

Consumer Spending Responses to the Covid-19 Pandemic: An Assessment of Great Britain *⁺

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Abstract

Since the first death in China in early January 2020, the coronavirus (Covid-19) has spread across the globe and dominated the news headlines leading to fundamental changes in the health, social and political landscape, and an unprecedented negative impact on the current and future prospects of households, businesses and the macro-economy. In this paper, we examine consumer spending responses to the onset and spread of Covid-19, and subsequent government imposed lockdown in Great Britain, GB (England, Scotland, Wales). Our sample period spans January 1st 2020 to 7th April 2020. This allows us to observe consumer spending behavior from the initial incubation phase of the crisis. We partition the sample period into *incubation* (1st-17th January), *outbreak* (January 18th-February 21st), *fever* (February 22nd-March 22nd), *lockdown* (March 23rd-May 10th 2020) and *stay alert* (May 11th- June 18th) phases. Using a high frequency transaction level proprietary dataset comprising 101,059 consumers and 23 million transactions made available by a financial technology company, we find that discretionary spending declines during the *fever* period as the government imposed lockdown becomes imminent, and continues to decline throughout the *lockdown* period. Shortly after the May 10th 'stay alert' announcement by Prime Minister Johnson, a short-term decline in spending across all nations occurs. However, a week later, spending is at the same level as that observed prior to the announcement. There is a strong increase in groceries spending consistent with panic buying and stockpiling behaviour in the two weeks following the World Health Organisation (WHO) announcement describing Covid-19 as a pandemic. Variations in the level and composition of consumer spending across nations and regions (particularly during the early stages of the *outbreak* period), and by age, gender and income level are also observed. Our results are of particular relevance to government agencies tasked with the design, execution and monitoring economic impacts arising from the spread of the virus and the public health measures imposed to mitigate the health costs of the crisis.

Keywords: Consumer Spending, Coronavirus, Covid-19, Great Britain, Household Finance, Households, Lockdown, Pandemic, Stay-Alert.

* The analysis presented in this paper is ongoing and subject to regular update See our 6th May commentary entitled 'Real Time Consumer Spending Responses to the COVID-19 Crisis and Government Lockdown' published on VoxEU at: <https://voxeu.org/article/real-time-consumer-spending-responses-lockdown>.

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1. Introduction

This study investigates the impact of the coronavirus (Covid-19) on consumer spending in Great Britain (GB). Since the first death in Wuhan, Hubei, China in early January 2020, the Covid-19 virus has spread across the globe and dominated the news headlines. The outbreak and initial spread of the virus was confined to China, but then spread through Asia, Europe and the rest of the world.¹ On March 11th 2020, the World Health Organization (WHO) declared Covid-19 as a global pandemic. By June 29th 2020, the total number of official cases exceeded 10.2 million and deaths exceeded 502,000.² Beyond the health and social costs, the economic damage to households, firms and the wider economy resulting from the outbreak of Covid-19 are likely to be enormous.

In this paper, we present estimates of consumer spending responses to the onset and spread of Covid-19 in Great Britain, where the first documented cases were reported in the city of York in late January 2020. The virus evolved quickly from a few isolated cases, to incidence across the country, and leading to the UK becoming one of the worst affected countries in the world. By 29th June, the number of official cases in the UK exceeded 313,000 and deaths exceeded

¹ Unchecked the spread of Covid-19 (and indeed any virus) depends crucially on the rate of transmission across individuals, which is driven by the relative levels of: those open to contracting the virus; those currently infected by the virus; and those have contracted the virus and have either recovered or passed away. However, active public health intervention measures (non-pharmaceutical interventions, NPIs) can affect the evolution of the virus, and mitigate the negative impacts of the crisis on public health, public services and the wider economy. The public health interventions used to slow virus transmission vary across countries, and continue to evolve at the time of writing. These responses have ranged from compulsory quarantining of known cases; voluntary quarantining of households (where a member of the household) is exhibiting symptoms; social distancing and shielding of vulnerable individuals and those exceeding 70 years of age; social distancing across all age groups; and the closure of schools, universities and non-essential workplaces (Ferguson, 2020). The effectiveness of such measures in slowing the spread of the virus is still to be determined with any certainty (Agosto et al, 2020; Anderson et al, 2020; Atkinson, 2020; Ferguson, 2020; McKibbin & Fernando, 2020). However, the more extensive the public health intervention measures aimed at slowing the rate of infection are, the less significant the macroeconomic costs are likely to be (Gourinchas, 2020; Greenstone & Nigam, 2020). Koren & Peto (2020) present theory-based measures by industry and location of the extent to which US businesses rely on close human interaction human interaction, and thus which are most likely to be significantly affected by social distancing measures. In a cross-country analysis, Dingel & Neiman (2020) find that lower-income economies have a lower proportion of jobs that can be performed from home. See Cheng et al (2020) and Elgin et al (2020) for a list and an early analysis of cross country economic policy responses. A resource base of international policy response produced by the International Monetary Fund can be found at: <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>.

² Officially recorded Covid-19 global cases are updated daily by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University <https://coronavirus.jhu.edu/map.html>.

43,500.³ As the virus spread, the UK government and devolved administrations introduced successive public health measures aimed at curbing the spread of the virus. This culminated in late March 2020 with: enforced closures of non-essential businesses; prohibition on large gatherings; cancellations of sporting events; extensive restrictions on freedom of movement; social distancing; and isolation of vulnerable individuals. Alongside, these health measures, the UK government introduced an extensive set of fiscal support measures for households and businesses in order to mitigate lost income and ensure stability in employment for millions of workers.⁴ In the medium term this is likely to have significant implications for public sector borrowing and debt (OBR, 2020). On May 10th Prime Minister Johnson announced a relaxation in lockdown measures in England (designed to begin to re-start much of the economic and social activity stalled during the lockdown period), thus shifting from a ‘*stay at home*’ to ‘*stay alert*’ policy stance. This change happened unexpectedly and did not apply to Scotland (Northern Ireland and Wales) where more stringent restrictions remained in place, and did not begin to ease significantly until the end of June 2020.

Observing the impact of Covid-19 and public policy interventions on consumer spending presents significant challenges given that official statistics produced by government agencies come with a lag, and as such do not provide an accurate picture of current spending.⁵ For example, the *Family Spending in the UK Report* for April 2018 – March 2019 produced by the UK Office of National Statistics was published in March 2020.⁶ Fortunately, recent advances in information technology and financial applications that allow consumers to manage money more efficiently have allowed the real time collection of transaction level data via supermarkets, financial institutions and technology platforms. This enables researchers to conduct more granular analysis of patterns in consumer spending and saving as they occur (Gelman et al, 2014; Pistaferri,

³ Year-on-year excess deaths were estimated on 2nd June at 62,000 (see for example: ‘UK excess deaths during pandemic reach 62,000’, Financial Times, June 2nd 2020, <https://www.ft.com/content/3c53ab12-d859-4ceb-b262-f6a0221ca129>). By the 23rd June this figures had increased to 65000.

⁴ These measures included: short-term funding to non-financial firms (Covid Corporate Financing Facility; Coronavirus Business Interruption Loan Scheme); tax deferrals and rates holidays; employer grants (Coronavirus Job Retention Scheme) and the self-employed.

⁵ Coronavirus outbreak will harm UK data collection and statistics, *Financial Times*, 2nd April 2020.

⁶ In March 2020, the UK Office for National Statistics (ONS) commenced collecting new experimental indicators on the UK economy and society. These indicators are constructed from novel data sources (including small scale surveys of approximately 4000 UK businesses and 1500 individuals) and experimental methods (such as scraping on-line prices data from supermarkets and other large shops), and include information regarding Covid-19.

2015; Aladangady et al, 2019; Kolsrud, 2019). Thus improving the accuracy of empirical testing and reducing potential problems inherent in using survey or experimental data (De Nicola & Gine, 2014; Karlan & Zinman, 2008)⁷ as well as providing up to date information to policymakers.

In order to assess the impact of the Covid-19 pandemic on consumer spending, we collect data from Money Dashboard. Money Dashboard is a popular personal finance application, which aggregates all transactions from linked bank accounts and credit or debit cards for users located throughout Great Britain (GB). Our sample contains 23 million transactions carried out by 101,059 individuals over the period January 1st, 2020 to June 18, 2020. This allows us to observe consumer spending responses during the period from the incubation of Covid-19 in the UK. We partition our sample period into five phases or sub-periods, which are labelled *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*. The *incubation* phase covers the period 1st to 17th January. *Outbreak* covers the period January 18th to February 21st. The *Fever* phase spans February 22nd to March 22nd. *Lockdown* covers the period March 23rd to May 10th when Prime Minister Johnson declared that every individual (barring non-essential workers) should stay at home (unless taking necessary exercise or trips to purchase essential food and medical items) and that non-compliance would be subject to police intervention and enforcement. *Stay Alert* covers the period since May 10th when Prime Minister Johnson announced a relaxation in lockdown measures in England (designed to begin to re-start much of the economic and social activity stalled during the lockdown period), thus shifting from a 'stay at home' to 'stay alert' policy stance. This change happened unexpectedly and did not apply to Scotland (and Northern Ireland and Wales). Consequently, there was a sudden and unexpected divergence in public policy between Westminster and other UK nations with potential implications for consumer spending behaviour.

Our analysis proceeds as follows. First, we examine total discretionary spending (defined as the sum of spending in categories such as groceries, dining and drinking, alcohol, gambling, games and gaming, and other related items, which individuals can influence directly) at: GB level; nation level (England, Scotland and Wales); and regional level (East Midlands, East of England, London, North East, North West, Scotland, South East, South West, Wales). Second, we analyse specific spending categories such as groceries spending and going-out (dining and drinking)

⁷ Data is produced by financial service providers such as mint.com (US), Money Dashboard (UK) or Meniga (Iceland). Notable examples of recent papers using this type of data include Baker (2014), Gelman et al. (2014), Kueng (2015), Baker et al (2018), Carlin et al. (2017), Olafsson & Pagel (2018), Gelman et al (2020).

related expenses by nation and region to better understand heterogeneities in consumer spending responses across different locations.

