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Changes in Consumption in the Early COVID-19 Era: Zip-Code Level Evidence from the U.S.

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Abstract: Using monthly zip-code level data on credit card transactions covering 16 U.S. cities, this paper investigates changes in consumption at local commercial places during the early coronavirus disease 2019 (COVID-19) era. Since using aggregate-level data can suppress valuable information on consumption patterns coming from zip codes, the main contribution is achieved by estimating common factors across zip codes that are controlled for factors that are zip-code and time specific as well as those that are zip-code and sector specific. The estimation results based on common factors across zip codes show that relative consumption of products and services that can be consumed at home (e.g., grocery, pharmacy, home maintenance) has increased up to 56% amid COVID-19 compared to the previous year, whereas relative consumption of products and services that cannot be consumed at home (e.g., fuel, transportation, personal care services, restaurant) has decreased up to 51%. Similarly, after controlling for the corresponding factors, online shopping has increased up to 21%, while its expenditure share has increased by up to 16% compared to the pre-COVID-19 period.

Keywords: COVID-19; coronavirus; consumption; sectors; online shopping

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1. Introduction

Consumption within the U.S. is reduced significantly due to the coronavirus disease 2019 (COVID-19). As shown by studies such as by Baker et al. (2020b) or Relihan et al. (2020), this reduction is evident widely across sectors (except for grocery) and especially for products purchased through offline (rather than online) shopping. However, these observations based on nationwide data can easily suppress valuable information on consumption patterns coming from more disaggregated areas as their effects may cancel each other out during the aggregation process. For example, when zip codes are considered, spending on a particular sector may increase in one zip code, whereas it may decrease in another, resulting in no significant impact at the aggregate level. Therefore, using data from more disaggregated areas is important to understand the changes in consumption patterns amid COVID-19.

Based on this motivation, this paper investigates sector-level as well as online versus offline consumption patterns within the U.S. by using monthly zip-code level data from the early COVID-19 era (covering 16 U.S. cities) on credit card transactions for local commercial purchases. The main strategy is to identify common factors across zip codes representing sector-level or online versus offline consumption patterns at the U.S. national level that do not suffer from an aggregation problem. This is achieved by estimating sector-time fixed effects or shopping channel-time fixed effects in the monthly zip-code level data, where factors that are zip-code and time specific as well as those that are zip-code and sector specific are controlled for.

The results based on the sector-level data show that relative consumption of products and services that can be consumed at home (e.g., grocery, pharmacy, home maintenance) has increased by up to 56% amid COVID-19, whereas relative consumption of products and services that cannot be consumed at home (e.g., fuel, transportation, personal care services, restaurant) has decreased by up to 51%. This result is analogous to the one

that has been used to explain the reduction in economic activity, unemployment or social distancing experience by workers' ability of working from home as in studies such as by Dingel and Neiman (2020); Bick et al. (2020) or Yilmazkuday (2020). The difference in this paper is that it is consuming at home that can be connected to the sectoral heterogeneity in consumption changes amid COVID-19.

With respect to the existing literature, the sector-level results are consistent with other studies focusing on the U.S. such as by Coibion et al. (2020) who have documented largest drops in spending on travel and clothing or by Baker et al. (2020b) who have shown that greater levels of social distancing are associated with drops in spending on restaurants or by Grashuis et al. (2020) who have shown that consumer spending on groceries has increased amid COVID-19. Nevertheless, different from these studies that focus on aggregate-level data in the U.S., this paper has shown that, after controlling for factors that are zip-code and time specific as well as those that are zip-code and sector specific, common factors across zip codes representing relative spending on general goods, home maintenance, pharmacy and professional services have increased over time amid COVID-19. This difference can be attributed to estimating common factor across zip codes in this paper as opposed to using aggregate-level data.

The results based on online versus offline shopping show that online shopping has increased by up to 21%, while its expenditure share has increased by up to 16% compared to the pre-COVID-19 period. These results are consistent with those in Relihan et al. (2020) who have used an earlier version of the dataset used in this paper and shown that the increase in online shopping has been only about 1.5% in March 2020 (with respect to March 2019). Nevertheless, different from Relihan et al. (2020) who have focused on aggregate-level data in the U.S. to obtain this measure, this paper has shown that, after controlling for factors that are zip-code and time specific as well as those that are zip-code and sector specific, the common factor across zip codes representing online spending within the U.S. has increased by about 7.4% in March 2020 (with respect to March 2019). This difference can again be attributed to estimating common factor across zip codes in this paper as opposed to using aggregate-level data.

