

Digital food sharing and food insecurity in the COVID-19 era

1. The platform- general

Olio is a UK based food sharing startup founded in 2015 by Tessa Clarke and Sasha Celestial One. The platform can be accessed via Web browsers (<https://olioex.com/>) or dedicated smartphone apps and is freely available through the Apple and Samsung application stores. At the time of writing the platform had over 2.8 million registered users worldwide. While the platform mostly centers on food sharing, it also has other sections where users can share various items including furniture, clothes etc. In addition to regular users, offering whatever surplus food they have in their houses, Olio also operates a network of individual volunteers, called ‘food waste heroes’, who collect food surplus from local businesses such as delis and bakeries, and offers them for collection via the network. Critically, while the startup is a for-profit enterprise, users are free to post or collect as many items as they wish, and all exchanges facilitated via the platform are currently free of charge.

When adding a listing, providers can add a photo and have three fields where they can enter text freely. While providers are encouraged to state exactly how many items are included, this is not a mandatory requirement. To illustrate, several listings’ examples are provided below.

Title	Description	Collection notes
2007 Chilean Cabernet Sauvignon red wine	2 bottles available; has aged a lot so is a bit acidic - may not suit your tastes but otherwise fine for cooking	10am - 8pm or I can leave outside building
Northern Catch Solid White Tuna Albacore in Water	Tuna Albacore in Water. Purchased at ALDI. Expires 11/26/2022. Three 5 oz cans.	12-4 pm
Avocados	Avocados that need to get eaten soon.	Now
Vinegar	Half full, Chinese brand, label says \Old Vinegar\".	
Lemons from our tree	Fresh lemons from our backyard tree.	Left outside on front bench

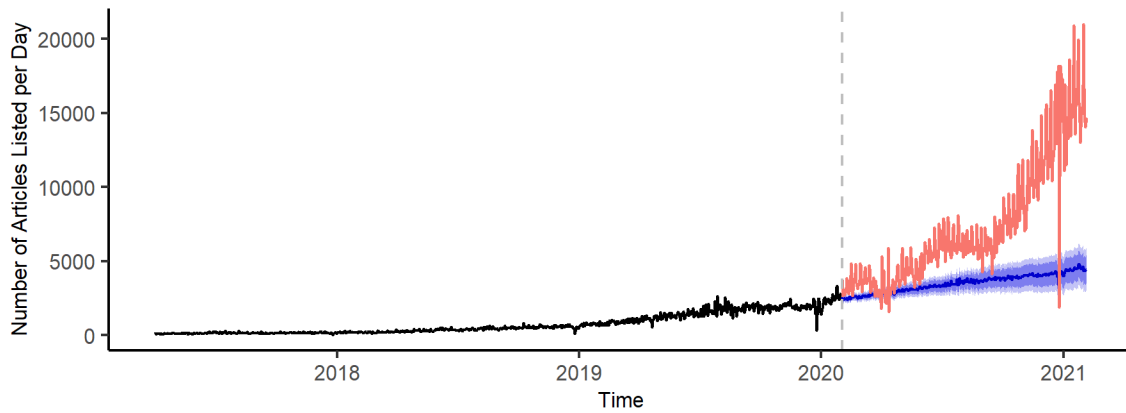
Southwest Beef and Rice Skillet	I made a big batch pan southwest beef and rice for families in need of meals tonight or tomorrow. Let me know how many servings your family needs. Not spicy. Cheddar cheese provided on the side.	Contact to arrange
Curry sauce	I did not know there is beef..so giving it away. I will only hang on my gate..as I do not want to have contact with ppl at this point of time	I can leave it outside my door..

2. Methods

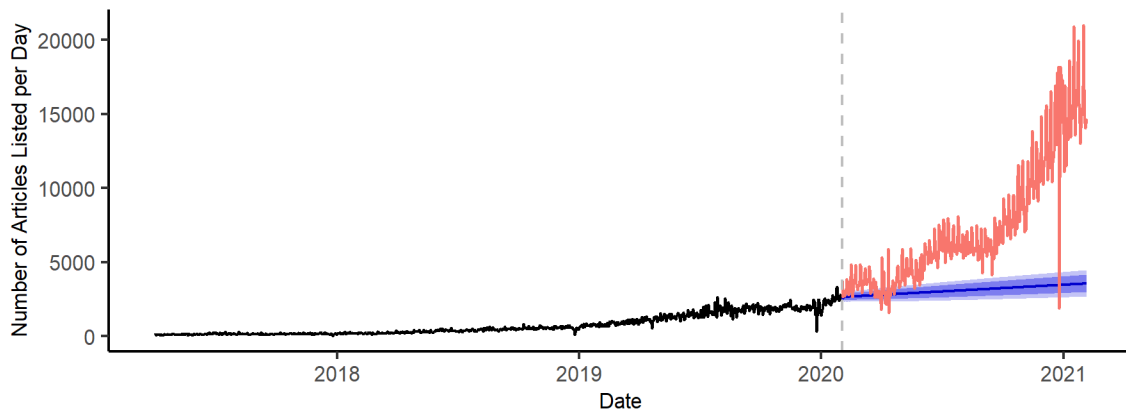
2.1. Forecasting activity on the platform