By way of preview, our findings suggest at GB level, discretionary spending remains relatively stable throughout the *incubation*, *outbreak* and most of the *fever* phases of our sample period. As the government imposed lockdown becomes imminent, discretionary spending declines markedly. This decline continues throughout the *lockdown* period. Shortly after the May 10th 'stay alert' announcement by Prime Minister Johnson, a short-term decline in spending across all nations occurs. However, a week later, spending is on the same level as before the announcement. By spending category, there is a strong increase in groceries spending for the two weeks following the announcement of Covid-19 as a pandemic by WHO. This is consistent with panic-buying and stockpiling behaviour reported widely by UK media outlets.⁸ Grocery spending declines considerably at the onset of the *lockdown* period. Spending on dining and drinking increases during the *outbreak* and early weeks of the *fever* period before declining (with the exception of a slight increase around the time of the government lockdown announcement). Moreover, we observe some variation in consumer spending responses across nations. For example, consumers based in Scotland appear to adjust spending more markedly during the early stages of the *outbreak* period. Spending on groceries remains significantly higher throughout the *lockdown* and remains so even after the *stay alert* announcement. These consumers also appear to reduce spending on dining and drinking before counterparts located in England and Wales. Interestingly, the week before *lockdown* shows the lowest values of dining and drinking expenses. Throughout the *lockdown* and *stay alert* period spending remains stable at around £50 in England and around £45 per week in Scotland and Wales. At regional level, we observe stark differences in discretionary spending between the *incubation* and *fever* period, with consumers based in the South East, South West, and especially London reducing discretionary spending faster than counterparts located in other regions. We also observe differences in groceries spending growth with individuals located in Scotland and the East Midlands appearing to spend more between the *incubation* and *fever* period, which could be indicative of early stockpiling. Utilising additional information regarding gender, age and income levels of the individuals in our sample, we find that males spend significantly more than females. Younger individuals spend more than older counterparts. High income individuals spend more than low income counterparts. A key

⁸ See for example: 'Coronavirus: Supermarkets ask shoppers to be 'considerate' and stop stockpiling', BBC News, 15th March 2020, <https://www.bbc.co.uk/news/business-51883440>; 'Supermarkets take measures to control panic buying', Financial Times, 18th March 2020, <https://www.ft.com/content/737a9a24-68ea-11ea-a3c9-1fe6fedcca75>; and 'How panic buying is affecting supermarkets', Economist, 21st March 2020, <https://www.economist.com/britain/2020/03/21/how-panic-buying-is-affecting-supermarkets>.

difference when considering spending reactions is the observation that older individuals appear to keep increasing dining and drinking expenditure until week nine of our sample period, while younger individuals exhibit declines in this form of spending in week seven. Females increase spending on dining and drinking related items up to week nine, while males show little increase during the first weeks of the *fever* period.

Overall, our results suggest that consumer spending has declined since the onset of the Covid-19 outbreak. As such our results offer real-time insights on consumer responses to the onset and spread of Covid-19, and on the impacts of the compulsory *Lockdown* policy introduced by the UK government in late March 2020 (which imposed significant restrictions on the movement and activities of individuals) and later *Stay Alert* policy introduced in mid May 2020 (which commenced a partial relaxation of the mobility and activity restrictions introduced at the time of *Lockdown*). Consequently, we augment and complement recent studies utilising official UK government data, where estimates suggest that the outbreak and spread of Covid-19 is having significant (albeit uneven) economic and social impacts on UK households, businesses and the wider economy (ONS, 2020a, 2020b; OBR, 2020).

Our study contributes to the general literature on consumer spending. This literature suggests that consumers respond to negative shocks by reducing spending. Prior evidence suggest that such declines occur due to the onset of increased uncertainty, financial constraints or declining expectations regarding future income prospects (Baker & Yannelis, 2017; Baker, 2018; Gelman et al., 2020; Garmaise et al., 2020). The structure of our dataset and our study is closest in spirit to several recent studies (reviewed in further detail in section 2 below) that take advantage of large transaction level datasets to examine the impacts of Covid 19 on consumer spending behaviour. These include: Andersen et al (2020a) who find significant declines in Danish consumer spending that varies across product categories and correlates with government imposed restrictions on consumer mobility; and Baker et al (2020a) who find that significant changes in US consumer spending across a broad range of product categories, which differs by age, gender and family structure. In contrast to the dataset used in the present study and (by Andersen et al, 2020a; Baker et al, 2020b), Chen et al (2020), Carvalho, Garcia et al (2020) and Carvalho (2020) rely on merchants' transactions and do not have access to the detailed demographic information on individuals executing transactions. Using these datasets, Chen et al (2020), Carvalho, Garcia et al (2020) and Carvalho et al (2020) find significant changes in Chinese, Spanish and Portuguese consumer spending following a government imposed lockdown limiting individual movement.

The results of our study are broadly in line with the aforementioned studies and suggest that the onset and spread of Covid-19 led to overall declines in consumer spending, but this masks differences across product category. Spending declines across many product categories is undoubtedly impacted by impending and actual restrictions on consumer mobility. Dining and drinking being very notable examples. However, in other product categories such as groceries spending we observe very strong increases in spending as the incidence of Covid-19 cases increases and a government imposed lockdown becomes imminent. By utilising our granular regional data, we also find that strong differences seem to appear between rural and urban areas within GB. Our data covering London suggests that in some categories individuals were quick to change their spending patterns.

We also contribute to the established literature on the economic impacts of pandemics as well as the emergent literature on the economic impacts of Covid-19. This rapidly growing literature (which is reviewed in Section 2) suggests that epidemics impose substantial costs to the real economy, which vary substantially across households, firms, industries and countries. The results produced in this study suggest that Covid-19 has negatively impacted average consumer spending. However, this decline masks variations across product categories, as well as the location, gender, age and income levels of consumers.

The rest of the paper is structured as follows. Section 2 provide a review of relevant literature which explores the impact of pandemics (with a specific focus on Covid-19) on stock markets, businesses, households as well as the wider macro-economy. In section 3 we discuss our sample period (and constituent sub-periods or phases) and data sources. We also present summary information on consumer spending by month and by demographic (income, age, gender) attributes. We also present the results of a descriptive empirical analysis of discretionary consumer spending at aggregate and product level at GB, nation and regional level as well as by gender, income and age. Section 4 provides concluding remarks where we provide a summary of key findings, caveats regarding the composition of the dataset and avenues where further research is urgently required.

2. Literature

In this section we provide a brief overview of literature regarding the impact of epidemics on economics outcomes. We also provide a selective review of recent studies that provide useful evidence regarding the initial impacts of the Covid-19 pandemic on businesses, stock markets, households and the macroeconomy.

Prior Epidemics

Prior literature suggests that epidemics such as the Spanish Flu (Almond, 2006; Garret, 2008; Karlsson et al., 2014; Guimbeau et al, 2020), avian influenza (Bruns et al, 2006), SARS (Chou et al, 2004; Hiu et al, 2004; Lee & McKibbin, 2005; Liu et al, 2005; Brahmabhatt & Dutta, 2008; Keogh-Brown et al, 2008), swine flu (Rassy & Smith, 2013) and Ebola (Kostova et al, 2004) impose substantial costs on the real economy.⁹ The extent of these costs varies considerably, and depends upon the extent and timing of public health interventions (Meltzer et al., 1999; Brainerd & Siegler, 2003; Bootsma, & Ferguson 2007; Karlsson et al., 2014; Correia et al., 2020).¹⁰

Macroeconomic Evidence

Early evidence suggests that Covid-19 is likely to transfer significant costs to the global economy due to disruptions to global supply chains, and temporary and permanent closures of businesses with resultant negative consequences for output and employment (Fornaro & Wolfe, 2020; OECD, 2020).¹¹ The overall negative impact on the economy is likely to depend on the extent of government investments in healthcare, particularly in less developed countries (McKibbin & Fernando, 2020a, 2020b). Barro et al (2020) utilise data from the Spanish Flu pandemic to estimate the potential impacts of the Covid-19 virus on economic activity. Based upon the two percent death rate observed during the Spanish Flu pandemic, the authors suggest that this would equate to 150 million deaths arising from Covid-19. If realised, such a death rate would result in global GDP and consumption declines of six and eight percent respectively. Fernandes (2020) contends the economic structure and industry composition will lead to a differential impact across countries, with more service-oriented economies likely to be most affected. Stock market volatility, newspaper-based coverage of economic uncertainty, and subjective uncertainty in business expectation surveys have all increased markedly following the onset of Covid-19 (Baker et al., 2020b; Leduc & Liu, 2020). Using these aforementioned measures of uncertainty, Baker et al (2020b) estimate the likely impact of Covid-19 on the macro-economy. The authors estimate a decline in real US GDP of approximately 11 percent by the final quarter of 2020.

⁹ Jorda et al (2020) provide a useful discussion of the long-run economic consequences of pandemics from the Black Death of 1347 to the present day.

¹⁰ Bloom & Canning (2006, 2014), Bloom et al (2018) and Fan et al (2017, 2018) provide useful overviews of the links between population health and economic outcomes.

¹¹ Baldwin & Weder di Mauro (2020a, 2020b) and Baldwin & Evenett (2020) provide a collection of essay from leading economists regarding the likely impacts of Covid-19 on trade, finance, travel and monetary policy among others.

Impact on Businesses

Recent surveys suggest that business uncertainty has increased dramatically since the onset and spread of Covid-19 (Altig et al, 2020). Hassan et al (2020) develop text-based measures of the costs, benefits, and risks to listed firms in over 80 countries affected by Covid-19. The authors find that as Covid-19 spreads across countries during the first quarter of 2020, firms expressed significant concerns regarding a collapse in demand, heightened uncertainty and disruptions to supply chains and detriment to employee welfare. Firms operating in locations impacted previously by SARS or H1N1 (swine flu) expressed greater confidence in their likely ability to absorb the negative impacts of Covid-19. De Vito and Gomez (2020) investigate via a series of scenarios, the likely impact of Covid-19 on the liquidity of listed firms across 26 countries. The authors assess the extent to which firms' liquidity can withstand a decline in sales of 25%, 50% and 75%. They find that in the most extreme case (where sales decline by 75%), the average firm would exhaust liquidity in approximately 12 months - with around a third of firms becoming illiquid in less than six months.¹² Bartik et al (2020) in a survey of 5800 US small and medium sized enterprises (SMEs) find that 43 percent were temporarily closed with a resultant decline in employment of 40 percent. Campello et al (2020) find that Covid-19 had a negative and varied impact on new hiring across firms, industries and locations. Reductions were most pronounced for: high skilled jobs; unionized and service sectors; and areas where low-incomes and income inequality were more prevalent. Bloom et al (2020) contend that Covid-19 will cause many industries to shrink as businesses cease trading. The authors also point out that Covid-19 will also lead to an intra- and inter-industry re-allocation of demand and employment. Landier and Thesmar (2020) find that earnings analysts expect the Covid-19 virus outbreak to have a significant and long-lasting impact on firm earnings.

