The distributional impact of the pandemic

Modelling with Big Data & Machine Learning: Measuring Economic Instability

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November, 2020

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Motivation

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- **COVID-19** plunged the global economy into the **worst recession** since WWII
- With things evolving so fast, crucial to be able to track the economy in real time
  - **KEY** to calibrate and evaluate stabilization policies
- **Problem**: Traditional macroeconomic indicators only available at monthly/quarterly frequency

This paper

- Use **high-frequency transaction data** to analyze how the **pandemic** affects **household behavior**
- Richness of the data allows us to track both **consumption** and **income**
- Study the **distributional effects** of the pandemic and government policies
- Look into sectoral and regional heterogeneity

Our results

1. **High earners** cut spending the most and **drive** the **drop in aggregate consumption**: account for almost half of it
2. **Low earners** suffer **largest drop** in earnings but **cut spending much less**
3. Reason: income of low earners falls much less than their earnings because of **government benefits**
4. Spending drop concentrated in **retail, restaurants, hospitality and entertainment**. Gains for **online shopping** and **food delivery**
5. Pervasive **regional heterogeneity**, with the largest spending declines in the most affluent regions

Burgeoning empirical literature

- **U.S.**: Baker et al. (2020); Chetty et al. (2020); Cox et al. (2020); Coibion, Gorodnichenko, and Weber (2020)
- **Spain**: Carvalho et al. (2020)
- **France**: Bounie, Camara, and Galbraith (2020)
- **Scandinavia**: Andersen et al. (2020)
- **Ireland**: Hopkins and Sherman (2020)
- **Norway**: Aastveit et al. (2020)
- **Portugal**: Carvalho, Peralta, and Pereira dos Santos (2020)
- **China**: Chen, Qian, and Wen (2020)
- **U.K.**: **This paper**, Bourquin et al. (2020), Chronopoulos et al. (2020)
- and many more ...

Data

Data

We use **transaction level data** from a large U.K. Fintech company (**Money DashBoard**)

- **Product**: Free app to manage household finances
- **Users**: Over 100,000 in total. About 15,000 in our sample (balanced panel)
- **Sample**: January 2019 to June 2020

- **Level**: Every time a user transacts on an account linked to the app, the transaction is collected with time stamp and description (millions of transactions)
- **Tagging**: Data provider uses machine learning techniques to categorize transactions into over **200 categories**, for **spending, earnings** and **income**
- **Privacy**: Data anonymized by provider, we observe year of birth, partial postcode, gender

Data

Unique features:

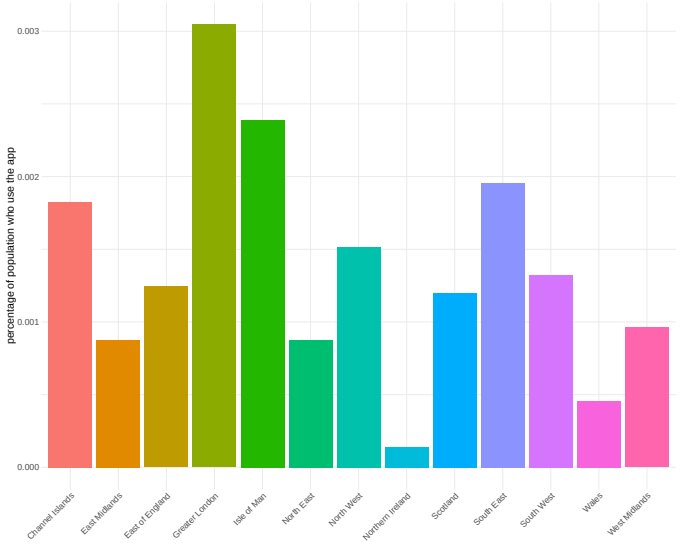
- **Complete picture** of household finances: users can link **all their accounts** in single platform
  - on average 4 accounts, 2 banks (current, credit, savings)
- Little measurement error
- Available in **real time**
- **But**: Sample not necessarily representative, only capture electronic transactions