We used a number of algorithms to predict long-term activity levels on Olio and assess the pandemic’s impact independent of pre-pandemic trends. In the main paper we present predicted activity levels (based on the number of listings collected) derived using Facebook’s prophet model. Here, we present predicted activity derived using the ARIMA, STL, and TBATS forecasting models (see Fig S1 below). The ARIMA (2,1,3) model with drift predicts a relatively slow growth of platform activity, which the actual levels of activity clearly outperformed during the pandemic. The STL model with ETS (A, A, N) specifications had similar predictions that also fell short of actual food sharing activity. Platform activity during the pandemic was mostly within the confidence interval of the TBATS predictive model, specified with only annual seasonality. However, this is partially due to the very large confidence interval of this model. Given that platform activity consistently outperformed three out of four predictive models, we conclude that overall levels of activity on the platform during the pandemic were higher than could be expected absent a significant change in the platform in this period.

Forecast using STL, trained until 2020-02-01



Forecast using ARIMA, trained until 2020-02-01



Forecast using TBATS, trained until 2020-02-01

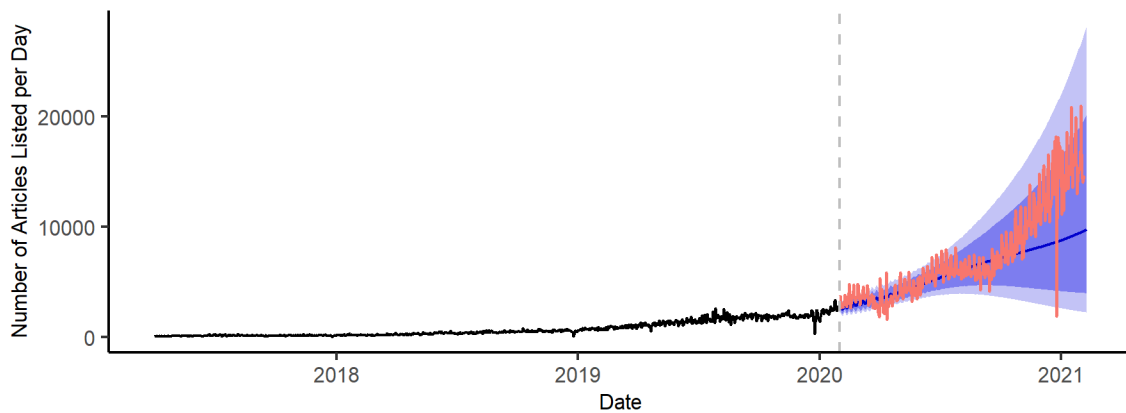


Figure S1: Daily number of listed articles on Olio in Great Britain. The training data (black lines) covers the period until February 1, 2020 (indicated with the gray dotted line). The test data (orange lines) covers the period since February 1, 2020. The blue lines are the predicted values and the blue bars represent confidence intervals around the predictions using the three models (ARIMA, STL, and TBATS).

2.2. New user registration and conversion from registered to active users UK.

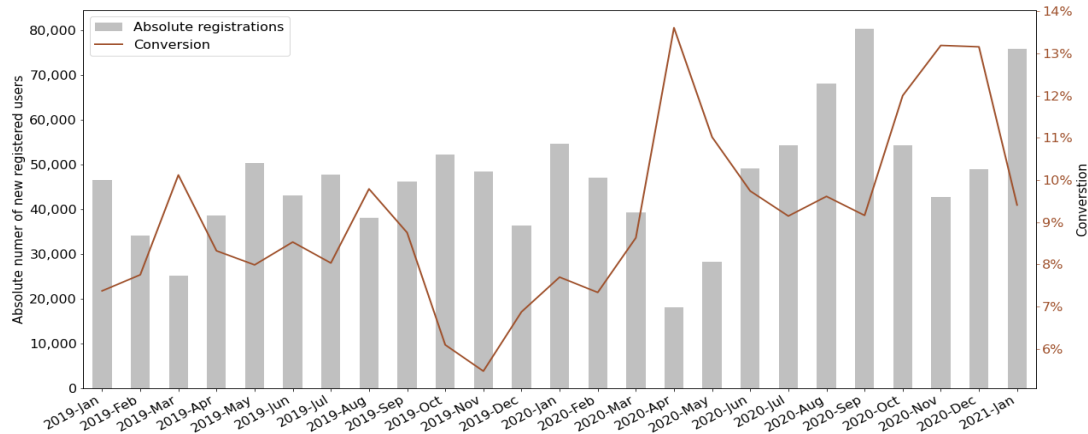


Figure S2: Monthly new user registration and conversion to active users over time. Grey bars show the absolute number of UK users registering to use the platform. Orange line shows the share of registered users who converge to become active users by providing or collecting one item or more.