In the UK, an ONS survey of businesses suggests that 24% had temporarily ceased trading (for the period 6 to 19 April 2020). Of businesses continuing to trade, 24% of all businesses continuing to trade reported that turnover had decreased by more than 50%, while 30% reported that their financial performance had been unaffected (ONS, 2020a). A study by the British Chamber of Commerce (2020) suggests that 66% of firms have furloughed staff. Prasher et al (2020) compare business incorporations and dissolutions in the early part of 2020, with the same period in 2019, in order to provide initial insights as to the possible impacts of Covid-19. The authors find a 70% increase in the dissolutions in March 2020 relative to March 2019. Younger

¹² Li et al (2020) note that upon the onset of COVID-19, liquidity pressures led US firms to drawdown pre-existing credit lines and loan commitments on an unprecedented scale.

businesses as well as businesses in the wholesale and retail, professional services, transport and construction are particularly affected. Joyce and Xu (2020) find that the impact of lockdown measures and enforced closures of non-essential business are likely to disproportionately affect employees under 25; low earners; and women.¹³ Lenoël & Young (2020) find that public policy interventions to limit the spread of Covid-19 are causing a severe contraction in the UK economy, with forecasts suggesting a GDP decline of seven per cent in 2020. Ogden and Phillips (2020) note that demographic and structural differences within the UK make some geographic areas more vulnerable than other to the economic, health and social impacts of the Covid-19 crisis.

Stock market Responses

Stock markets have responded to the spread of Covid-19 as investors have adjusted expectations regarding future corporate earnings. Baker et al (2020c) note that news coverage of Covid-19 is the most significant driver of large daily US stock market movements since the end of February 2020. Ramelli & Wagner (2020a, 2020b) assess stock market reactions to Covid-19. The authors partition their sample period into *incubation* (1st-17th January), *outbreak* (20th January - February 21st), and *fever* (February 24th - March 20th) sub-periods. They find that the overall stock price reaction varies by the extent of international trade exposure; firms with global value chains experiencing larger declines in value. Firms with high levels of debt also experience marked declines in value. Industry factors also played an important role, with firms located in telecommunications and food retailing experiencing increases in value for much of the sample period. However, the authors note that during the *fever* period most stocks decline as investors anticipated an economic recession. For the US, Albuquerque et al (2020) compare the returns of firms with higher environmental and social (ES) ratings compared to other firms. The authors show that the stocks of firms with higher ES ratings have significantly higher returns, lower return volatilities and higher trading volumes than stocks of firms with lower ES ratings. Gormsen & Koijen (2020) examine aggregate movements in the US S&P500 and the EU Euro Stoxx 50 index since the outbreak of Covid-19. The authors find that stock markets declined sharply as the virus spread to Italy, South Korea, and Iran around February 20th, and later in March upon announcements of travels restrictions by the US and successive EU member states. Alfaro et al (2020) find that day-to-day changes in forecasts of infectious disease during the SARS epidemic (in Hong Kong) and the Covid-19 pandemic (in the US) lead to significant changes in aggregate

¹³ Similarly, for the US, Alon et al (2020) suggest that employment losses arising from social distancing interventions has a larger impact on sectors with higher female employment shares.

stock returns. For the UK covering the period 2nd January to 20th March, Griffith et al (2020) examine changes in share prices of listed firms (relative to the FTSE All-Share index). They find that firms located in tourism and leisure, fossil fuels production and distribution, insurance, non-food and non-drug retailers and several large manufacturing industries saw the largest declines in value, while food and drug manufacturers, food retailers, utilities, high tech manufacturing and tobacco firms outperformed the market. Ding et al (2020) use a large cross-country, cross-industry dataset to investigate the relationship between corporate balance sheet characteristics and stock prices following the spread of Covid-19 cases. The authors find that while the spread of Covid-19 resulted in an overall decline in stock prices, the decline was less severe for firms with: stronger balance sheets; less globalised supply chains and international trade; and more CSR engagement in the pre-crisis period. Fahlenbrach et al (2020) stock price and credit risk reactions to Covid-19. The authors find that firms with less cash and more short and long-term debt perform experience larger stock price declines and large increases in credit default swap premiums. Finally, Capelle-Blancard and Desroziers (2020) provide an extensive international assessment of stock market reactions to the Covid-19 crisis. Using stock market data covering the period January to April 2020 for a sample of 74 countries (to trace investor reactions to the onset and evolution of the Covid-19 crisis) - the authors find that investor reactions to the onset of Covid-19 were initially subdued before reacting negatively as the virus spread. These negative responses were relatively short lived before prices recovered.

Impacts on Households

Evidence of household level responses to the onset of Covid-19 is emerging. Much of the evidence presented to date relies upon online surveys of consumer expectations. However, a number of important studies have emerged where researchers have used transaction level datasets made available by commercial banks, credit card companies and FinTech platforms to examine consumer spending behaviour in real time.

China

Chen, He et al (2020) assess the impact of the Wuhan, Hubei lockdown on the monthly sales of various products for sale on a major online platform in China. The authors find a significant decline in the sales of digital and electronic goods, and a significant increase in sales of groceries. Chen et al (2020) use daily transaction data in 214 cities over a 12 week period to study the impact of Covid-19 on consumption after China's outbreak in late January 2020. The authors utilise consumer spending transaction level data at offline merchants using bank cards and QR codes (captured by a large payment provider Point of Sale machines and QR scanners) to find that consumption declined by an average of 32% across Chinese cities. Spatial variation is

observed with heavily exposed cities such as Wuhan experiencing more significant declines (70%) in consumer spending.

United States

Dietrich et al (2020) assess the response of household expectations to the Covid-19 outbreak using an online survey of US consumers. From a sample of 1,600 responses, the authors find that consumers expect GDP to decline by six percent over a 12-month period and two per cent over 36 months. Binder (2020) conducts an online survey on US consumers on 5th and 6th March 2020, to solicit information regarding concerns and responses to the Covid-19 virus. The results of the survey suggest that consumers are *somewhat* or *very concerned* regarding the effects of coronavirus on their financial and personal well-being as well as the wider economy. Of the consumers surveyed, 28% postponed travel, while 40% had purchased additional food supplies. Armantier et al (2020a, b) utilise the March and April 2020 *Survey of Consumer Expectations (SCE)* to find that between February and April 2020, the median expected year-ahead forecast of growth in income and spending declined dramatically across all genders, age groups, income level, race, and education level. Using US survey data collected on March 24th 2020, Adams-Prassl et al (2020a) find that 65% of workers engaged in less paid work, and expected to earn 39% less in the next four months. 11% of workers had lost employment, with a 40% chance of job loss within the next four months for those remaining employed. 56% of those surveyed reported likely problems in facing future bills. Variations are observed across both the age and income distribution with younger and lower income individuals most affected. Baker et al (2020a) use transaction-level household financial data from a personal financial website to examine US consumer spending responses to the onset of the Covid-19. The authors observe a substantial increase in consumer spending (transactions increasing by 15%; average transaction value by 50%) as the rate of increases in Covid-19 cases increases, followed by a significant decline in general spending. Spending on grocery items remains at a higher level over a longer time period before declining. The authors also observe heterogeneity in spending responses across states (depending on the severity of the virus outbreak) the age distribution and structure of the family unit. Building upon this Baker et al (2020d) investigate consumer spending responses to US government direct cash payments to households which form part of the fiscal stimulus measures set out in the 2020 CARES Act. They find that households respond to the receipt of direct payments; those on lower incomes and experiencing larger income declines responding most strongly. Consumers with higher bank account balances do not appear to adjust consumption following the receipt of a direct payment. Coibion et al (2020) investigate how the varied timing of local lockdowns affects households' spending using several waves of a survey exceeding 10,000 respondents. The authors find significant declines in aggregate consumer spending. Very large

declines are observed in travel and clothing sectors. They also observe that households under lockdown spend less than other households due to mobility restrictions and expectations regarding future economic conditions. Finally, Chetty et al (2020) examine weekly consumer spending disaggregated by geographic area, industry, and income group. The authors find that following the spread of Covid-19, high-income individuals reduced spending. These declines were particularly marked in geographic areas with high numbers of reported Covid-19 cases and in industry sectors where physical proximity is required. The authors also find a positive impact of government stimulus payments on consumer spending of low-income households.

Denmark

For Denmark, Andersen et al (2020a) use transaction-level bank account data from a large Danish bank to find a decline in spending following the onset of the Covid-19 virus, which varies across expenditure categories and correlates with government restrictions. Specifically, the authors find that that aggregate card spending declined by approximately 25% following the government shutdown. Moreover, the observed decline in spending is more concentrated on product categories where trading is restricted under the terms of the government shutdown. Andersen et al (2020b) utilise transaction-level bank account data from a large Scandinavian bank to study the effect of government social distancing laws on consumer spending. In order to disentangle the possible effects on consumer spending due to fears regarding the virus from the impact of the lockdown measures, the authors design a quasi-natural experiment. Specifically, they compare consumer spending patterns in Denmark where the government mandated social distancing (in order to reduce the spread of Covid-19) and Sweden where a lockdown was not imposed. The authors find that at the time of the lockdown announcement in Denmark, there is a large decline in consumer spending across both countries. The overall decline in consumer spending comprised a common 25 percent to both countries, and an additional decline of 4 percentage points in Denmark. The observed declines were most significant across younger consumers (below 29 years of age). The authors conclude that the most significant declines in consumer spending arise not from government imposed interventions, but rather the virus spread impacting consumer choices on discretionary spending.

France

For France, Bounie et al (2020) utilise data on five billion payment card transactions from 70 million cards issued by all banks in France. The sample period is split into two sub-periods covering the time before and during the containment measures imposed by the French government. The authors find that consumers used their cards in less locations and across a small number of retailers following the imposition of containment. Both off- and on-line consumer spending declined, with the former experiencing twice the decline of the latter.

Portugal

For Portugal, Carvalho, Gaercia et al (2020) use a large point of sale terminal and on-line payments dataset, in order to investigate the impact of a government imposed lockdown on consumer purchases. Using a difference-in-differences event study approach (which compares purchases from January to April 2020 with purchases for the same period of 2018 and 2019), the authors observe a significant overall decline in spending. However, changes in the patterns of purchases varies across product types with groceries spending increasing, while spending on products and services most affected by the lockdown (leisure, bars, restaurants) declined.

Spain

For Spain, Carvalho et al (2020) utilise a large high-frequency transaction data from a large commercial bank to investigate consumer expenditure during the Covid-19 pandemic. The authors find no significant change in consumer spending patterns prior to the lockdown measures. However, following the lockdown, large overall spending declines are observed, albeit significant variation exists across product categories with expenditures on drinking and dining, clothing and personal services exhibiting large declines, while food expenditure increased.