Descriptive statistics

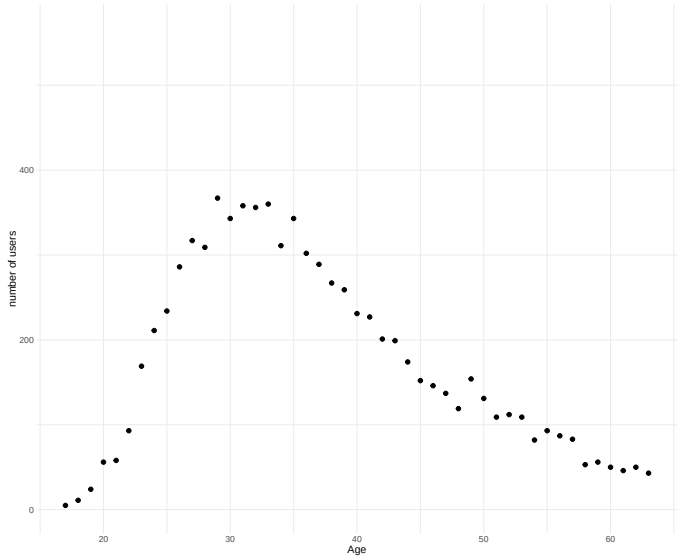
Table 1: Summary statistics

	Mean	$p10$	$p25$	$p50$	$p75$	$p90$
User Characteristics						
#Banks	2.30	1.00	1.00	2.00	3.00	4.00
#Accounts	4.38	1.00	2.00	4.00	6.00	8.00
Age	37.90	26.00	30.00	36.00	44.00	53.00
Salary	3349.71	1096.90	1712.28	2585.14	4000.00	6002.06
Monthly Transactions						
#Transactions	103.63	44.00	65.00	95.00	132.00	172.00
Total expenditure	1637.62	472.21	768.71	1289.66	2097.33	3130.91
Nondurables	601.48	128.32	250.73	470.47	831.21	1239.25
Durables	155.06	7.05	18.00	50.24	136.57	344.66
Services	941.95	227.59	390.46	679.33	1148.38	1854.73
Groceries	336.05	42.43	113.23	251.06	481.31	738.59
Restaurant	120.08	13.60	34.49	78.58	154.09	259.02
Monthly Mortgage and Rent Payments						
Mortgage payments	1095.50	300.00	521.34	836.00	1324.46	1965.24
Rents	818.65	81.00	298.62	595.00	1012.33	1650.00

