COVID-19 Consumption: Analysing UK Household Expenditure Under Pandemic Restrictions

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Abstract:
This study examines the degree to which UK Government-imposed restrictions impacted household expenditure across the COVID-19 Pandemic. Contrary to early reports, this paper finds no evidence that restrictions affected essential or retail expenditure across the entirety of the period. Consumers, however, lowered spending on the latter when on furlough. We observe declines in dining-out expenditure, albeit not to previously reported levels. In addition to precautionary saving in several sectors, we find strong evidence of present-bias via rebounding social expenditure when restrictions ease. We report diminishing effects of consumer confidence on aggregate expenditure, where peak UK restrictions were associated with a 10.4 percentage point reduction in spending (four times less than social expenditure).

AI Statement:
I confirm that generative AI was not used during the research or drafting of this paper.

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I dedicate all of my hard work, awards, and achievements to my family – past, present, and future – with my Walter Hagenbuch Prize for Stage 2 Best Performer dedicated specifically to my late father, Richard. I must also express great appreciation for my mother, (little) nan, dissertation supervisor Dr Savagar and econometrics lecturer Dr Szydłowski. Special mentions go to Mr Karnovski, Mrs Fitzgibbon, and Mr Naik. Thank you all for your support.

I. Introduction

The tumultuous COVID-19 Pandemic will be well-remembered and studied for generations – marking a significant event in global history for a multitude of reasons. Fortunately (for researchers), the event occurred during a period of increasing data-collection, enabling businesses, governments, think tanks, and academics alike to evaluate the impact of Coronavirus-19, and form practices and policies to mitigate against similar or comparable future events. Consumer behaviour, spending patterns, reactions to government intervention and assistance, and confidence levels during the period are areas of great interest that this paper sheds light upon.

Such analyses enable economists to study which sectors of the economy are impacted the most, how aforementioned relationships between variables may be measured and tested, and provide solutions to protect vulnerable sectors should the country endure another similar exogenous shock. One weakness of existing literature is that many publications exist from mid-2020 (following the first lockdown) that strongly indicate early causal relationships between COVID-19 restrictions and spending at the household-level, but without further exploration when restrictions disappeared completely. This paper analyses the sectoral impact of restrictions on household expenditure across the entirety of the pandemic period, and notable, fascinating correlations with control variables. In doing so, we determine whether early-reported phenomena persisted or dissipated, exploring potential reasons why. This paper, therefore, slots in nicely amongst existing publications, adding (and connecting) microeconomic, macroeconomic, and behavioural themes and analyses.

To answer the question "to what extent did COVID-19 restrictions impact UK household spending", this paper employs an OLS regression model, analogous to the type implemented by Yazdanparast and Alhenawi in (2022). Weekly expenditure category time-series data from the Bank of England, and Revolut (via the ONS), is employed to perform three key comparisons in the Results section, to: 1) Existing literature; 2) Economic models and theory; and 3) An aggregate-expenditure 'Base Model' which acts as a benchmark for comparison.

Below, we detail empirical findings, ascertaining the degree to which COVID-19 restrictions reduced sectoral expenditure across most categories. We explain why early panic-buying behaviour dissipates and is unobservable across the triennium studied (despite early findings to the contrary), and how elastic retail expenditure is unaffected by restrictions – likely a

result of business adaptability and online-model adjustment increasing supply to households. Using economic models and theory, we highlight the extent to which delayable expenditure is impacted by restrictions, dependent on the degree of demand elasticities and interpersonal contact, and whether the in-person shopping experience can be replaced by a digital alternative. We consider traditional static Marshallian demand theory and more applicable, modern dynamic equilibria models, such as the two-way model employed by Eichenbaum, Rebelo, and Trabandt (2021).

We also examine early evidence of borrowing to finance short-term consumption – consistent with Friedman's (1957) writings – in contrast to the longer-term precautionary savings behaviour observed during the furlough period, particularly in relation to discretionary purchases. We consider applications from behavioural economics, noting that the effect of confidence on aggregate expenditure is non-linear (concave) with diminishing effects beyond the turning point. Lastly, in addition to measuring the impact of restrictions, we also find that overall, inflation levels did not reduce expenditure.