2.3. Analysis by food type

2.3.1. Collection rates by food type over time

Table SI-1: Food types and definitions

Food type	Description
Baby food	Liquid baby formula, baby formula powder
Baked Goods	Breads, pastries, cakes, cookies, flatbreads, etc. from bakeries and markets. Includes both savory and sweet baked goods. Can include mixed postings if all (or a vast majority of) items also fall within this category.
Beverages	Liquid beverages, Milk and non-dairy variants thereof (e.g. soy milk).
Dairy	Butter, yogurt, ice cream, cheese, and other dairy products
Frozen Food	Mainly frozen meals and other ready-to-cook items. Also includes other food items that must be kept frozen but that do not fall into any other category.
Snacks & packaged foods	Crackers, chips (crisps), popcorn, and other snack foods.
Kitchen & pantry staples	All pantry items, incl. baking ingredients, canned foods, bottles, oils, condiments, spices, grains, and open (i.e. perishable) examples thereof.

Mixed	Posts that include substantial amounts from more than one of the food categories listed above
Prepared Food	Perishable food that has been prepared for consumption. Includes cooked grains, meals, and chopped vegetables. Excludes sandwiches and baked goods.
Fresh produce	Fresh fruits, vegetables, and herbs.
Protein	Meat, eggs, and meat substitutes (e.g. tofu)
Sandwiches	Sandwiches, wraps, ciabatta, and other like items.
Tea & Coffee	Dry tea & coffee, coffee pods

2.3.2. Collection rates by food type over time

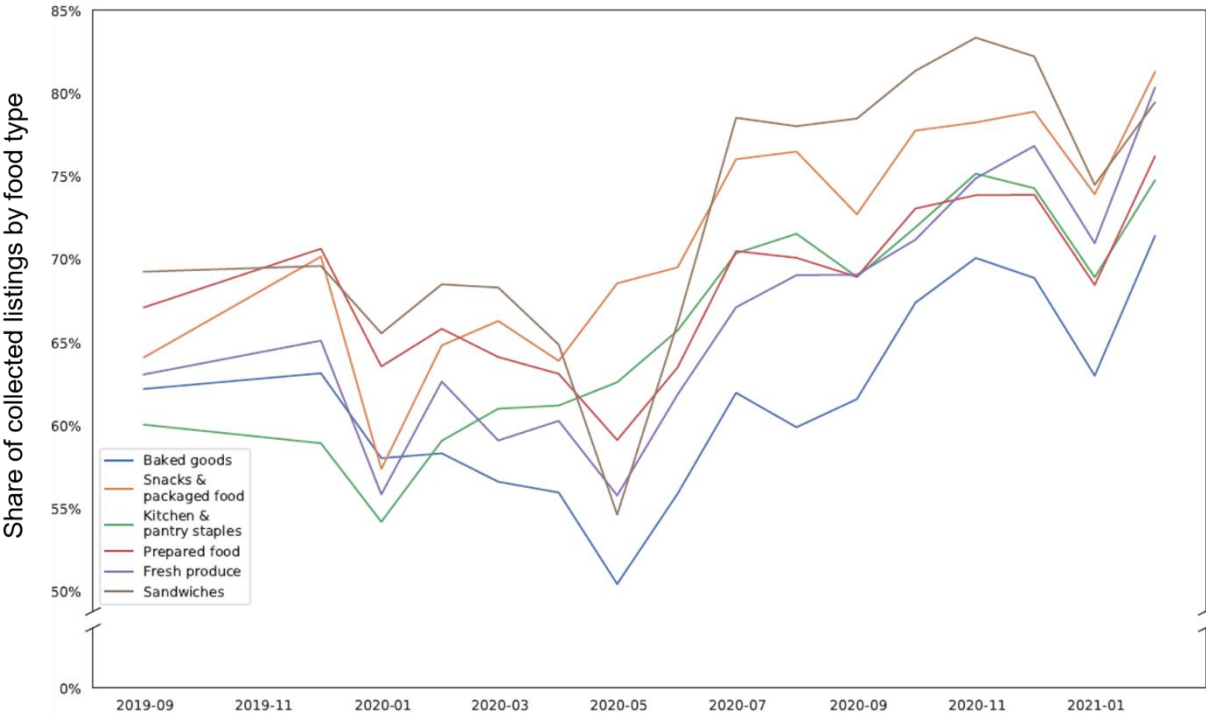


Figure S3: Collection rate by food type over time for major food categories (collectively comprising roughly 90% of all listings offered for sharing via Olio).