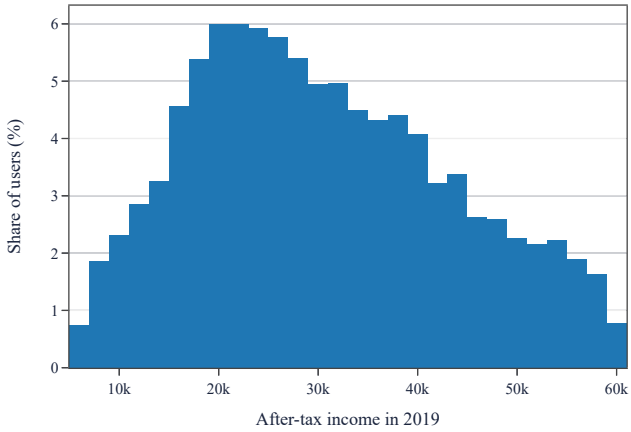
Regional distribution



Age distribution



Income distribution



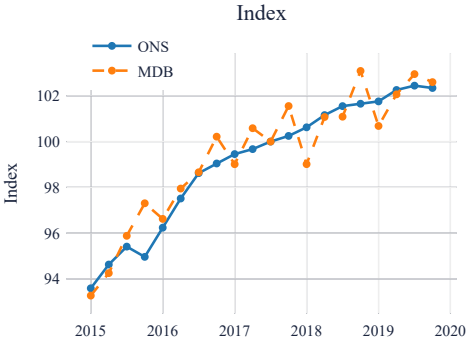
Representativeness

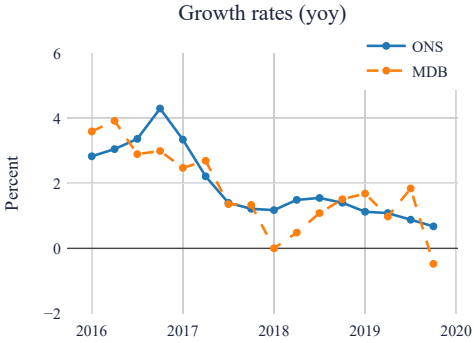
MDB population

- is more likely to be based in London
- is somewhat younger
- have somewhat higher income

How representative is the data?

Consistency with national accounts: 2016-2020





Correlation of 0.79 in the yoy growth rates of household expenditure from national accounts and aggregated MDB series

The role of cash

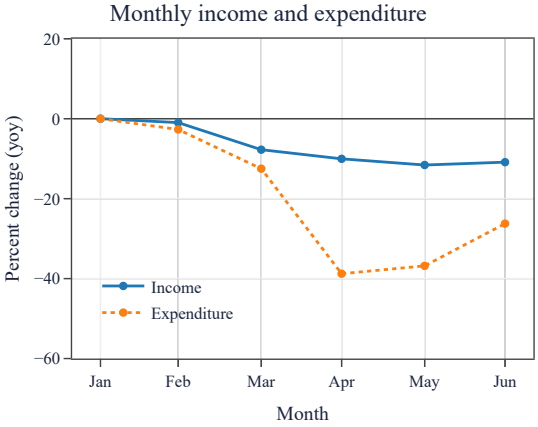
We only capture electronic transactions and ATM withdrawals. But:

- **Card usage**: 98% (65%) of adults holds a debit (credit) card
- **Cash vs electronic payments**: less that 25% of payments are done by cash. Only 9% by 2028

Data likely representative of the current transaction environment

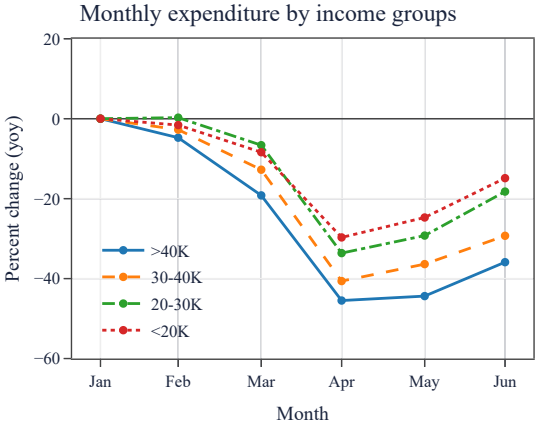
Results

On the shape of the recovery



- **Substantial drop** in **total expenditure**
- Fall in **income** smaller but more persistent

Spending heterogeneity by income groups



- **Top earners** have **largest** and most persistent **fall** in expenditures, **lower earners** cut expenditure by **less**
- Poorest households cut the least as they spend more on essentials

Contribution to overall drop in spending by income group

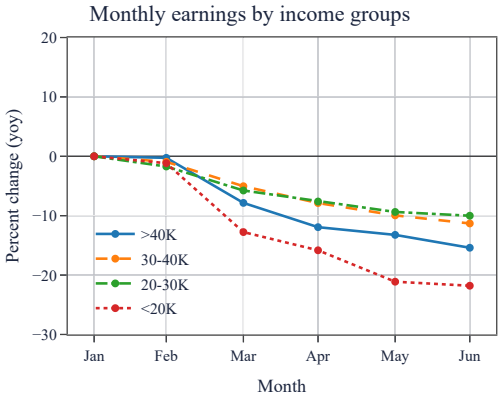
Table 2: Percentage spending decline by groups of the ex-ante income distribution