2. Literature Review

The economic implications of COVID-19 have been covered in several studies such as by Atkeson (2020b); Guerrieri et al. (2020); and Eichenbaum et al. (2020) based on macroeconomic consequences, in studies such as by Alfaro et al. (2020); Baker et al. (2020a); Anglin et al. (2021) and Siddique et al. (2021) based on financial markets, in studies such as by Alon et al. (2020) or Dingel and Neiman (2020) based on labor markets, and in studies such as by Kuchler et al. (2021); Atkeson (2020a); Jones et al. (2020) or Chiou and Tucker (2020) based on social distancing and health. Within this literature, this paper belongs to the strand that focuses on the economic implications of COVID-19 on sector-level consumption and on online versus offline consumption. As an example, studies such as by Andersen et al. (2020) have shown evidence for a significant reduction in consumption following COVID-19, where individuals being exposed to health risks have suffered more than others.

Regarding the sector-level consumption, studies such as by Baker et al. (2020b) have shown that consumption on retail (food) products have initially increased, followed by a significant reduction in overall spending; they have also shown that greater levels of social distancing are associated with drops in spending on restaurants. Similarly, Coibion et al. (2020) have documented largest drops in spending on travel and clothing, whereas Grashuis et al. (2020) have documented increases in spending on groceries. Different from these studies focusing on the (geographically) aggregate level data covering different sectors, this paper focuses on common factors across zip codes to avoid any aggregation bias.

Regarding online versus offline consumption, studies such as by Carvalho et al. (2020) have shown that offline shopping has declined much more than online shipping, whereas studies such as by Chen et al. (2021) have shown that offline shopping has reduced

by about 70% following COVID-19. Similarly, Relihan et al. (2020) have shown that the increase in online shopping has been only about 1.5% in March 2020 (with respect to March 2019). Different from these studies focusing on the (geographically) aggregate level data covering online versus offline shopping or the corresponding heterogeneity, this paper focuses on common factors across zip codes to avoid any aggregation bias.

3. Data Set

Monthly zip-code level dataset on consumption covering 3674 zip codes from 16 U.S. cities is borrowed from Relihan et al. (2020). This dataset has been constructed by aggregating approximately 450 million credit card transactions (at the zip-code level based on consumer residence) per month made by a rolling sample of 11 million JPMorgan Chase customer accounts. Focusing on purchases from local commercial places, the dataset distinguishes between consumption across different sectors as well as between online and offline shopping as we detail in the following subsections.

The dataset includes information on percentage changes (with respect to the previous year) in spending on products of 11 sectors as well as corresponding the expenditure shares over the period between October 2019 and May 2020. The list of these 11 sectors can be found in Table 1. Although most of these sector names are self-explanatory, some may require further clarification.

Table 1. Estimated Changes in Spending across Sectors.

	% Change in Spending		
Sector	**March 2020**	**April 2020**	**May 2020**
Clothing	−24.293 ***	−18.012 ***	−13.194 ***
	(0.27)	(0.30)	(0.31)
Fuel	−9.885 ***	−22.995 ***	−17.901 ***
	(0.28)	(0.26)	(0.26)
General Goods	19.506 ***	27.760 ***	29.302 ***
	(0.25)	(0.25)	(0.23)
Grocery	55.510 ***	54.944 ***	47.246 ***
	(0.25)	(0.24)	(0.23)
Home Maintenance	11.844 ***	17.397 ***	26.945 ***
	(0.28)	(0.26)	(0.26)
Leisure	−20.268 ***	−25.199 ***	−27.571 ***
	(0.26)	(0.25)	(0.28)
Personal Care Services	−29.699 ***	−50.647 ***	−39.343 ***
	(0.34)	(0.59)	(0.45)
Pharmacy	35.492 ***	21.487 ***	18.239 ***
	(0.31)	(0.28)	(0.25)
Professional Services	7.778 ***	11.481 ***	9.041 ***
	(0.37)	(0.38)	(0.33)
Restaurant	−27.995 ***	−31.404 ***	−26.168 ***
	(0.26)	(0.27)	(0.25)
Transportation	−29.506 ***	−42.995 ***	−43.281 ***
	(0.28)	(0.40)	(0.33)

Source: Author calculations. Notes: *** represents significance at the 0.1% level. The numbers represent the estimated sector-time fixed effects that are normalized with respect to the period before March 2020 by subtracting the corresponding average values between October 2019 and February 2020.