2.4. Food insecurity

2.4.1. Households struggling with food insecurity and collection rates on Olio (01-2021)

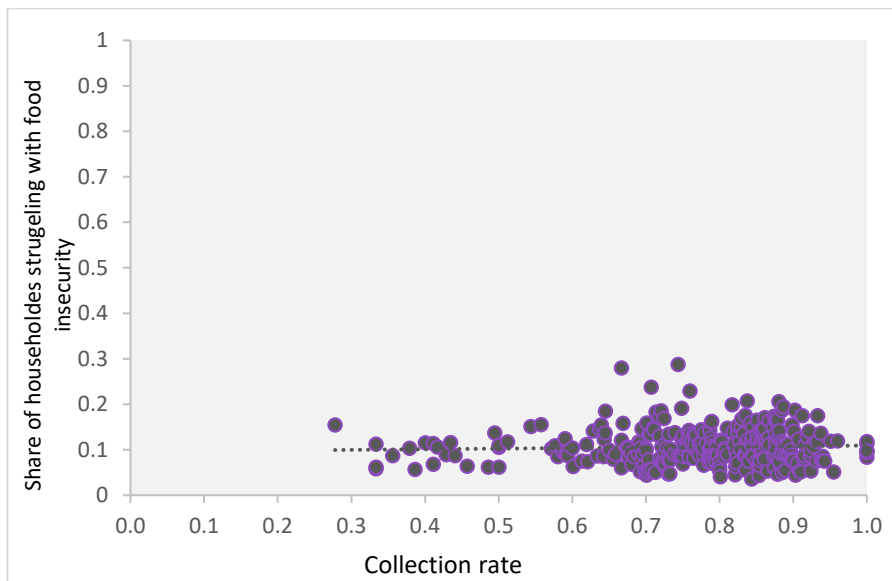


Figure S4: Relationship between Collection rate and the share of households struggling with food insecurity at the Local Authority level. This analysis is built on survey data collected by the Food foundations during January 2021, and subsequent estimates of food insecurity as presented online in the UK local food insecurity of adults Jan 2021 (UK local food insecurity of Adults Jan 2021 (arccis.com)).

2.4.2. Trussell Trust parcels

Table S2: Relationship between food sharing exchanges and food insecurity as measured via the total number of food aid parcels handed out by the Trussell trust in each Local Authority area.

	During Covid
Number of listings posted to the platform	0.755*** (100.33)
Population (Local Authority)	0.00859* (2.08)
Parcels handed out by Trussell	0.0964 (1.59)
_cons	-1915.4* (-2.55)
<i>N</i>	223
<i>R</i> ²	0.983

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2.4.3. Food insecurity vs. active participation in food sharing