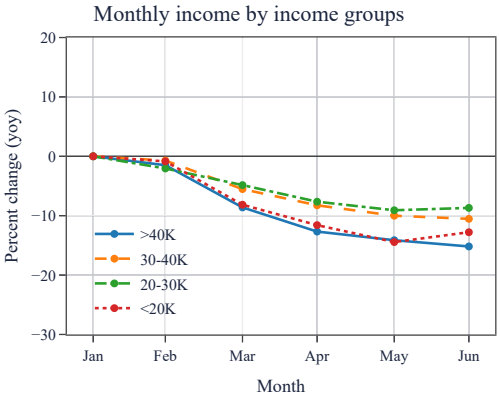
Income group	Share of users	Share in expenditure	Contribution to decline
$< 20K$	23.8	17.5	9.8
$20 - 30K$	28.6	20.9	16.3
$30 - 40K$	23.0	26.9	28.6
$> 40K$	24.6	34.7	45.3

Note: The table reports the share of users by after-tax income groups of (i) below 20K, (ii) between 20 to 40K, (iii) from 30k to 40K, and (iv) above 40K, based on their 2019 income distribution. It also reports these income groups' share in aggregate total expenditure in the second quarter of 2019 (third column) and how much each group contributes to the decline in spending in the second quarter of 2020 relative to the same period of 2019 (fourth column). Total expenditure has been deflated by the U.K. CPI.

- Large drop in aggregate consumption **driven** by the spending cuts by **high earners**
- Most of their basket is on non-essentials

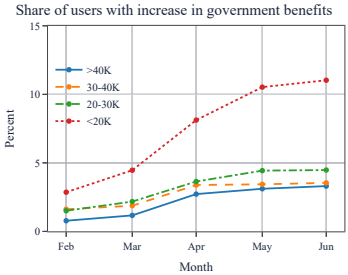
Earnings and income heterogeneity by income groups

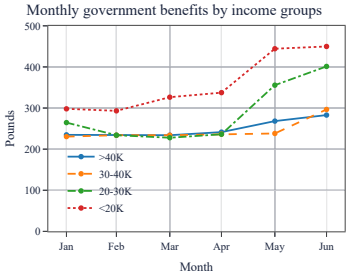


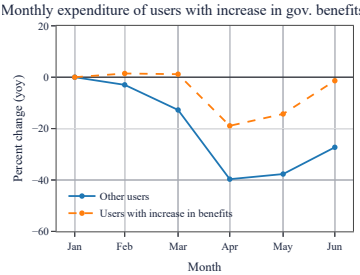


- The poorest households experienced the **largest fall in earnings**
- **But** the **fall in income** is more muted and comparable to other groups

The role of government benefits

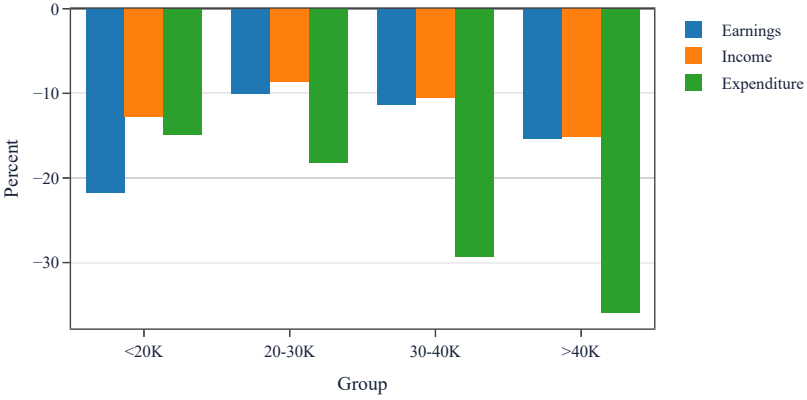






- **Government benefits** increased disproportionally for **low income** group, both along extensive and intensive margin
- Beneficiaries **cut consumption by less** than other households