Specifically, general goods include department stores, discount stores, large non-specific online retailers, and other miscellaneous retailers such as florists and books stores that sell everyday goods. Home maintenance includes both goods and services. Leisure goods and services include those related to arts and sporting activities. Personal care

services include salons and dry cleaners. Professional consumer services examples include veterinary, legal, and childcare services.

The dataset also includes information of shopping channels, namely online versus offline shopping, at the aggregate level (for all rather than individual sectors). Due to the heterogeneity across zip codes, in the following sections, we focus on formal investigations to estimate sector-level consumption patterns, as well as those through online versus offline shopping, in the U.S. by focusing on the common factors across zip codes to avoid any aggregation bias as discussed above.

4. Sector-Level Analysis

This section achieves formal investigations on the sector-level data as described above.

4.1. Empirical Methodology

We are interested in estimating common factors across zip codes representing sector-level consumption patterns within the U.S., where the dataset described above is controlled for factors that are zip-code and time specific as well as those that are zip-code and sector specific. We focus on both percentage changes in sector-level spending and sector-level expenditure shares, below.

The formal investigation based on the sector-level spending is achieved according to the following expression:

$$\underbrace{\Delta C_{szt}}_{\%\text{Change in Spending}} = \underbrace{\phi^{c}_{st}}_{\text{Sector}-\text{Time FE}} + \underbrace{\kappa^{c}_{zt}}_{\text{Zip}-\text{Code}-\text{Time FE}} + \underbrace{\varphi^{c}_{sz}}_{\text{Sector}-\text{Zip}-\text{Code FE}} + \underbrace{\varepsilon^{c}_{szt}}_{\text{Residuals}} \quad (1)$$

where ΔC_{szt} is the percentage change (with respect to the previous year) in spending on sector-s products in zip-code z at time t. In this expression, we are interested in sector-time fixed effects represented by ϕ^{c}_{st}'s as they are common factors across zip codes representing relative sector-level percentage changes in spending within the U.S. after controlling for other factors. These factors include zip-code-time fixed effects represented by κ^{c}_{zt}'s as they control for the effects of zip-code specific developments over time, such as a certain zip code being affected by COVID-19 more than others in general over time. Similarly, sector-zip-code fixed effects represented by φ^{c}_{sz}'s control for factors such as consumer preferences in certain zip codes that are constant over time.

Similarly, the formal investigation based on sector-level expenditure shares is achieved according to the following expression:

$$\underbrace{W_{szt}}_{\text{Expenditure Share}} = \underbrace{\phi^{w}_{st}}_{\text{Sector}-\text{Time FE}} + \underbrace{\kappa^{w}_{zt}}_{\text{Zip}-\text{Code}-\text{Time FE}} + \underbrace{\varphi^{w}_{sz}}_{\text{Sector}-\text{Zip}-\text{Code FE}} + \underbrace{\varepsilon^{w}_{szt}}_{\text{Residuals}} \quad (2)$$

where W_{szt} is the expenditure share on sector-s products in zip-code z at time t. Here, we are interested in sector-time fixed effects represented by ϕ^{w}_{st}'s, this time as they are common factors across zip codes representing relative sector-level expenditure shares within the U.S. after controlling for other factors as they are described above.

4.2. Empirical Results Based on Spending

The estimation of Equation (1) is achieved by using 249,698 observations that results in estimates of ϕ^{c}_{st}'s, κ^{c}_{zt}'s and φ^{c}_{sz}'s with an adjusted R-squared value of 0.73. The corresponding estimates of ϕ^{c}_{st}'s representing common factors across zip codes for individual sectors are depicted in Figure 1 for individual sectors, where their average values between October 2019 and February 2020 are also shown for comparison purposes. As is evident, there is evidence for sectoral heterogeneity in consumption changes amid COVID-19. In particular, relative spending on sectors of clothing, fuel, leisure, personal care services, restaurant services and transportation has decreased amid COVID-19, whereas relative spending in other sectors of general goods, grocery, home maintenance, pharmacy or professional services has increased.