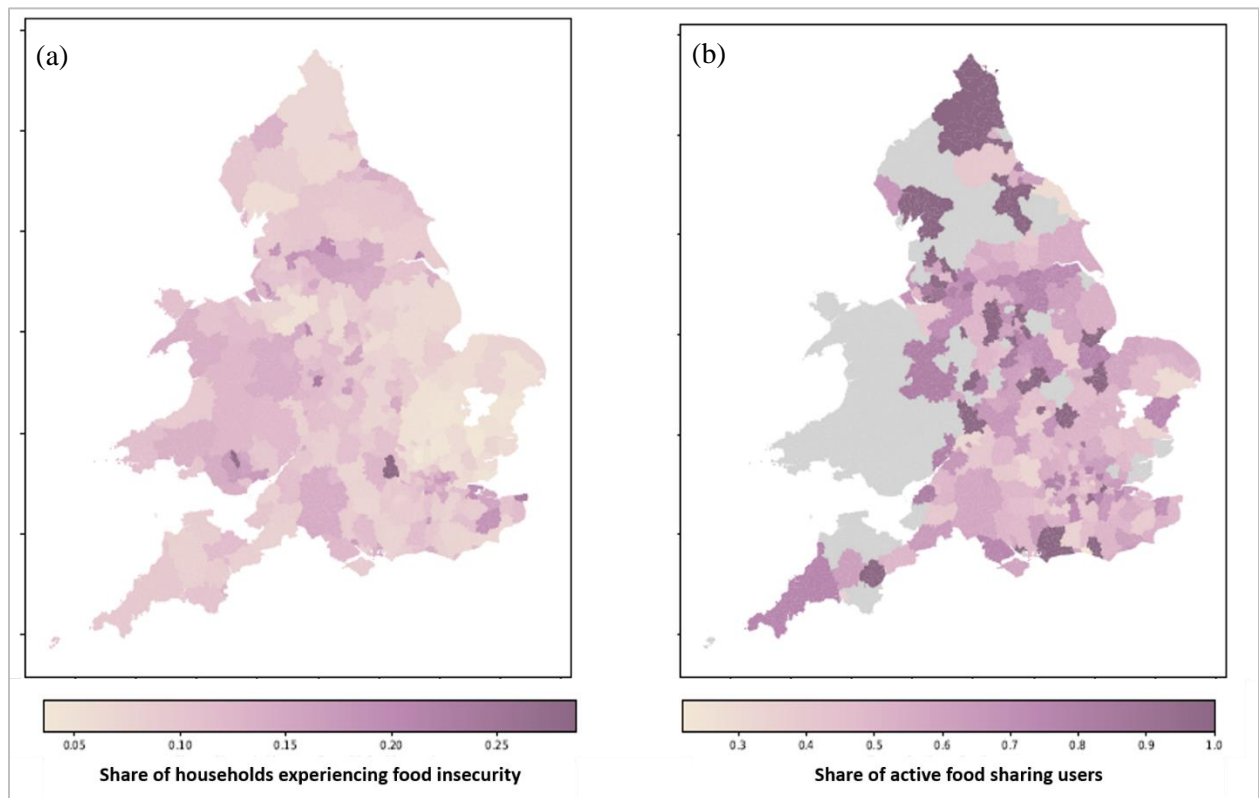


Figure S5: Prevalence of food insecurity vs and food sharing activity across the UK during January 2021. Left panel-food insecurity prevalence based on the share of households struggling with food insecurity (Moretti, 2021). Right panel- the share of active users collecting sourcing food via sharing. Lighter shades reflect lower prevalence while darker shares reflect higher prevalence.

2.5. Redistributive nature of the network

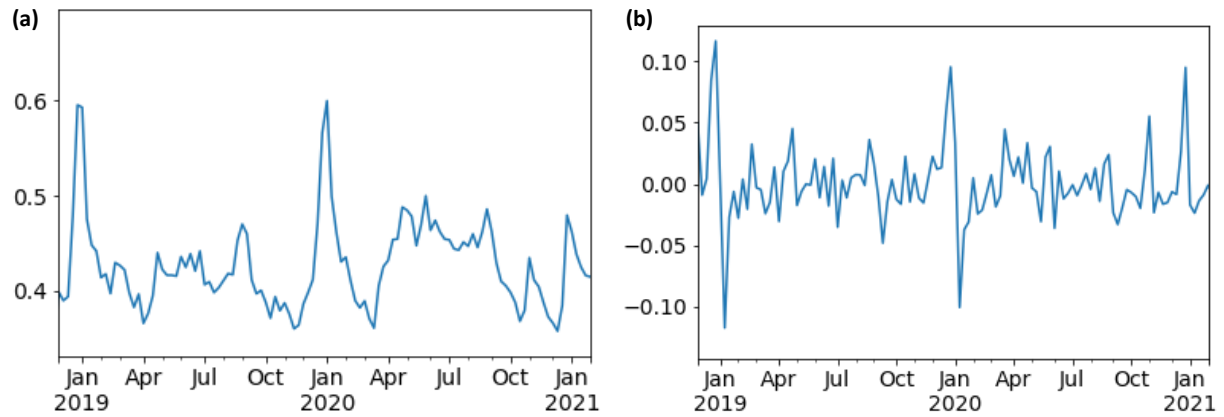


Figure S5: Weekly ratio of providing vs. collecting users, by week (a) and 1st difference by week (b).