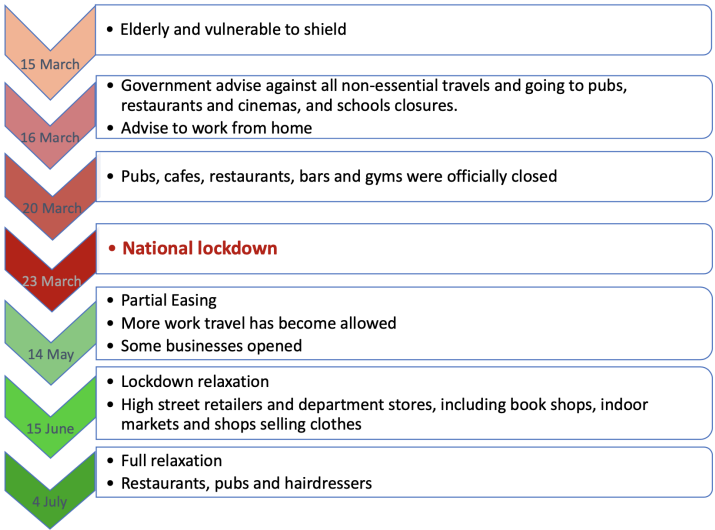
Implied personal savings by income groups



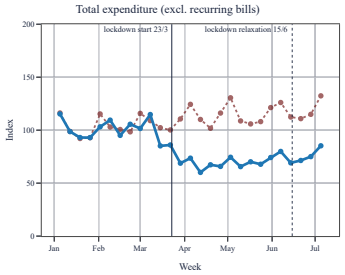
- **Higher income** groups **increase savings** substantially
- **Low income** group had to dissave without government benefits

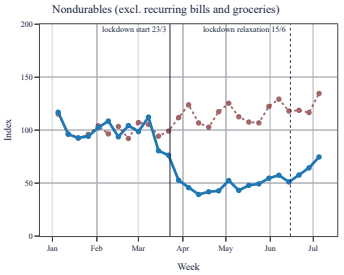
▸ More

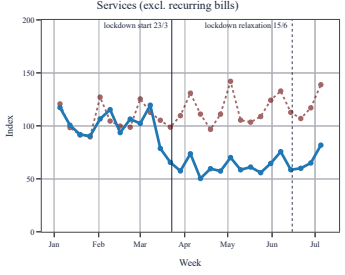
Covid timeline in the U.K.