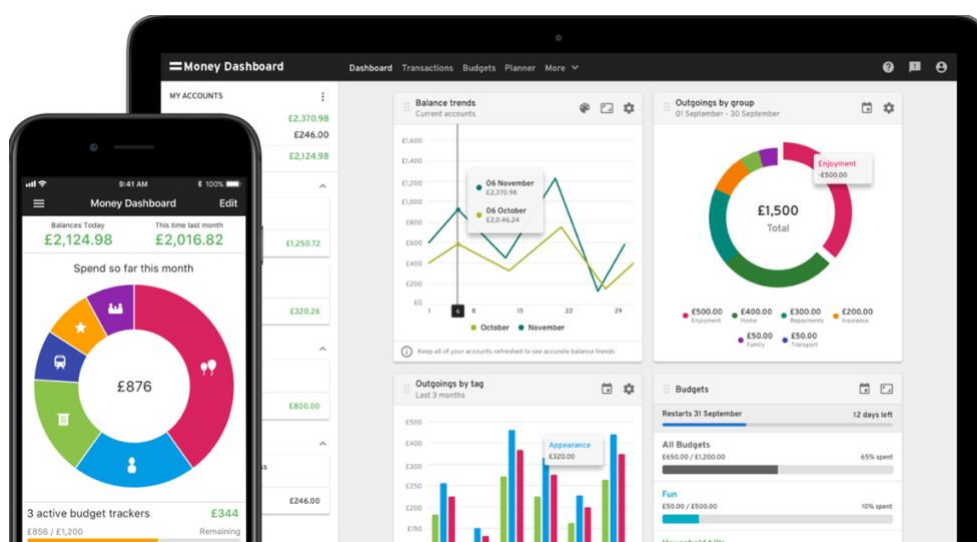
United Kingdom

For the UK, Crawford et al (2020) use the *ONS Living Costs and Food Survey, 2017* in order to predict which types of spending are likely to be most affected by the spread of Covid-19 and social distancing measures. The authors assert lower-income households find it more difficult to absorb income shocks and adjust relative to higher-income counterparts, given that these households spend a greater proportion of their income on essential items. Spending in higher income households are likely to decline more for areas (such as restaurant dining and drinking) prohibited or discouraged as a consequence of public health interventions. An ONS survey of UK households suggests that the well-being (82%) and household finances (22.9%) was negatively affected by the Covid-19 virus (ONS, 2020b). Using UK survey data collected on March 25th 2020, Adams-Prassl et al (2020b) find that 57% of workers engaged in less paid work, and expected to earn 35% less in the next four months. 8% of workers had lost employment, with a 33% chance of job loss within the next four months for those remaining employed. 49% of those surveyed reported likely problems in facing future bills. Variations are observed across both the age and income distribution with younger and lower income individuals most affected. In the remainder of this paper, we augment substantially these insights to produce the most granular and comprehensive assessment of consumer spending responses over the duration of the Covid-19 crisis and public policy interventions to date.

3. Data & Results

The empirical analysis in the present study is based on data provided by Money Dashboard, a popular personal financial technology company founded in 2010 and based in Edinburgh. Money Dashboard's application aggregates all transactions from linked bank accounts and credit or debit cards to provide users with a detailed view of how, when and where money is being spent. The service is aimed at individuals who have more than one bank account or several different credit cards. Once users sign up, Money Dashboard collects all available information from an individuals' online account. In the next step, Money Dashboard uses a machine learning algorithm to identify the type of transaction and automatically assigns each transaction to one of 270 expense and income tags. All data is anonymised prior to sharing with the authors of this study. A timestamp of the transaction and a merchant tag are also included. The user interface for the mobile and web based versions of the application are shown in Figure 1.

Figure 1: Money Dashboard Interface



Note: This figure illustrates the iOS and web interface of Money Dashboard. The example for the mobile phone interface shows the current balance across accounts and a chart summarising expenditures per category and the current status of three active budgets.

We focus our analysis on consumer spending behaviour from January 1st to April 7th 2020. We separate our analysis into five sub-periods comprising: *incubation* (1st-17th January), *outbreak* (20th January-February 21st), *fever* (February 24th-March 22nd), *lockdown* (March 23rd to 7th April) and *stay alert* (May 11th- June 18th). In total, there are 101,059 individual users in our sample, which can be matched to postcode level. For 98,939 of these information regarding age is available. For our analysis, we use those users where location can be identified. We are also able to identify, the income of a large number of users (45,858). Panel A, Table 1 provides

summary statistics. Panels B to D present summary statistics for spending categories including discretionary, groceries and dining and drinking for each full month covered in our analysis.

Moreover, we also separate our analyses into nine distinct regions as defined by the UK Office for National Statistics. This serves the purpose of shedding light on possible heterogeneous responses to the pandemic in terms of spending patterns across different regions of GB. Table 2 reports the regional distribution of the consumers in our sample.

Table 1: Summary Statistics

	mean	median	sd	N
<i>Panel A: Demographics</i>				
Income	3149.55	2339	2941.79	45,858
Age	37.33	35	11.033	98,939
Male	.6037	1	.4891	103,856
<i>Panel B: Monthly Sums January</i>				
Total Discretionary	867.58	594.37	1035.55	96,467
Cash	280.99	100	606.41	57,083
Dining & Drinking	129.55	81.96	150.78	79,439
Home Improvement	157.28	46.65	344.75	43,897
Fuel	105.80	79.11	94.47	51,122
Gambling	71.76	20	252.61	19,221
Groceries	267.94	186.69	261.27	83,711
<i>Panel C: Monthly Sums February</i>				
Total Discretionary	792.15	515.77	1037.92	87,662
Cash	271.32	100	632.44	49,049
Dining & Drinking	134.67	81.69	161.40	69,943
Home Improvement	154.56	43.50	346.09	34,950
Fuel	102.09	73.89	92.15	43,032
Gambling	70.87	20	258.31	15,784
Groceries	253.30	167.30	259.78	74,519
<i>Panel D: Monthly Sums March</i>				
Total Discretionary	626.41	360.84	840.49	73,510
Cash	213.15	82	444.50	33,786
Dining & Drinking	85.986	50.57	107.08	54,815
Home Improvement	147.73	45.89	308.61	25,839
Fuel	79.179	58.46	72.17	31,509
Gambling	74.070	20	287.91	11,344
Groceries	240.42	134.66	285.13	61,485
<i>Panel E: Monthly Sums April</i>				
Total Discretionary	620.76	395.94	750.31	41,186
Cash	243.74	70	600.47	7,323
Dining & Drinking	72.062	43	87.15	16,089
Home Improvement	163.85	64.04	296.14	11,884
Fuel	57.72	40.01	61.96	9,707
Gambling	52.09	20	188.02	8,436
Groceries	325.12	229.91	313.70	29,473
<i>Panel F: Monthly Sums May</i>				
Total Discretionary	638.36	411.425	754.03	36,554
Cash	237.76	80	502.52	8,694
Dining & Drinking	75.849	43.975	97.04	16,828
Home Improvement	161.81	66.65	277.12	12,281
Fuel	59.38	43.2	58.25	10,711
Gambling	60.08	20	238.13	7,197
Groceries	321.41	223.935	314.88	26,216

Note: This table provides summary statistics for a sample of 103,856 consumers. Panel A of the table summarises key demographic indicators for the 2020 sample and income levels (winsorised at the 1% of the distribution). Panel B to F provide the monthly sums by spending category in the months covering *incubation, outbreak, fever, lockdown* and *stay alert*. The complete data for June 2020 was not available at the time of writing and is therefore excluded in this version.

Table 2: Regional Sample Distribution

Region	Frequency	Percentage (%)	Cum. (%)
East Midlands	5,742	5.68	5.68
East of England	9,194	9.10	14.78
London	25,189	24.93	39.70
North East	2,497	2.47	42.18
North West	8,775	8.68	50.86
Scotland	8,233	8.15	59.01
South East	17,178	17.00	76.00
South West	8,874	8.78	84.78
Wales	3,099	3.07	87.85
West Midlands	6,225	6.16	94.01
Yorkshire and The Humber	6,053	5.99	100.00

Note: This table presents the number of users included in our sample distributed across Scotland, Wales and different regions of England as defined by the Office for National Statistics.

Discretionary spending

Figure 2 shows the evolution of total discretionary spending (measured as the sum of spending in a wide range of categories including groceries, dining and drinking, clothing, games and gambling, entertainment and other related items); groceries spending; and spending on dining and drinking at GB level over the sample period, which is partitioned into *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert* sub-periods. Figure 3, Figures 4a – 4c and Figures 5a-5c present this information at a disaggregated national level, demographic and regional level respectively. While the general trends are similar between the GB and the individual nations, some differences occur at key points during the sample period, especially at the regional level. The following sections summarise the key trends in the total discretionary, groceries and dining and drinking spending categories at GB, individual nation and regional level.

Panel A of Figure 2 suggests that at GB level, discretionary spending is largely flat throughout the first three (*incubation*, *outbreak*, *fever*) phases of the pandemic. The first significant change in overall discretionary spending occurs around week nine of the sample period. Here, a trend-change occurs, with average discretionary spending declining by 10.4% on a week-to-week basis (from an average of £307 to £275). This downward trend continues with declines of similar magnitudes throughout the remainder of the *fever* phase. The largest decline occurs during the first weeks of the *lockdown* phase. In the first week after *lockdown*, discretionary spending is at an all-year low average spend of £258 (a decline of 11% compared to spending in the *incubation* period) before declining further to an average spend of £251 per

week in week 15. Shortly after the 'stay alert' message, average discretionary spending increases again with a high of £290 in week 18 which is nearly on the same level as pre-lockdown spending.

Discretionary spending differs significantly between demographic groups. Figure 4a illustrates differences in discretionary spending between males and females by applying a median split analysis for age (35), and monthly net income (£2,333). We find that females spend less than males in all phases. The average gap in weekly spending between males and females during the *incubation* and *outbreak* period is around £50. This spending gap decreases after female users start spending slightly more after week 9. One week before *lockdown*, spending differs by around £30. The spending gap is insignificant during *lockdown*. The spending gap is larger across younger and older individuals, ranging between £120 and £130 until the commencement of *lockdown*, after which the gap closes. In terms of changes in spending patterns, we observe very similar increases and decreases in weekly spending for both age groups. We also find very similar results, when assessing differences across income groups. The gap between age and income remains on a similar level in the *stay alert* phase. However, it appears that male and female individuals reacted differently to the announcement. While we find nearly identical levels of discretionary spending in week 18, it appears that female users reduce their spending after the announcement whereas male individuals keep spending on similarly high levels.