II. Literature Review

The COVID-19 Pandemic was unlike past recessions – largely a result of the increasingly technological environment within modern economies. European studies highlight the expected strong inverse relationship between *"confinement measures"* imposed on hotels/restaurants and revenue, and the role of forbearance in deferring business-related debts aiding job retention (Janzen and Radulescu, 2022). Recent research closer to home, also details how despite declines in traditional outlet sales, pandemic firm creation – particularly in the online retail space – was shown to grow, although mostly driven by solo-entrepreneurs who were less likely to hire and whose businesses were more likely to dissolve than those formed pre-Pandemic (Bahaj, Piton, and Savagar, 2024).

Existing literature varies greatly in analyses of psychological, geographical, financial, and sectoral trends during the Pandemic period, undoubtedly a positive for future policy makers. Despite this, is it vital to consider that some were conducted, written and published during mid-2020, directly focusing on initial responses to COVID-19. This contrasts the approach of this paper, and several others, designed to evaluate the entirety of the COVID-19 period from

the start of 2020 (and the imposition of measures in that March) until the phase-out period of restrictions that could influence regular behaviour in 2022.

A. Methodology

Methodology employed by researchers varies amongst publications, and the approach used in this paper. Analysing the response of consumer spending patterns to the initial pandemic stages, one paper dissected the period into five sub-groups from January-June 2020 consisting of *"incubation"*, *"outbreak"*, *"fever"*, *"lockdown"*, and *"stay alert"* phases (Chronopoulos, Lukas & Wilson, 2020). This approach contrasts using the COVID-19 Stringency Index devised by the Oxford Coronavirus Government Response Tracker (OxCGRT) project as the explanatory variable of interest across the entire period. Another by Yazdanparast and Alhenawi (2022) focused on behavioural consequences of *"pandemic-induced changes"* such as changes in attitudes to saving, investing, and spending, used a multivariate ordinary least squares (OLS) regression model. This paper employs similar methodology (see Section III.B). This framework oversees substitution of dependent variables with numerous *"consumer vulnerability"* characteristics (e.g. attitudes towards the individual's own health, the health of loved ones, and work and social life concerns). Regressors remained constant – including personality traits and household characteristic controls. Although measurements of household expenditure differ slightly – focusing more on consequential behavioural differences from the Pandemic rather than increasing severity of restrictions (and subsequent impacts on spending categories) – the methodology is analogous to experiments conducted below. The regressand changes for each expenditure group, holding regressors constant. Below, our regressand is an expenditure index, whereas the regressor of interest in each model is the COVID-19 Stringency Index; other key factors are also controlled for where appropriate.

Elsewhere, AbdulHussein, Cozzarin, and Dimitrov (2022) use an ordered logistical model:

$$\ln\big(Prob(S_i \leq j)\big) = \alpha_n - [\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_{10} X_{10}]$$

Explaining briefly, j refers to either lower, constant, or greater online expenditure, α_n refers to *"cutoff points"* (these separate cumulative probabilities for different spending categories), and i refers to one of twelve item groups. The model allows for measurement of *ceteris paribus* effects of each regressor. X_i represents each explanatory variable (demographic characteristics), and β_i is the corresponding estimated coefficient.

To calculate the probability that spending was unchanged by the COVID-19 Pandemic, the following formula is employed:

$$Prob(S_i = 2) = Prob(S_i \leq 2) - Prob(S_i \leq 1) = \frac{1}{1 + e^{-B}} - \frac{1}{1 + e^{-A}}$$

Assuming selection of some given regressor values (X_i), the probability that $S_i \leq 1$ (i.e. that expenditure decreased) must be calculated, then subtracted from the cumulative probability that $S_i \leq 2$ where spending remained constant. A and B refer to cutoff points α_1 and α_2 minus the sum of coefficients and regressors respectively. Using such models allow for estimation of the probability that expenditure remained constant given the chosen demographic characteristics.