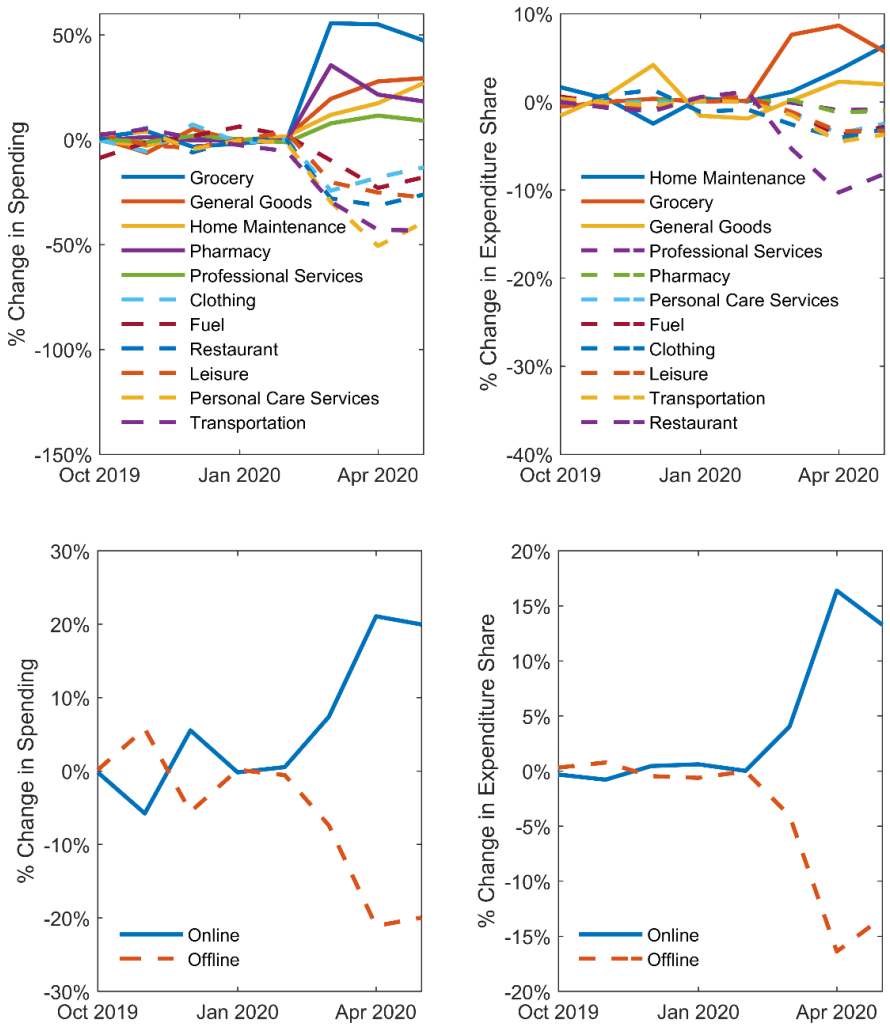

Figure 1. Spending and Expenditure Shares with Equal Pre-COVID-19 Values. Source: Author calculations. Note: Series in percentage changes represent the estimated values of sector-time fixed effects or shopping channel-time fixed effects that have been normalized by their average values between October 2019 and February 2020.

Regarding the magnitudes, the estimation results in Figure 1 are further given with more details in Table 1, where the estimates are again normalized with respect to their pre-COVID-19 period. As is evident, spending on grocery products has increased by about 56%, whereas spending on personal care services or transportation has decreased about 30%, all in March 2020 with respect to the pre-COVID-19 period. Similarly, spending on grocery products has increased by about 55%, whereas spending on personal care services has decreased about 51%, both in April 2020 with respect to the pre-COVID-19 period. Similar values are observed for May 2020, when home maintenance has increased about 27% with respect to the pre-COVID-19 period.

4.3. Empirical Results Based on Expenditure Shares

The estimation of Equation (2) is achieved by using 249,698 observations that results in estimates of ϕ_{st}^{w}'s, κ_{zt}^{w}'s and φ_{sz}^{w}'s with an adjusted R-squared value of 0.97. The corresponding estimates of ϕ_{st}^{w}'s representing sector-time fixed effects are depicted in Figure 1 for individual sectors with equal pre-COVID-19 values for comparison purposes. As is evident, the results based on expenditure shares highly mimic those based on spending, except for sectors of pharmacy and professional services of which expenditure shares have decreased, and spending on these sectors have increased.

Regarding the magnitudes, the estimation results in Figure 1 are further given with more details in Table 2, where the estimates are again normalized with respect to their pre-COVID-19 period. As is evident, expenditure share has increased up to 9% (for grocery products), whereas it has decreased up to 10% (for restaurant services), both in April 2020.