There are some apparent differences in the way individuals located in England, Scotland and Wales react to the Covid-19 crisis. Panel A of Figure 3 suggests that while individuals from England and Wales exhibit relatively stable spending patterns throughout the first nine weeks of the crisis, Scottish consumers appear to react more dramatically to the announcements of the first Covid-19 cases in the UK. We observe a strong significant increase in the first two weeks of the outbreak period. In week five, individuals located in Scotland spent around 10% (£323 versus £291) more than English, and 18.9% more than Welsh (GBP 262) counterparts. However, after this week, spending in Scotland is at a similar level to the other two nations. Finally, while we see a disparity in the level of spending in the early weeks between Scotland and England on the one hand and Wales on the other hand, this difference disappears during lockdown where spending on discretionary spending is almost identical across the three nations. In terms of discretionary spending behaviour after the 'stay alert' message, we find that English residents seem to keep spending on similar levels while Scottish individuals marginally reduce their spending. Welsh individuals reduced their spending for two weeks but returned to high levels around week 22.

While the discretionary spending patterns are relatively similar at national level, larger differences occur at the regional level. Figure 5a summarises change in average weekly spending across regions between the different phases of the Covid-19 pandemic. Changes from the *incubation* to the *outbreak* phase are largely similar for all regions. All regions experience single-digit growth in discretionary spending, albeit this growth is at low levels in the South East England, South West England and Wales (of between 2% and 3%). However, when comparing the figures for changes between the *incubation* and *fever* period, stark differences occur. It appears that the South East, South West, and especially London react more quickly in terms of discretionary spending reductions than other regions (with between 2.5% and 3.2% declines in spending). Increases in discretionary spending during this phase of the pandemic are observed for East-Midlands (plus 0.8%) and Scotland (plus 1.3%) only. Figure 6 further details the differences in spending between the lockdown and stay alert phases (Panel: (a) total discretionary spending; (b) groceries; (c) dining & drinking). The results suggest, that total discretionary spending (panel (a)) increases in nearly all regions. This is also true for Scotland, which should not be affected by the stay alert announcement, which only applied to England. Nevertheless, spending on discretionary items increased by around 2.3% after this announcement.

These recorded differences in the week-to-week spending appear to be driven by changes in groceries and dining and drinking spending. While we observe very strong increases in spending on grocery items, a strong decline in spending on dining and drinking and other discretionary items occurs. We explore these patterns in further detail below.

Groceries spending

According to Panel B of Figure 2, with the exception of seasonal spending in the first week of January, groceries spending remains relatively flat throughout the *incubation* period, and continues in this manner until the last week of the *outbreak* period. This is followed by elevated spending in the first part of the *fever* period. There is a strong increase in groceries spending for the two weeks following the WHO announcement on March 11, 2020, which designated Covid-19 as a pandemic. This is consistent with panic buying behaviour and stockpiling behaviour, which was widely reported by UK news media outlets. However, groceries spending declines considerably as the UK enters the *lockdown* phase, albeit this effect is only short lived. One week after *lockdown* total grocery spending increases again to around £30 more per week than in the *incubation* period. Only in the *stay alert* period grocery spending decreases slightly towards £123 per week.

As with discretionary spending, differences between the three nations in terms of groceries spending is also apparent. The results in Panel B of Figure 3 indicate that individuals in Scotland began to stockpile on grocery items much earlier than individuals located in Wales and England. Specifically, we can see that spending on groceries accelerates by 13.23% during the outbreak phase (from an average of £98.95 in week three to £112.05 in week seven). Individuals based in Scotland continue spending more on groceries than counterparts located elsewhere in GB until week 12, at which point individuals located in England exhibit the same average weekly spending patterns. This points to a stark increase in spending by individuals located in England in the two weeks prior to the announcement of a lockdown by the UK government. During this time, individuals located in England increased average weekly grocery spending by 18.5% (relative to spending in week three). Shortly after the announcement of the lockdown, groceries spending declines significantly to a level lower than that observed prior to the onset of the crisis. As in the case of discretionary spending, grocery spending shows considerable convergence across the three nations during the *lockdown* period.

In a similar manner to the analysis of overall discretionary spending, Figure 4b presents the differences in grocery spending by demographic indicators. As before, we see a trend of absolute differences in spending with male, older and wealthier individuals spending more than female, younger and lower income individuals.

Figure 5b summarises the results for changes in grocery spending at the regional level. As indicated previously, most regions show strong increase in week-to-week grocery spending between the *incubation* and *outbreak* period. In particular, the spending growth in grocery shopping of individuals located in Scotland (plus 4.8%) and the East Midlands (plus 5%) is indicative of early stockpiling. The effect becomes even stronger when comparing *incubation* to the *fever* period. In this case, individuals located in Scottish increased spending on groceries by more than 7%, which is nearly twice the increase observed for individuals located in other regions of GB. Individuals located in London and the North East only marginally increased spending between the *incubation* and *fever* periods. The figures comparing spending in the *incubation* to *lockdown* period suggest a rather strong divide between regions such as London (minus 5.2%) or the North West (minus 5.1%) and Wales (plus 4%) or the West Midlands (plus 6%). However Figure 6 panel (b) shows that the *stay alert* announcement reduces groceries spending. Only the North East exhibits an increases in grocery spending when comparing spending between the *lockdown* and *stay alert* periods.

Dining and Drinking

Similar to the patterns observed for overall discretionary and groceries spending, Panel C of Figure 2 shows a steady increase in spending on dining and drinking related items in the first eight weeks of the crisis. We observe an increase of more than 11% in spending between the first week and up to two weeks into the *fever* period. However, shortly after week 13, spending on these items declines by 47.1% within four weeks. Contrary to the advice of UK government and counterparts in devolved administrations to refrain from going out for non-essential activities, it appears that individuals actually spend slightly more around the time of the lockdown announcement than they did in the days leading up to it. It appears that there is a marginal increase in related spending during the five weeks of lockdown (from £48 to £49.70). The change of policy towards a *stay alert* approach does not seem to influence the overall spending within Great Britain. However, further analysis shows heterogeneity between the nations.

Three interesting patterns emerge when analysing the spending trends between the individual nations in Panel C of Figure 3. First, it appears that while all nations show an increasing trend in dining and drinking spending, Scottish individuals appear to reduce spending in this category in week nine, one week earlier than counterparts located in England and Wales. Secondly, the relative change in spending between the beginning and end of the *fever* period is very similar between the nations. England experiences a 42% reduction, Scotland a reduction of 45.2% and Wales of 46%. Thirdly, it appears that especially dining and drinking expenses seem to rise in Scotland after the 'stay alert' message. Hence, even though the stay alert announcement was only directed at English residents, the consumer spending behaviour of Scottish residents changed as well.

Another pattern appears when considering the differences in spending for dining and drinking in different age groups. We find that younger individuals start to spend less on dining and drinking than older users. Specifically, young individuals (below 35 years of age) exhibit their highest spending in week six of the sample period, while the upper age group continues to increase spending until week eight. This appears to suggest that younger individuals were quicker to react to news and public health announcements to avoid non-essential journeys and public gatherings. However, as before the gap between absolute spending figures diminishes over time, with older users exhibiting a significant change in spending in week nine.

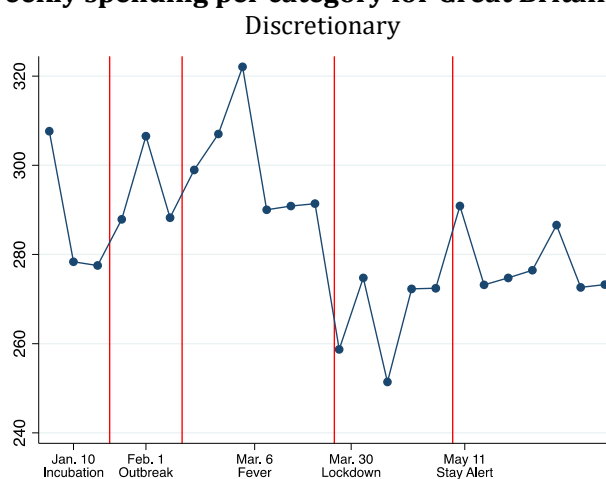
Figure 5c provides additional insights for dining and drinking spending patterns across the regions. Unsurprisingly, this category shows the strongest differences between the different phases. As before, we observe a strong increase in spending between the *incubation* and *outbreak*

phase of around 9% to 12%. Only the North East exhibits slower growth of around 5% during this period. Larger differences are observable when comparing the *incubation* and *fever* phases. As in the groceries category, we see that especially London and the North East show slower growth rates (around 0.7%) compared to the East of England (with an increase of 4%). The largest declines in spending occur when comparing the *incubation* to the *lockdown* periods. Almost all regions exhibit a reduction exceeding 30% in dining and drinking spending. Only individuals based in Wales show slightly lower decreases, albeit spending declines in this category exceed 20%. As in the previous analysis, Figure 6, panel (c) shows that there is strong heterogeneity in terms of the impact of the stay alert message on dining and drinking spending between the regions. It appears that especially individuals in Wales significantly increased relevant spending (+14.5%) whereas spending in the South West dropped further by around 8%.

Overall, the results of our analysis suggest that discretionary spending of consumers in GB declines as the incidence of Covid-19 increases. This confirms findings for recent studies carried out using transaction level data for consumers located in China, Denmark, France, Spain, Portugal and the United States. Unsurprisingly, and also in line with recent evidence presented for Denmark and the United States, government interventions to mitigate the spread of Covid-19 cases (such as lockdown) impact negatively on spending, albeit these declines are uneven across product type, and the age, gender and income of consumers.