2.6. User registration and collections by user income decile

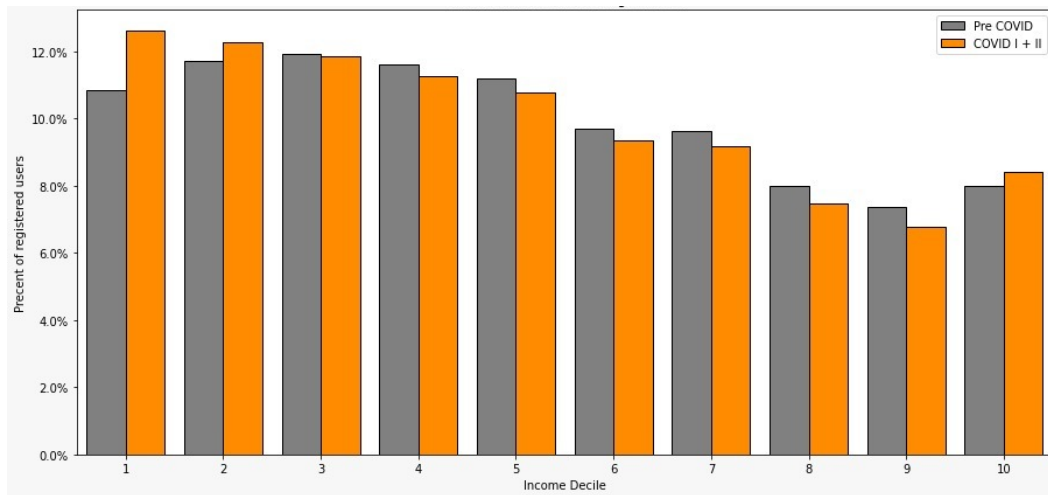


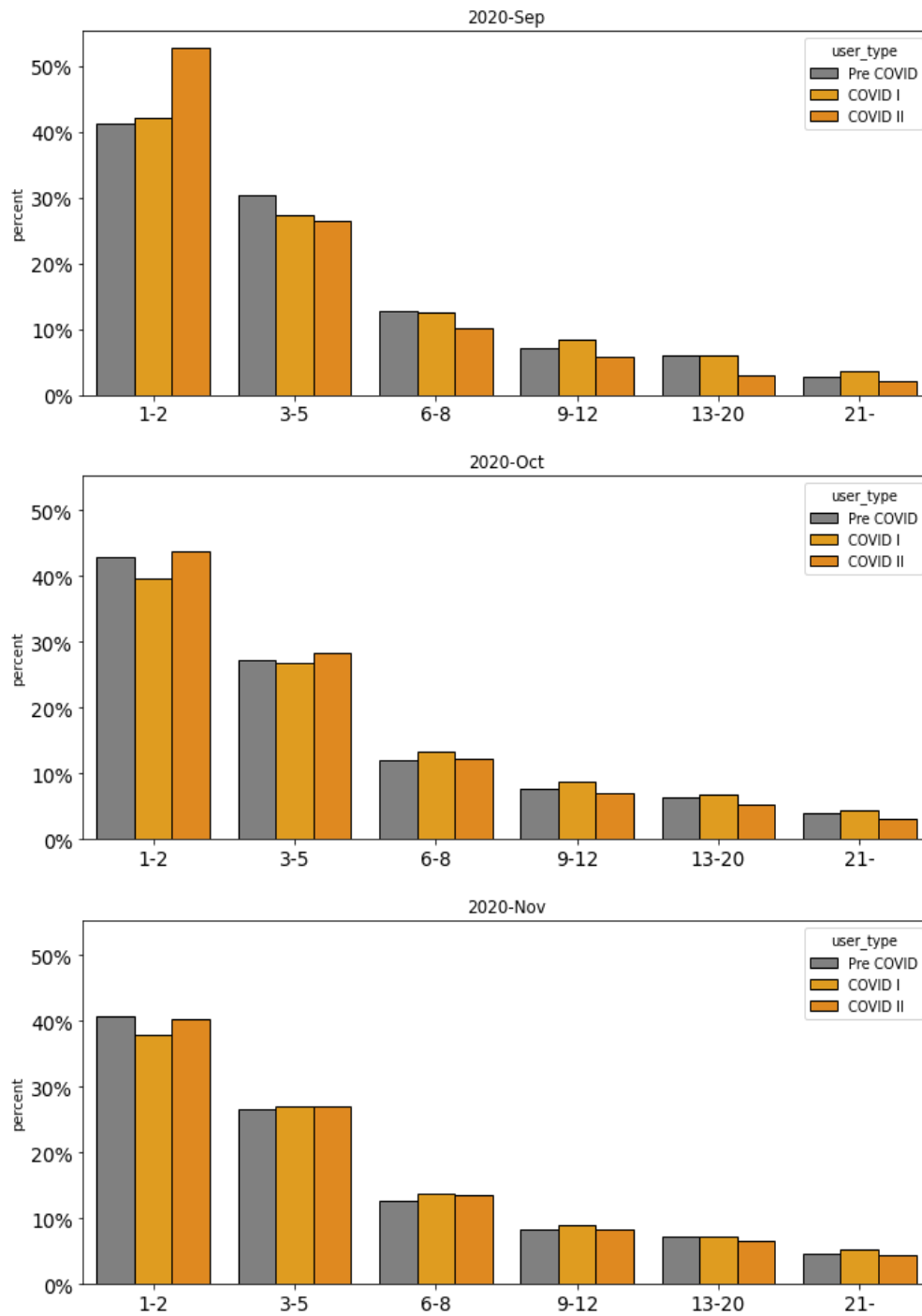
Figure S6- New user registration by user income decile, before (Gray) and during (Orange) the pandemic.