Table 2. Estimated Changes in Expenditure Share across Sectors.

	% Change in Spending		
Sector	**March 2020**	**April 2020**	**May 2020**
Clothing	−2.560 ***	−4.097 ***	−3.099 ***
	(0.02)	(0.03)	(0.02)
Fuel	−1.172 ***	−3.780 ***	−2.836 ***
	(0.02)	(0.02)	(0.02)
General Goods	0.177 ***	2.299 ***	1.992 ***
	(0.02)	(0.02)	(0.02)
Grocery	7.623 ***	8.665 ***	5.722 ***
	(0.02)	(0.02)	(0.02)
Home Maintenance	1.153 ***	3.627 ***	6.357 ***
	(0.02)	(0.02)	(0.02)
Leisure	−1.134 ***	−3.349 ***	−3.287 ***
	(0.02)	(0.02)	(0.02)
Personal Care Services	−1.134 ***	−3.604 ***	−2.467 ***
	(0.03)	(0.04)	(0.03)
Pharmacy	0.217 ***	−1.207 ***	−0.993 ***
	(0.02)	(0.02)	(0.02)
Professional Services	−0.089 ***	−0.945 ***	−0.821 ***
	(0.03)	(0.03)	(0.03)
Restaurant	−5.338 ***	−10.276 ***	−8.165 ***
	(0.02)	(0.02)	(0.02)
Transportation	−1.494 ***	−4.532 ***	−3.698 ***
	(0.02)	(0.03)	(0.03)

Source: Author calculations. Notes: *** represents significance at the 0.1% level. The numbers represent the estimated sector-time fixed effects that are normalized with respect to the period before March 2020 by subtracting the corresponding average values between October 2019 and February 2020.

4.4. Discussion on Estimation Results

The results based on the sector-level data are consistent with other studies focusing on the U.S. such as by Coibion et al. (2020) who have documented largest drops in spending on travel and clothing or by Baker et al. (2020b) who have shown that greater levels of social distancing are associated with drops in spending on restaurants or by Grashuis et al. (2020) who have shown that consumer spending on groceries has increased amid COVID-19. Nevertheless, different from these studies that focus on aggregate-level data in the U.S., this paper has shown that, after controlling for factors that are zip-code and time specific as well as those that are zip-code and sector specific, common factors across zip codes representing relative spending on general goods, home maintenance, pharmacy and professional services have increased over time amid COVID-19.

Regarding economic intuition behind the results, it is evident that consumption of products and services that can be consumed at home (e.g., grocery, pharmacy, home maintenance) have increased amid COVID-19, whereas consumption of products and services that cannot be consumed at home (e.g., fuel, transportation, personal care services, restaurant) have decreased. This approach is similar to the one that has been used to explain the reduction in economic activity, unemployment or social distancing experience by workers' ability of working from home as in studies such as by Dingel and Neiman (2020); Bick et al. (2020) or Yilmazkuday (2020). The only difference is that it is consuming

at home that can be connected to the sectoral heterogeneity in consumption changes amid COVID-19 as in this paper.

5. Online versus Offline Shopping

This section achieves formal investigations using data on online versus offline shopping as described above.

5.1. Empirical Methodology

We are interested in estimating common factors across zip codes representing online versus offline shopping patterns within the U.S., where the dataset described above is controlling for factors that are zip-code and time specific as well as those that are zip-code and sector specific. As in the case of sector-level investigation, we focus on both percentage changes in spending and expenditure shares, below.

The formal investigation based on online versus offline shopping is achieved according to the following expression:

$$\underbrace{\Delta C_{nzt}}_{\%\text{Change in Spending}} = \underbrace{\phi^{c}_{nt}}_{\text{Channel}-\text{Time FE}} + \underbrace{\kappa^{c}_{zt}}_{\text{Zip}-\text{Code}-\text{Time FE}} + \underbrace{\varphi^{c}_{nz}}_{\text{Channel}-\text{Zip}-\text{Code FE}} + \underbrace{\varepsilon^{c}_{nzt}}_{\text{Residuals}} \quad (3)$$

where ΔC_{nzt} is the percentage change (with respect to the previous year) in spending through shopping channel n (representing either online or offline shopping) in zip-code z at time t. In this expression, we are interested in shopping channel-time fixed effects represented by ϕ^{c}_{nt}'s as they are common factors across zip codes representing relative percentage changes in spending through online versus offline shopping within the U.S. after controlling for other factors as they are described above.