Figure 2. Average Weekly spending per category for Great Britain

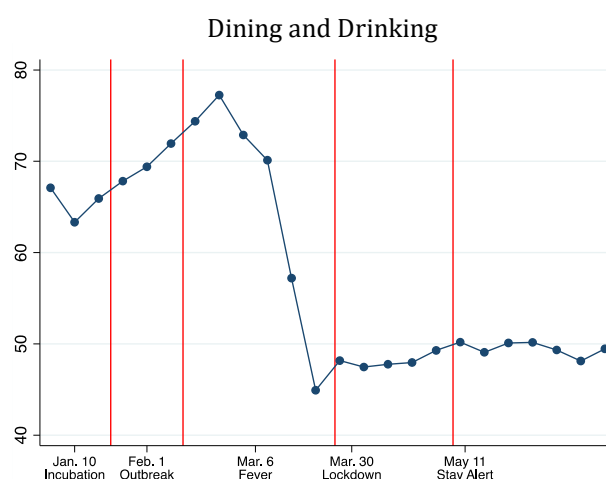
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Panel B:



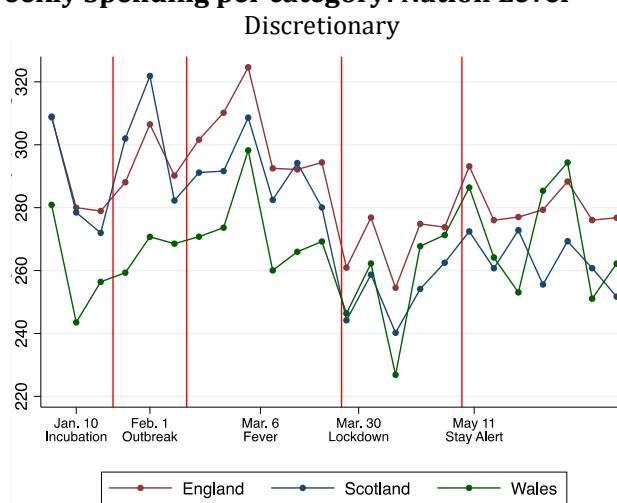
Panel C:



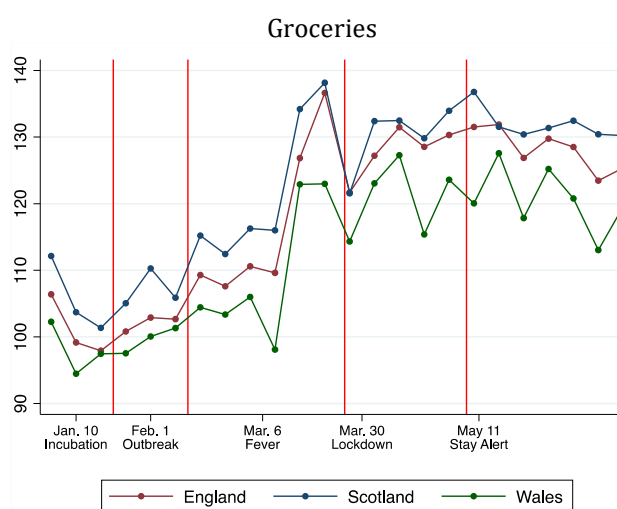
Note: Each panel shows the weekly average spending in pounds sterling (£) per average individual for the respective expense category on the y-axis. The x-axis shows the week of the year, starting on Wednesday 1st of January. The period of analysis is separated in four phases: *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*.

Figure 3. Average Weekly Spending per category: Nation Level

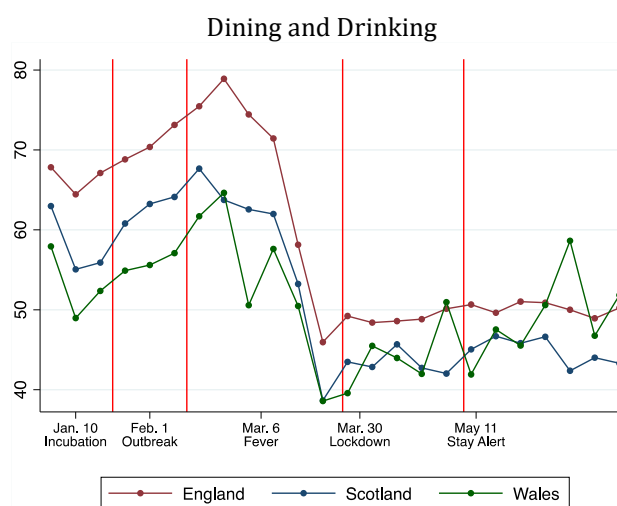
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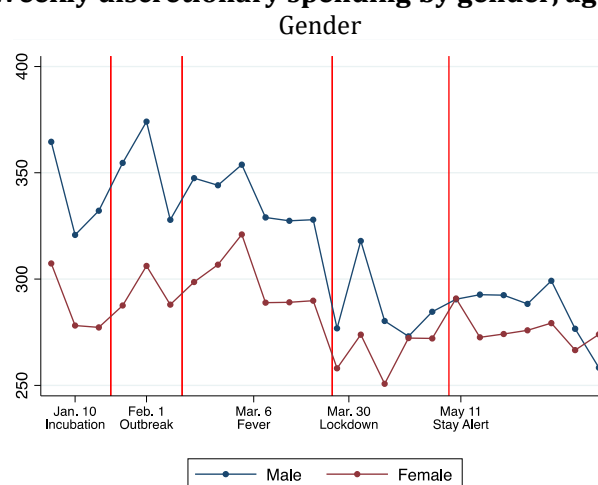
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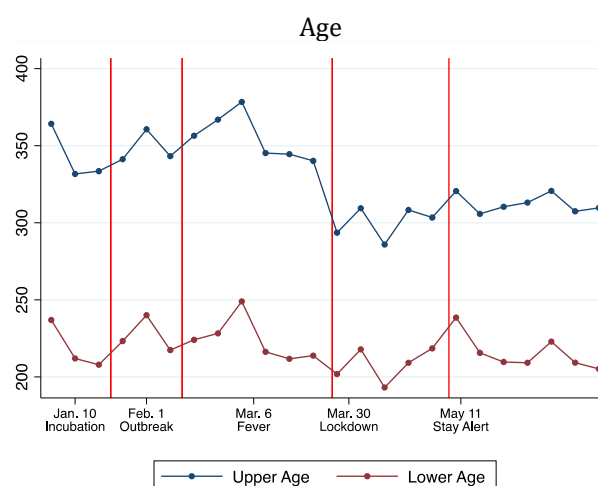
Note: Each panel shows the weekly average spending in pounds sterling (£) per average individual for the respective expense category on the y-axis. Spending is separated by country - England, Scotland and Wales. The x-axis shows the week of the year, starting on Wednesday 1st of January. The period of analysis is separated in four phases: *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*.

Figure 4a. Average Weekly discretionary spending by gender, age and income

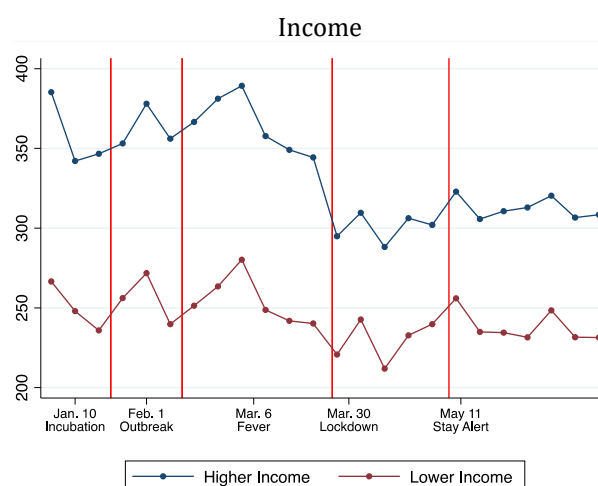
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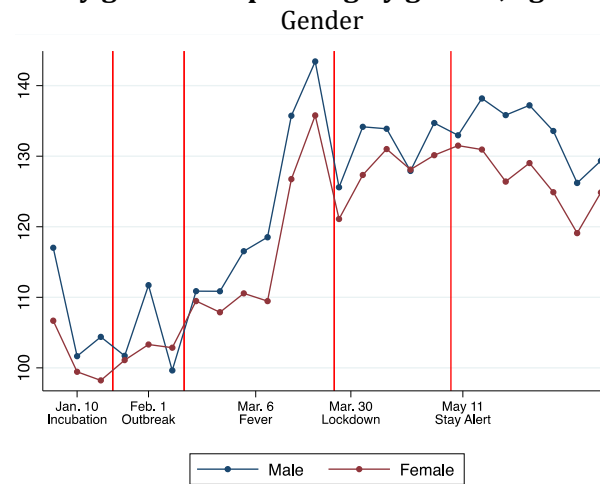
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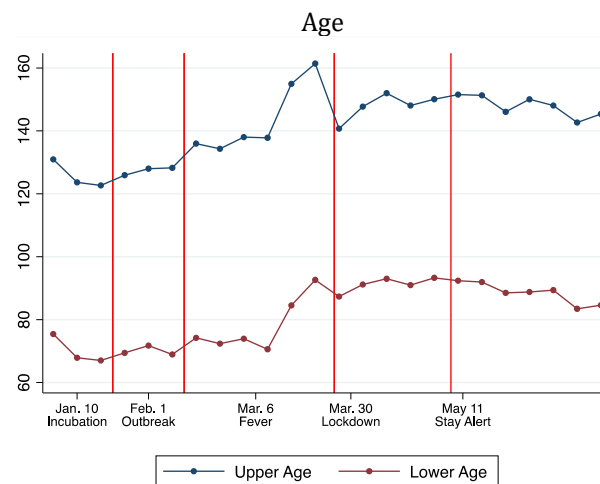
Note: Each panel shows the weekly average spending in pounds sterling (£) per average individual for the respective expense category on the y-axis. Spending is separated by demographic characteristic – gender, age, income. The x-axis shows the week of the year, starting on Wednesday 1st of January. The period of analysis is separated in five phases: *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*. All individuals with identifiable postcodes or monthly income in Great Britain are included.