2.7. New user registration by period and income

Table S3: Income decile for new registered users in the UK by time period

Income decile	Pre COVID	Covid I+II
1	27,978 <i>2%</i>	31,964 <i>3%</i>
2	60,442 <i>5%</i>	62,166 <i>5%</i>
3	92,145 <i>7%</i>	90,258 <i>7%</i>
4	119,744 <i>9%</i>	114,300 <i>9%</i>
5	144,285 <i>11%</i>	136,655 <i>11%</i>
6	149,946 <i>11%</i>	142,482 <i>11%</i>
7	173,523 <i>13%</i>	163,086 <i>13%</i>
8	164,960 <i>13%</i>	151,440 <i>12%</i>
9	171,090 <i>13%</i>	155,025 <i>12%</i>
10	206,060 <i>16%</i>	213,540 <i>17%</i>
Grand Total	1,310,173	1,260,916

2.8. Average number of listings collected each week per user, by user cohort



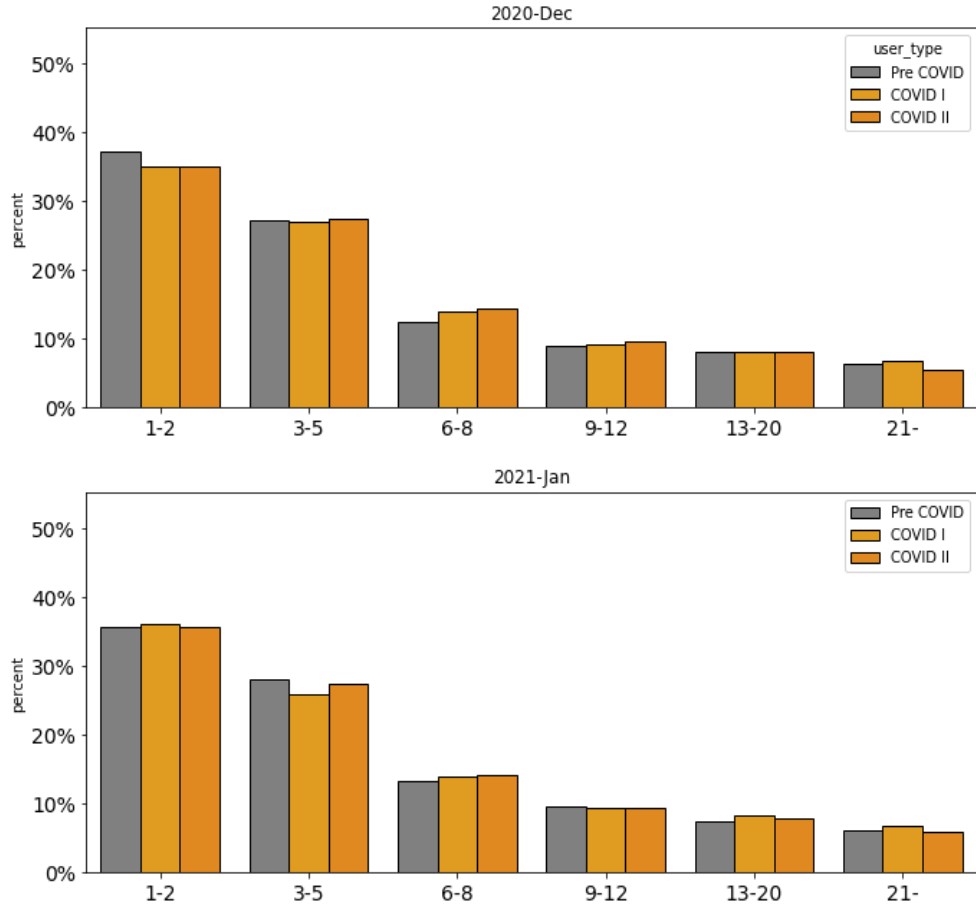


Figure S7: Distribution of users by number of monthly collections in each cohort. Bars reflect the absolute number of listings collected that month by user cohorts: in Gray, users who joined the platform before the pandemic (per-COVID users); in Orange, users who joined during the first period (COVID I users); in Dark Orange- users who joined during the second COVID period (COVID II users).

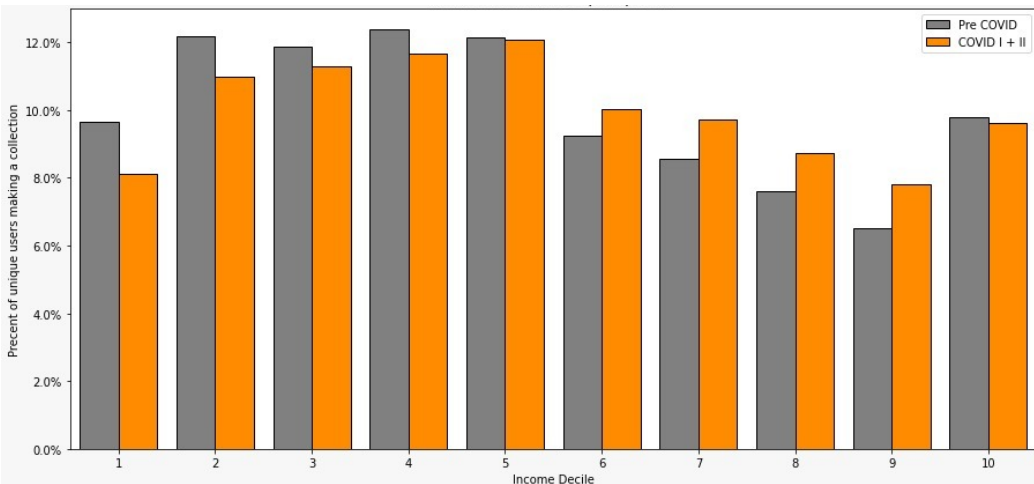


Figure S8: Collecting users by income decile, before (Gray) and during (Orange) the pandemic.