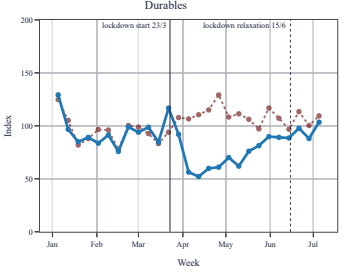


Fears and uncertainty versus lockdown effects, 2019 vs 2020





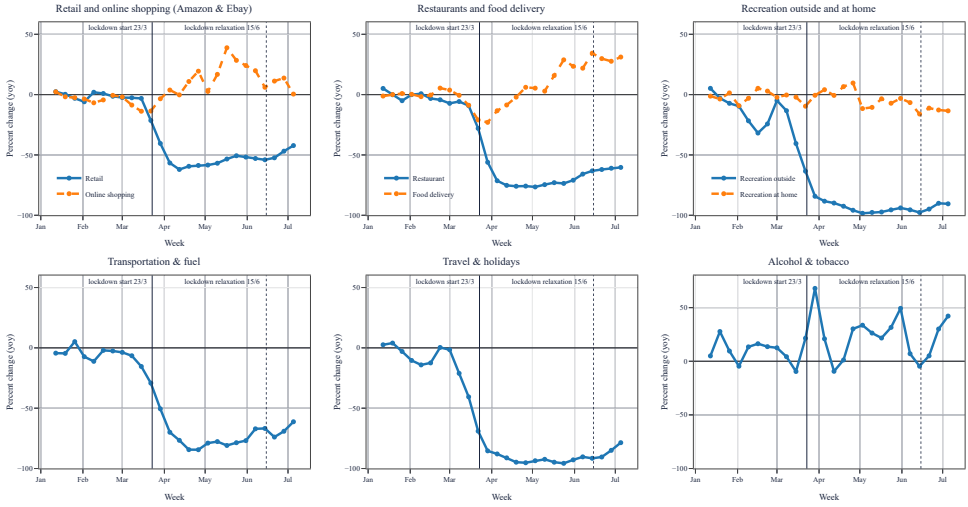




Fears and uncertainty versus lockdown effects

- Most of the **decline in spending** occurred **before** the lockdown and social distancing measures
  - Consistent with **precautionary behavior** because of fears regarding health and economic uncertainty
- Little sign of any significant recovery after partial ease in May, only modest improvement in June

Which sectors are losing and which ones are gaining?

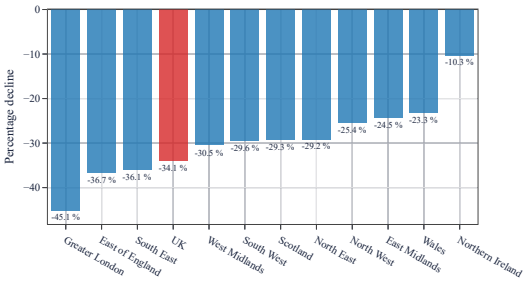


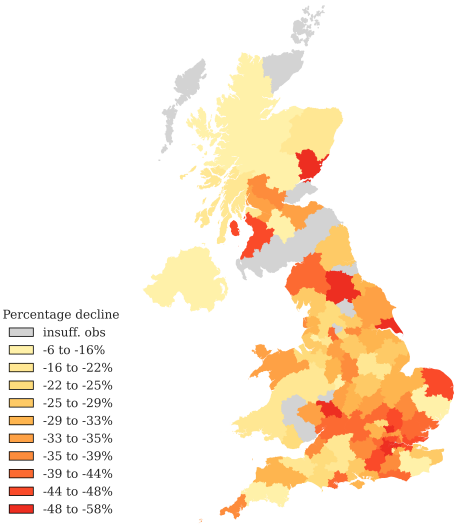
▸ More

Which sectors are losing and which ones are gaining?

- Pervasive sectoral heterogeneity
- **Retail, restaurant and transportation** hit the most
- Online shopping, food delivery and alcohol & tobacco made most gains

Regional variation in spending





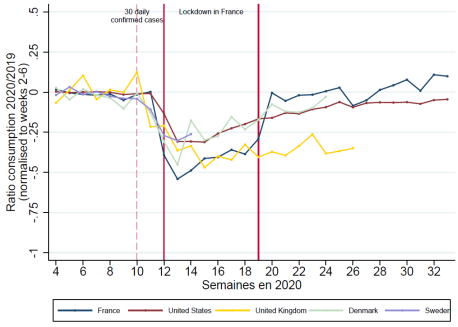
Conclusion

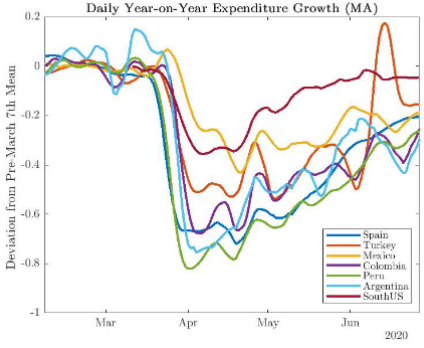
Take aways

1. **Largest spending decline** started **before** lockdown and social distancing measures. Little sign of any significant recovery yet
2. Drop in expenditure **driven by high earners**; most of their basket is on non-essentials
3. Basket of low earners mainly made of essentials and thus their smaller pound fall in spending has had a larger effect on their standard of living
4. Spending cuts for high earners used to **increase savings**/repay debt. **Government benefits** played crucial role for low earners whose salary dropped more than their spending
5. Pervasive heterogeneity across sectors and regions

Thank you!

