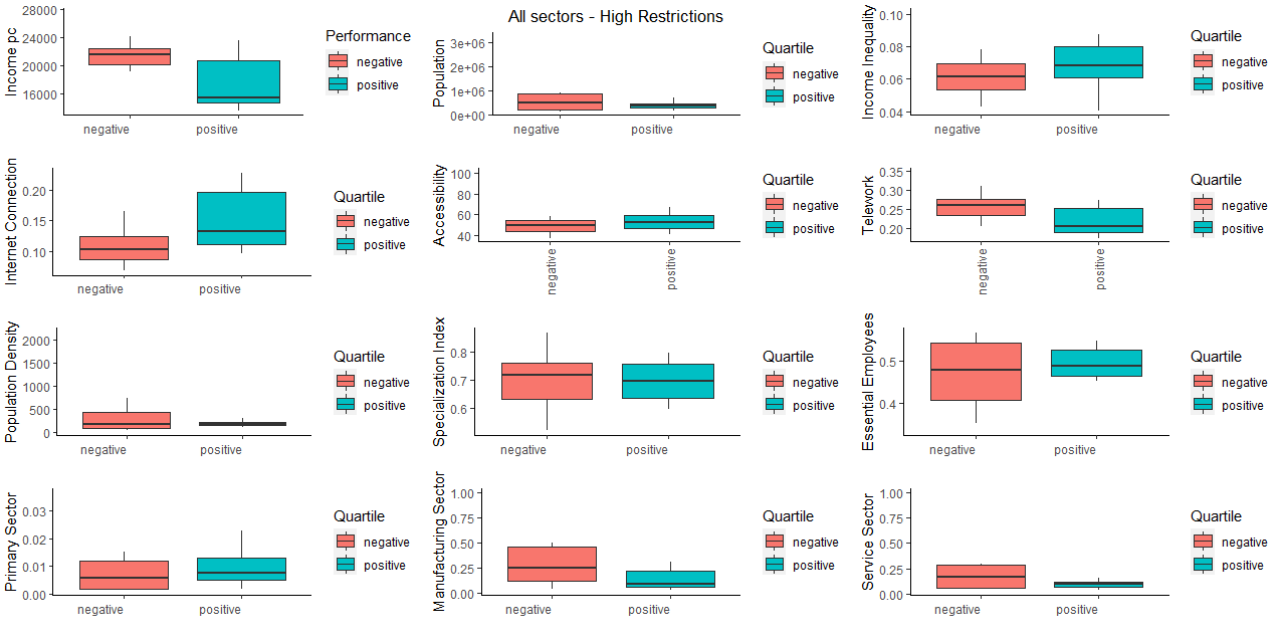

Figure F3: Distribution of socio-economic characteristics of high risk $Positive\ Performance_r$ and $Negative\ Performance_r$ provinces. The two groups of territories are identified considering aggregate consumption across all economic sectors.