2.8 Bay Area Network

One example of a sharing network that has been significantly disrupted by the pandemic is the relatively small Olio network in the San Francisco Bay Area. Over a long period prior to the pandemic, there was a slow increase in food sharing activity in the Bay Area, averaging a few dozen listed articles per day (see Figure SI-6 below). In the period immediately following the onset of the pandemic at a global scale (the dotted line is February 1, 2020), activity levels rose. This rise, however, was not sustained. By mid-March the number of new listings dwindled compared to pre-pandemic times, and food sharing via Olio in the Bay Area has not recovered. These findings suggest that network density plays a critical role in fostering food sharing on the platform.

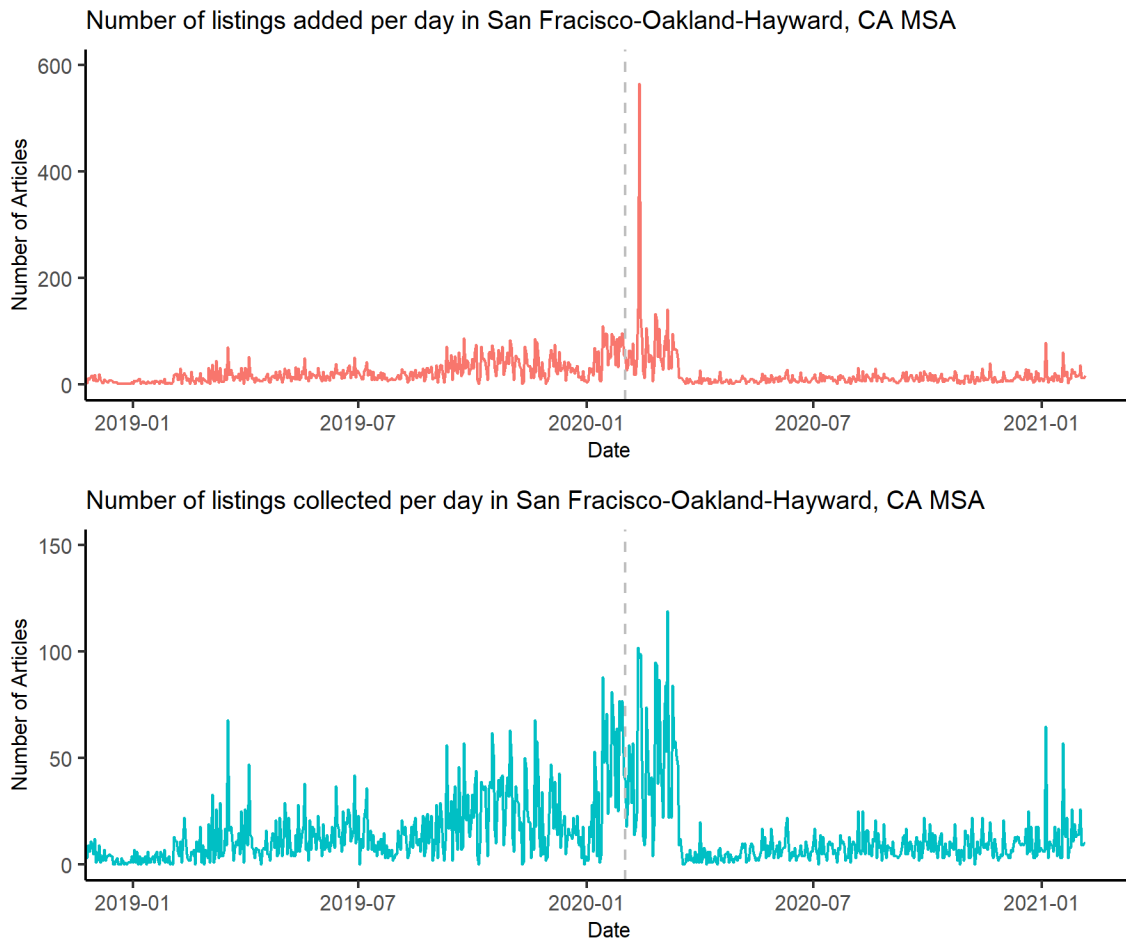


Figure S9: Daily food sharing activity in the San Francisco Bay Area. The orange line shows the number of listings added each day on Olio, while the green line shows the number of listings collected by users each day.