Likewise, the formal investigation based on online versus offline expenditure shares is achieved according to the following expression:

$$\underbrace{W_{nzt}}_{\text{Expenditure Share}} = \underbrace{\phi^{w}_{nt}}_{\text{Channel}-\text{Time FE}} + \underbrace{\kappa^{w}_{zt}}_{\text{Zip}-\text{Code}-\text{Time FE}} + \underbrace{\varphi^{w}_{nz}}_{\text{Channel}-\text{Zip}-\text{Code FE}} + \underbrace{\varepsilon^{w}_{nzt}}_{\text{Residuals}} \quad (4)$$

where W_{nzt} is the expenditure share on products through shopping channel n (representing either online or offline shopping) in zip-code z at time t. Here, we are again interested in shopping channel-time fixed effects represented by ϕ^{w}_{nt}'s, this time as they are common factors across zip codes representing relative expenditure shares on products purchased through online versus offline shopping within the U.S. after controlling for other factors as they are described above.

5.2. Empirical Results Based on Spending

The estimation of Equation (3) is achieved by using 56,220 observations that results in estimates of ϕ^{c}_{nt}'s, κ^{c}_{zt}'s and φ^{c}_{nz}'s with an adjusted R-squared value of 0.73. The corresponding estimates of ϕ^{c}_{nt}'s representing shopping channel-time fixed effects are depicted in Figure 1 with equal pre-COVID-19 values for comparison purposes. As is evident, relative spending through online shopping has increased amid COVID-19, whereas relative spending through offline shopping has decreased.

Regarding the magnitudes, the corresponding estimates between March 2020 and May 2020 are further given in Table 3, where they are mirror images of each other (representing relative changes) as they add up to zero. As is evident, relative online (offline) spending has increased (decreased) significantly amid COVID-19 by up to 21% in April 2020 and 20% in May 2020, both with respect to the pre-COVID-19 period.

5.3. Empirical Results Based on Expenditure Shares

The estimation of Equation (4) is achieved by using 56,220 observations that results in estimates of ϕ^{w}_{nt}'s, κ^{w}_{zt}'s and φ^{w}_{nz}'s with an adjusted R-squared value of 0.79. The corre-

sponding estimates of ϕ_{nt}^{w}'s representing shopping channel-time fixed effects are depicted in Figure 1 for online versus offline shopping with equal pre-COVID-19 values for comparison purposes. As is evident, relative expenditure share through online shopping has increased amid COVID-19, whereas relative expenditure share through offline shopping has decreased.

Table 3. Estimated Changes in Spending across Shopping Channels.

	% Change in Spending		
Sector	**March 2020**	**April 2020**	**May 2020**
Online	7.403 ***	21.077 ***	19.959 ***
	(0.12)	(0.10)	(0.12)
Offline	−7.403 ***	−21.077 ***	−19.959 ***
	(0.12)	(0.10)	(0.12)

Source: Author calculations. Notes: *** represents significance at the 0.1% level. The numbers represent the estimated sector-time fixed effects that are normalized with respect to the period before March 2020 by subtracting the corresponding average values between October 2019 and February 2020.

Regarding the magnitudes, the corresponding estimates between March 2020 and May 2020 are further given in Table 4, where they are mirror images of each other (representing relative changes) as they add up to zero. As is evident, relative expenditure share of online (offline) shopping has increased (decreased) significantly amid COVID-19 by up to 16% in April 2020 and 13% in May 2020, both with respect to the pre-COVID-19 period.

Table 4. Estimated Changes in Expenditure Shares across Shopping Channels.

	% Change in Spending		
Sector	**March 2020**	**April 2020**	**May 2020**
Online	4.047 ***	16.381 ***	13.277 ***
	(0.03)	(0.04)	(0.04)
Offline	−4.047 ***	−16.381 ***	−13.277 ***
	(0.03)	(0.04)	(0.04)

Source: Author calculations. Notes: *** represents significance at the 0.1% level. The numbers represent the estimated sector-time fixed effects that are normalized with respect to the period before March 2020 by subtracting the corresponding average values between October 2019 and February 2020.