Figure 4b. Average Weekly groceries spending by gender, age and income

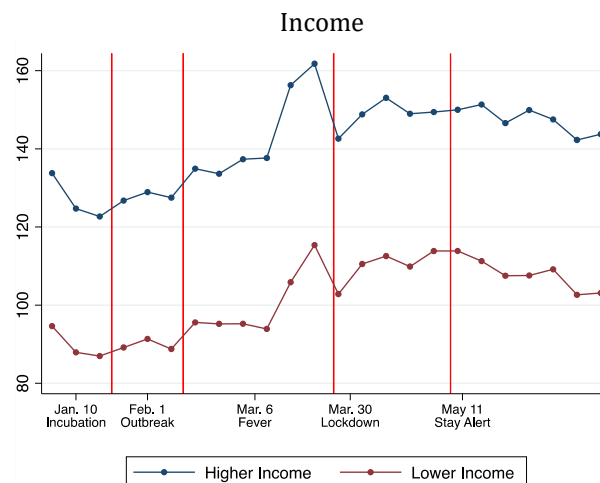
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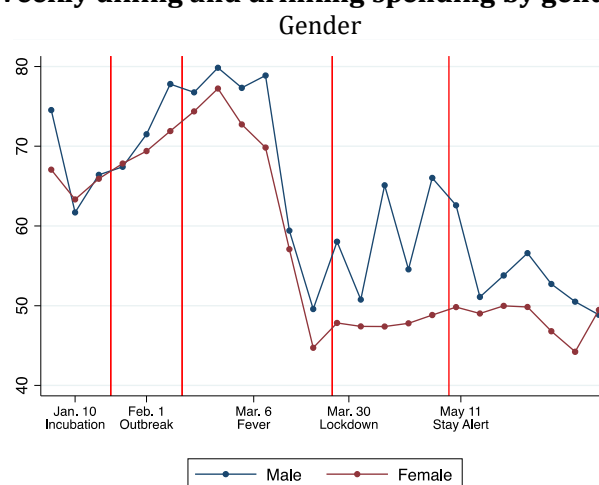
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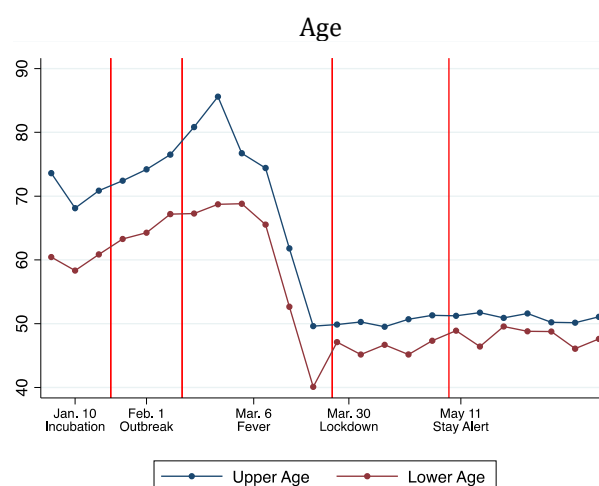
Note: Each panel shows the weekly average spending in pounds sterling (£) per average individual for the respective expense category on the y-axis. Spending is separated by demographic characteristic – gender, age, income. The x-axis shows the week of the year, starting on Wednesday 1st of January. The period of analysis is separated in five phases: *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*. All individuals with identifiable postcodes or monthly income in Great Britain are included.

Figure 4c. Average Weekly dining and drinking spending by gender, age and income

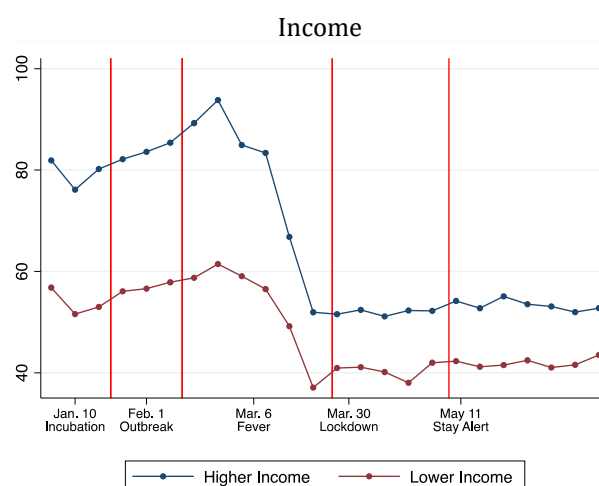
Panel A:



Panel B:

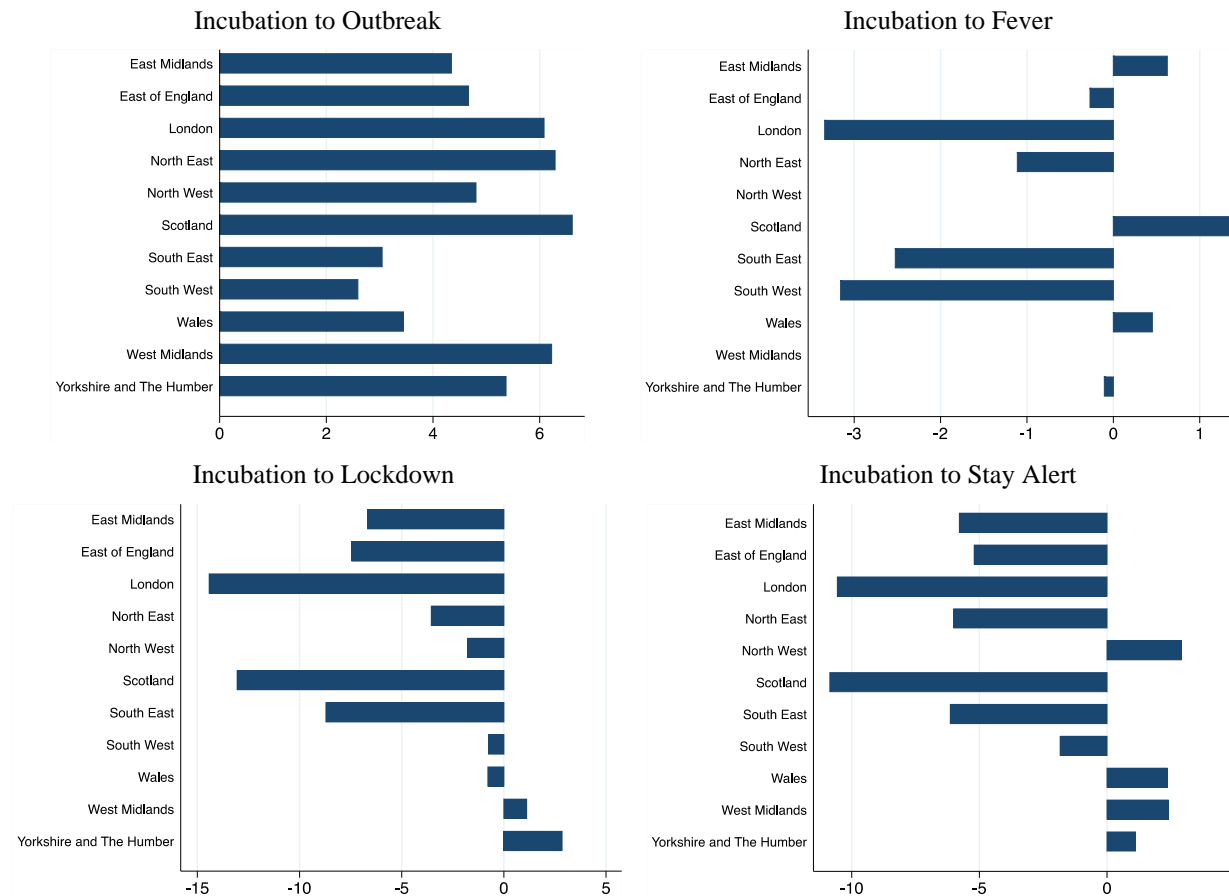


Panel C:



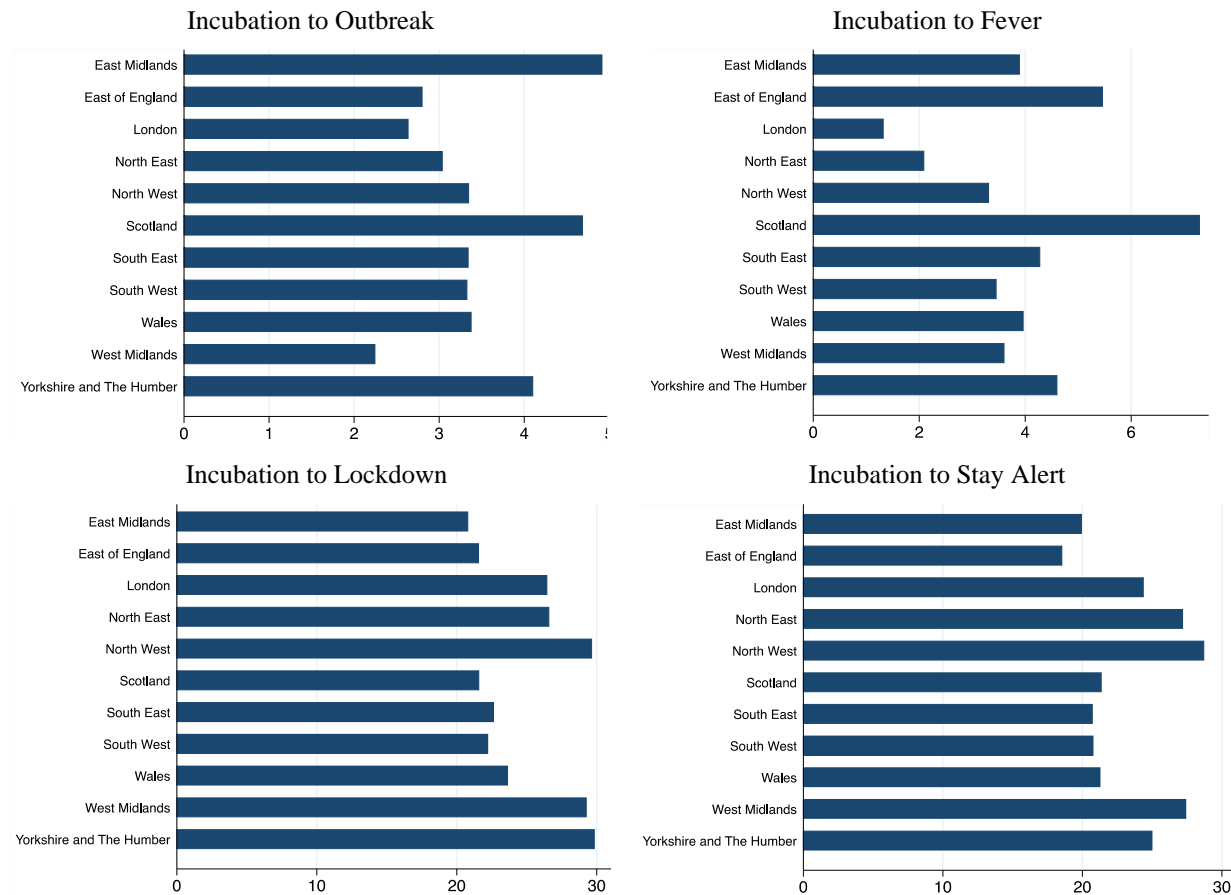
Note: Each panel shows the weekly average spending in pounds sterling (£) per average individual for the respective expense category on the y-axis. Spending is separated by demographic characteristic – gender, age, income. The x-axis shows the week of the year, starting on Wednesday 1st of January. The period of analysis is separated in five phases: *incubation*, *outbreak*, *fever*, *lockdown* and *stay alert*. All individuals with identifiable postcodes or monthly income in Great Britain are included.