Burgeoning empirical literature



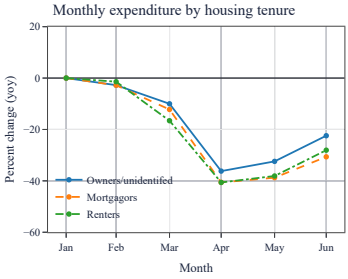


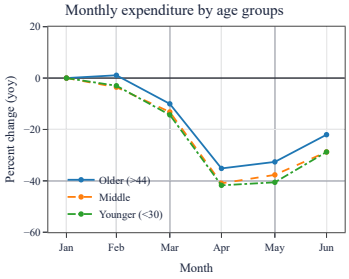
User selection

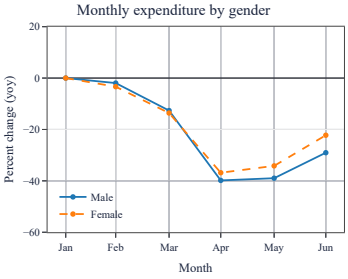
We focus on users that

- have at least one current account
- transact at least 200 pounds in debits and have a minimum of 5 transactions in each month in our sample (Jan 2019 - June 2020)
- have refreshed their account in July 2020
- exclude business accounts
- additional restrictions on tagged total expenditure and income

Spending by housing tenure, age and gender







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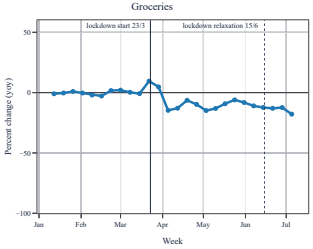
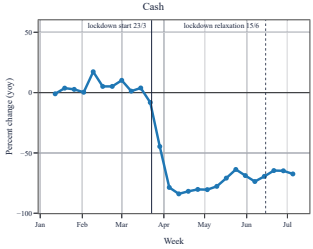
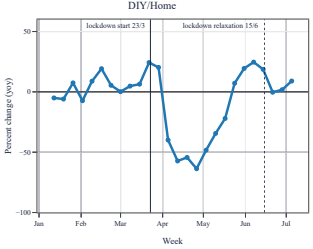
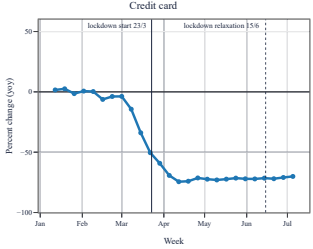
Additional sectors









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Regional variation in spending

Table 4: Regional regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Covid-19 deaths	-0.0728*			-0.0718	-0.0508		-0.0498
	(0.0366)			(0.0372)	(0.0341)		(0.0347)
furloughed workers		0.535		0.506		0.530	0.510
		(0.443)		(0.437)		(0.438)	(0.438)
higher-income users			-0.546***		-0.505***	-0.546***	-0.505***
			(0.135)		(0.134)	(0.136)	(0.134)
Constant	-0.258***	-0.472***	-0.186***	-0.410**	-0.157***	-0.344*	-0.310*
	(0.0315)	(0.136)	(0.0338)	(0.139)	(0.0429)	(0.138)	(0.141)
Observations	108	108	108	108	108	108	108
Adjusted R^2	0.028	0.001	0.104	0.028	0.113	0.105	0.114

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Dependent variable: percentage decline in regional spending over Q2 2020 relative to Q2 2019. Sources: the variable 'Covid-19 deaths' refers to the number of Covid-19 deaths per 1,000 inhabitants and is available from the ONS; 'furloughed workers' stands for the share of furloughed workers as reported by HMRC; 'higher-income users' is the share of users with after tax income above £40,000 in 2019 from the MDB sample. The 107 geographical areas are determined on the basis of the first two digit of MDB users' home post code. We exclude areas for which there are only 15 users or less.

Regional variation in spending

- Substantial regional heterogeneity
- Most affected areas are Greater London and South East, Northern Ireland and Wales are less affected
- **Share of higher-income users** is a significant and robust **predictor** of decline in spending