5.4. Discussion on Estimation Results

The results based on online versus offline shopping are consistent with those in Relihan et al. (2020) who have used an earlier version of the dataset used in this paper and shown that the increase in online shopping has been only about 1.5% in March 2020 (with respect to March 2019). Nevertheless, different from this study that has focused on aggregate-level data in the U.S., this paper has shown that, after controlling for factors that are zip-code and time specific as well as those that are zip-code and sector specific, the common factor across zip codes representing online spending within the U.S. has increased by about 7.4% in March 2020 (with respect to March 2019).

Regarding economic intuition behind the results, the increase in online shopping during COVID-19 can be observed as a reducing factor on the negative consumption effects as in studies such as by Bounie et al. (2020). Hence, it can be claimed that resilience of the U.S. economy has improved due to online shopping. However, as shown by studies such as by Watanabe and Omori (2020), online consumption has increased mostly due to consumers who were already familiar with online consumption before COVID-19. It is implied that encouraging online shopping can easily reduce the severity of economic recessions caused by similar reasons in the future.

6. Conclusions

Using monthly zip-code level data on credit card transactions covering 16 U.S. cities, this paper has investigated the changes in consumption at local commercial places in the early COVID-19 era. Different from earlier studies focusing on aggregate-level data that can suppress valuable information coming from more disaggregated areas, this paper has identified common factors across zip codes so that the estimated sector-level or online versus offline consumption patterns at the U.S. national level do not suffer from an aggregation bias.

The results based on the sector-level data show that relative consumption of products and services that can be consumed at home (e.g., grocery, pharmacy, home maintenance) has increased by up to 56% amid COVID-19, whereas relative consumption of products and services that cannot be consumed at home (e.g., fuel, transportation, personal care services, restaurant) has decreased by up to 51%. Therefore, similar to the working-from-home approach in the literature used to explain the reduction in economic activity, unemployment or social distancing, consuming-at-home that can be connected to the sectoral heterogeneity in consumption changes amid COVID-19 as in this paper.

The results based on online versus offline shopping show that online shopping has increased by up to 21%, while its expenditure share has increased by up to 16% compared to the pre-COVID-19 period. This increase in online shopping can be observed as a reducing factor on the negative consumption effects, and thus, it can be claimed that resilience of the U.S. economy has improved due to online shopping. Since online consumption has increased mostly due to consumers who were already familiar with online consumption before COVID-19, it is implied that encouraging online shopping can reduce the severity of economic recessions caused by similar reasons in the future.

The results are not without caveats, though. Specifically, although the monthly dataset on consumption cover 3674 zip codes from 16 U.S. cities for the early COVID-19 period, a better geographical coverage with a longer sample period within the U.S. or across countries may improve the results. As such data were not available at the time this paper as written, we leave this extension as a topic of future research.

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Data Availability Statement: Publicly available datasets were analyzed in this study. This data can be found here: https://www.jpmorganchase.com/institute/research (accessed on 1 September 2020).

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References

Alfaro, Laura, Anusha Chari, Andrew N. Greenland, and Peter K. Schott. 2020. *Aggregate and Firm-Level Stock Returns during Pandemics, in Real Time (No. w26950)*. Working Papers. Cambridge: National Bureau of Economic Research.

Alon, Titan, Matthias Doepke, Jane Olmstead-Rumsey, and Michèle Tertilt. 2020. *The Impact of COVID-19 on Gender Equality (No. w26947)*. Working Papers. Cambridge: National Bureau of Economic Research.

Andersen, Asger Lau, Emil Toft Hansen, Niels Johannesen, and Adam Sheridan. 2020. Consumer Responses to the COVID-19 Crisis: Evidence from Bank Account Transaction Data. Available online: https://dx.doi.org/10.2139/ssrn.3609814 (accessed on 1 September 2020).

Anglin, Paul, Jianxin Cui, Yanmin Gao, and Li Zhang. 2021. Analyst Forecasts during the COVID-19 Pandemic: Evidence from REITs. *Journal of Risk and Financial Management* 14: 457. [CrossRef]

Atkeson, Andrew. 2020a. *How Deadly Is COVID-19? Understanding the Difficulties with Estimation of its Fatality Rate (No. w26965)*. Working Papers. Cambridge: National Bureau of Economic Research.

Atkeson, Andrew. 2020b. *What Will be the Economic Impact of COVID-19 in the US? Rough Estimates of Disease Scenarios (No. w26867)*. Working Papers. Cambridge: National Bureau of Economic Research.