Figure 5a. Change in weekly discretionary spending across sub-periods (*incubation to outbreak; incubation to fever; incubation to lockdown, incubation to stay alert*) by region



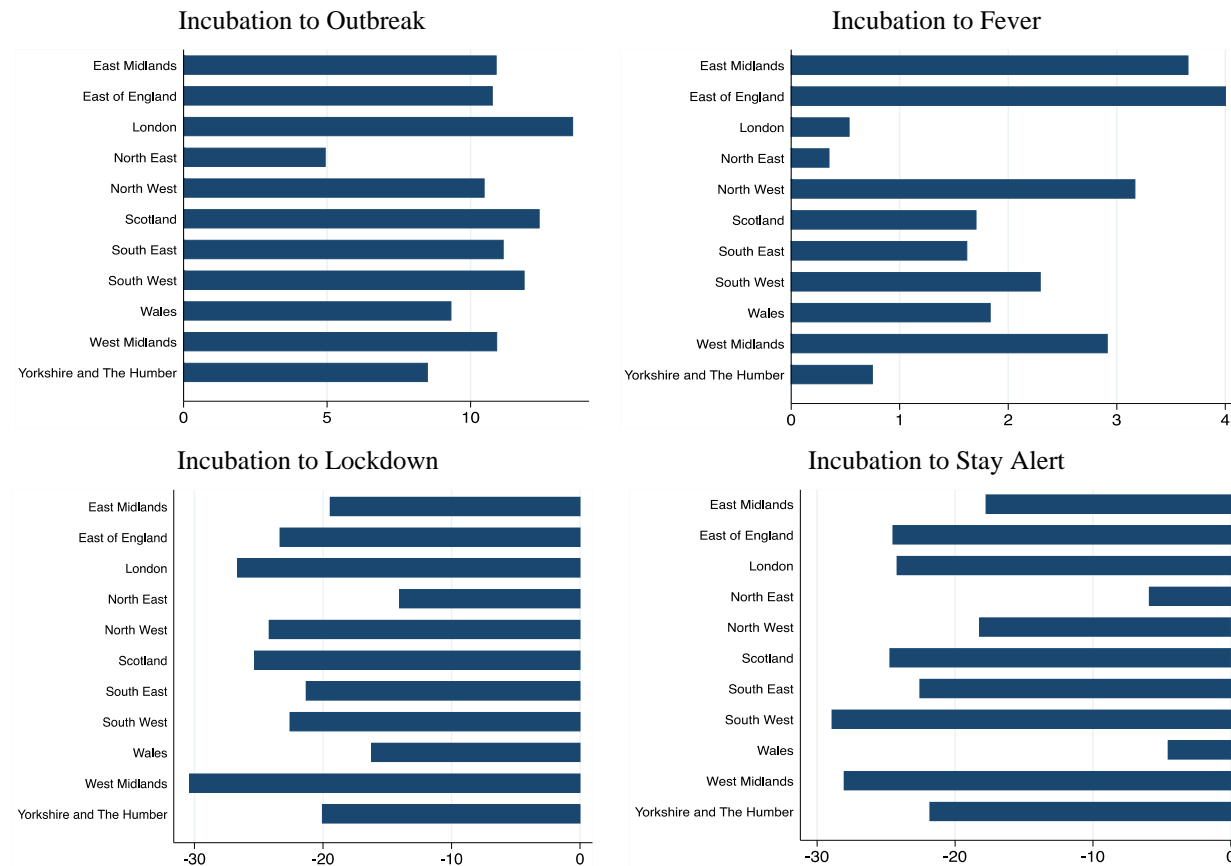
Note: Each sub-figure shows the median relative change in average weekly discretionary spending between the five time periods: incubation, outbreak, fever, lockdown and stay alert. The change is measured in comparison to the average weekly spending in the incubation phase. The y-axis is separated into the main nine regions of Great Britain as defined by the Office for National Statistics. The x-axis depicts the phase-to-phase change of weekly spending in percent. Included are all individuals who spent on discretionary items and whose postcode could be identified (as summarised in Table 2).

Figure 5b. Change in weekly groceries spending across sub-periods (*incubation to outbreak; incubation to fever; incubation to lockdown, incubation to stay alert*) by region



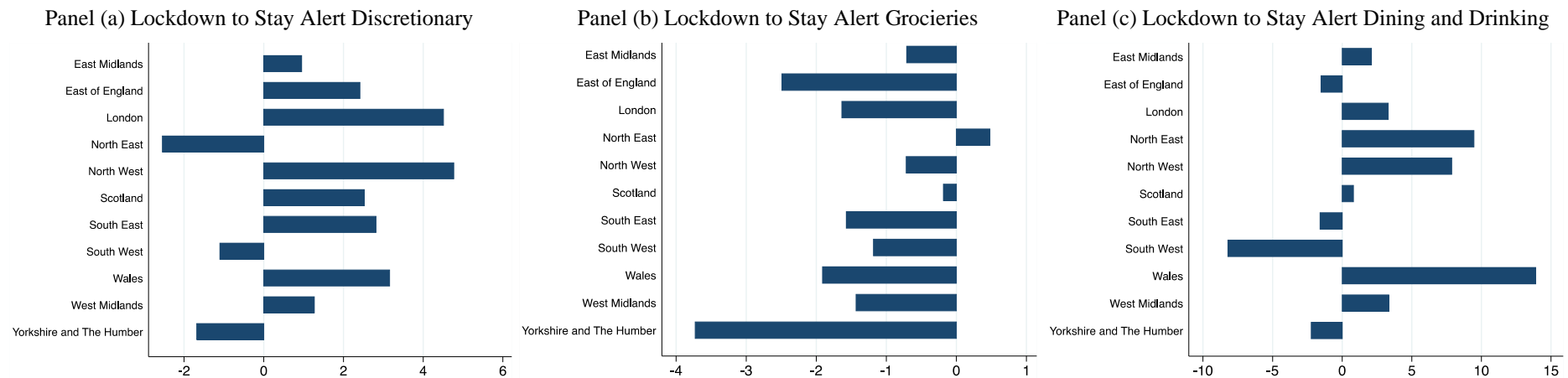
Note: Each sub-figure shows the mean relative change in average weekly grocery spending between the five time periods: *incubation, outbreak, fever, lockdown* and *stay alert*. The change is measured in comparison to the average weekly spending in the incubation phase. The y-axis is separated into the main nine regions of Great Britain as defined by the Office for National Statistics. The x-axis depicts the phase-to-phase change of weekly spending in percent. Included are all individuals who spent on grocery items and whose postcode could be identified (as summarised in Table 2).

Figure 5c. Change in weekly dining and drinking spending across sub-periods (*incubation to outbreak; incubation to fever; incubation to lockdown, incubation to stay alert*) by region



Note: Each sub-figure shows the mean relative change in average weekly dining and drinking spending between the five time periods: *incubation, outbreak, fever, lockdown* and *stay alert*. The change is measured in comparison to the average weekly spending in the incubation phase. The y-axis is separated into the main nine regions of Great Britain as defined by the Office for National Statistics. The x-axis depicts the phase-to-phase change of weekly spending in percent. Included are all individuals who spent on dining and drinking items and whose postcode could be identified (as summarised in Table 2).

Figure 6. Change in weekly spending across sub-periods between lockdown and the ‘stay alert’ message for all categories by region



Note: Each sub-figure shows the mean relative change in average weekly spending between the *lockdown* and *stay alert period*. The y-axis is separated into the main nine regions of Great Britain as defined by the Office for National Statistics. The x-axis depicts the phase-to-phase change of weekly spending in percent. Included are all individuals who spent on the relevant items and whose postcode could be identified (as summarised in Table 2).

4. Concluding Remarks

In the first quarter of 2020, the Covid-19 virus spread around the world to become a global pandemic. The virus has wreaked havoc on the health and well-being of individuals, and stretched health and social care systems to breaking point as governments scrambled to dampen its spread (via closures of non-essential businesses; prohibitions on large gatherings; and severe restrictions on freedom of mobility) and short term economic impacts (via short-term funding to non-financial firms, tax and rates deferrals and employer grants). Early evidence assembled in a variety of settings using: historical comparisons with prior epidemics; computer-based simulations; stock market event studies; surveys of businesses and households; and econometric analyses of large transaction level datasets suggest that the spread of Covid-19 is having an unprecedented negative impact on the current and future prospects of households, businesses and the macro-economy.

In this study, we use Great Britain (England, Scotland, Wales) as a setting to examine initial consumer spending responses to the onset, and spread of Covid-19, and accompanying public health interventions (including social distancing and lockdown). Using proprietary data on 103,856 consumers and 23 million transactions collected from a popular personal finance application (which aggregates transactions from linked bank accounts and credit and debit cards), we find that consumer spending remains relatively stable in the early stages (*incubation* and *outbreak* periods) of the Covid-19 crisis. During the latter stages of the *fever* period when a government imposed lockdown becomes imminent, discretionary spending declines significantly, and continues to do so after the *lockdown* is announced. Since the *stay alert* announcement by Prime Minister Johnson, a temporary decline in consumer spending across all nations occurs before returning to the same level as that observed prior to the announcement.

Consumer spending responses vary across product categories, especially for groceries, where we observe large increases in spending (associated with panic-buying and stockpiling behaviour) prior to the onset of the *lockdown* period. Spending responses also vary by location (across nations and regions) and demographic characteristics (age, gender and income level). These findings suggest that the Covid-19 virus and public health interventions instituted by the UK government (and devolved administrations) are having significant impacts on the level and composition of consumer spending patterns across Great Britain. However, these impacts are not uniform with differential impacts observed across different nations, regions and demographic groups.

Our results augment a growing international evidence base regarding the impacts of Covid-19 on the economic behaviour of consumer. The real time, high frequency aspects of our

dataset allow for insights regarding changes in the level and composition of consumer spending in response to changes in the incidence of Covid-19 and adjustments to public policy by the UK government and the devolved administrations based in Scotland and Wales. However, our findings are preliminary and come with the caveat that our sample is skewed toward younger individuals. Nevertheless, our results do provide a starting point for academics, policymakers and practitioners in understanding the real-time impacts of Covid-19 on consumer spending, and basis for further in-depth investigations of consumer spending behaviour as the Covid-19 crisis evolves. Future research will extend to a formal regression-based analysis in order to observe the extent to which patterns observed represent transitory or more permanent changes in consumer spending across consumer locations and demographic characteristics. The insights from such research will provide a basis for a nuanced analysis of the impacts of changes in government policies regarding social distancing, lockdown and differential easing of mobility restrictions on consumer spending patterns.

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