Baker, Scott R., Nicholas Bloom, Steven J. Davis, Kyle J. Kost, Marco C. Sammon, and Tasaneeya Viratyosin. 2020a. *The Unprecedented Stock Market Impact of COVID-19 (No. w26945)*. Working Papers. Cambridge: National Bureau of Economic Research.

Baker, Scott R., Robert A. Farrokhnia, Steffen Meyer, Michaela Pagel, and Constantine Yannelis. 2020b. How Does Household Spending Respond to an Epidemic? Consumption during the 2020 Covid-19 Pandemic. *The Review of Asset Pricing Studies* 10: 834–62. [CrossRef]

Bick, Alexander, Adam Blandin, and Karel Mertens. 2020. Work from Home after the COVID-19 Outbreak. Available online: https://ssrn.com/abstract=3650114 (accessed on 1 September 2020).

Bounie, David, Youssouf Camara, and John W. Galbraith. 2020. Consumers' Mobility, Expenditure and Online-Offline Substitution Response to COVID-19: Evidence from French Transaction Data. Available online: https://dx.doi.org/10.2139/ssrn.3588373 (accessed on 1 September 2020).

Carvalho, Vasco M., Stephen Hansen, Alvaro Ortiz, Juan Ramon Garcia, Tomasa Rodrigo, Sevi Rodriguez Mora, and Pep Ruiz de Aguirre. 2020. Tracking the COVID-19 Crisis with High-Resolution Transaction Data. Available online: https://ssrn.com/abstract=3594273 (accessed on 1 September 2020).

Chen, Haiqiang, Wenlan Qian, and Qiang Wen. 2021. The impact of the COVID-19 pandemic on consumption: Learning from high-frequency transaction data. *In AEA Papers and Proceedings* 111: 307–11. [CrossRef]

Chiou, Lesley, and Catherine Tucker. 2020. *Social Distancing, Internet Access and Inequality (No. w26982)*. Working Papers. Cambridge: National Bureau of Economic Research.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber. 2020. *The Cost of the Covid-19 Crisis: Lockdowns, Macroeconomic Expectations, and Consumer Spending (No. w27141)*. Working Papers. Cambridge: National Bureau of Economic Research.

Dingel, Jonathan I., and Brent Neiman. 2020. How many jobs can be done at home? *Journal of Public Economics* 189: 104235. [CrossRef] [PubMed]

Eichenbaum, Martin S., Sergio Rebelo, and Mathias Trabandt. 2020. *The Macroeconomics of Epidemics (No. w26882)*. Working Papers. Cambridge: National Bureau of Economic Research.

Grashuis, Jasper, Theodoros Skevas, and Michelle S. Segovia. 2020. Grocery shopping preferences during the COVID-19 pandemic. *Sustainability* 12: 5369. [CrossRef]

Guerrieri, Veronica, Guido Lorenzoni, Ludwig Straub, and Iván Werning. 2020. *Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages? (No. w26918)*. Working Papers. Cambridge: National Bureau of Economic Research.

Jones, Callum J., Thomas Philippon, and Venky Venkateswaran. 2020. *Optimal Mitigation Policies in a Pandemic: Social Distancing and Working from Home (No. w26984)*. Working Papers. Cambridge: National Bureau of Economic Research.

Kuchler, Theresa, Dominic Russel, and Johannes Stroebel. 2021. JUE Insight: The geographic spread of COVID-19 correlates with the structure of social networks as measured by Facebook. *Journal of Urban Economics*: 103314. [CrossRef]

Relihan, Lindsay, Marvin Ward, Chris W. Wheat, and Diana Farrell. 2020. The Early Impact of COVID-19 on Local Commerce: Changes in Spend across Neighborhoods and Online. Available online: https://dx.doi.org/10.2139/ssrn.3647298 (accessed on 1 September 2020).

Siddique, Asima, Ghulam Mujtaba Kayani, and Saira Ashfaq. 2021. Does Heterogeneity in COVID-19 News Affect Asset Market? Monte-Carlo Simulation Based Wavelet Transform. *Journal of Risk and Financial Management* 14: 463. [CrossRef]

Watanabe, Tsutomu, and Yuki Omori. 2020. Online consumption during the covid-19 crisis: Evidence from Japan. *Covid Economics* 38: 218–52.

Yilmazkuday, Hakan. 2020. COVID-19 and unequal social distancing across demographic groups. *Regional Science Policy & Practice* 12: 1235–48.