B. Findings

Throughout this study, we should consider increased digitalisation of (and the degree of adaptability within) sectors of the economy during The Pandemic. Although intra-sectoral expenditure may change after several weeks of restrictions, we should question how much of the change is contributable to consumer behaviour, spending patterns, and restriction severity, and how much is resultant of supply-side changes whereby businesses have adapted to the changed environment in which they operate. Perhaps it took considerable (or little) time to hire and train new staff and the increase in expenditure partly stems from greater availability of products. One critique of certain research is the absence of connecting changes in expenditure to the supply side of the economy. Theoretically, with limited supply of goods and inventories, one must consider possible underestimation of the full extent of consumer demand. An example may be the inability to purchase essential goods, like toilet rolls, from supermarkets for many days during panic-buying periods when shelves remain empty, or supermarket-imposed item per-customer limits (explored in Section III.A).

From the demand side, pre-lockdown expenditure on groceries skyrocketed in the two weeks following the World Health Organization (WHO) declaration of a global pandemic on 11th March 2020, mainly caused by panic-buying and hoarding of essentials (Chronopoulos, Lukas & Wilson, 2020). Approximately one week into the first lockdown, grocery spending had increased again to a level £30 per week (on average) greater than in the first two weeks of January (Chronopoulos, Lukas & Wilson, 2020). This highlights great short-term volatility, reflecting changing consumer behaviour (and expenditure patterns) prior to The Health

Protection (Coronavirus Restrictions) Regulations 2020 passing into law. Only during what Chronopoulos, Lukas and Wilson (2020) define as the *"stay alert"* phase of the first lockdown – the period where severity of restrictions eased somewhat, and employees were encouraged to return to workplaces – did grocery expenditure begin to marginally decrease.

A key theme witnessed in this paper (in addition to existing literature from the UK and similar Western countries) can be seen in the relationships between expenditure groups and the various phases of The Pandemic. Of all sectors considered, the early relationship between expenditure and restriction severity is only positive in the grocery sector, as highlighted by Baker et al. (2020) and Byrne et al. (2020). Card transactions also increase, indicating that households looked to finance their accumulation of essentials through borrowing (Baker et al., 2020), indicating support early on in The Pandemic of the Permanent Income Hypothesis (Friedman, 1957) – assuming that households viewed the shock as temporary and sought to smooth consumption accordingly. As Celik, Ozden, and Dane (2020a) highlight in a limited but indicative paper using global samples of data, ~70% of respondents during the first wave of The Pandemic reported an increase in food and drink expenditure, whilst ~45% reported a decline in income. This statistically significant conclusion draws attention to the consideration of consumer demand being limited by the extent to which income is reduced, which will vary across regions and households. Perhaps some families desired greater stockpiling of goods but were unable to as a result of decreased income – reflecting a type of latent demand as defined by Clifton and Moura (2017). Both changes in consumer behaviour and business operations are highlighted by greater food delivery expenditure, described by Baker et al. (2020) as *"consistent with [individuals] substituting meals at restaurants with meals at home"*. Relihan et al. (2020, quoted in AbdulHussein, Cozzarin, and Dimitrov, 2022) concluded that British online restaurant expenditure in March 2020 increased 12% against the previous six-month period. Future policymakers should also reflect on household composition of constituents – it appears that larger households with multiple children are more likely to order food online rather than smaller households – potentially because of efforts to reduce their children's exposure to COVID-19 (AbdulHussein, Cozzarin, and Dimitrov, 2022).

Throughout extensive evaluation of this interesting and eventful period, one should be mindful of intra-categorical changes. One may not observe a statistically significant change in expenditure when comparing sectors, however, spending within a category may have shifted between individual products (or product types). A practical example is demonstrated in the

multiple-country study by Celik and Dane (2020b) – highlighting how respondent's preferences shifted within the food consumption category from purchasing meat and bakery products to fruit and vegetables. Such intra-categorical findings illustrate how pandemic behaviours transformed so that individuals opted for healthier options, moving from prioritising cost to prioritising quality in an effort to boost immune systems and improve health, with such patterns also observed during the SARS outbreak of the early 2000s (Celik and Dane, 2020b).

This contrasts the sharp (but expected) decline in discretionary expenditure as a result of more intense restrictions – observed with dining and drinking expenditure plummeting by almost 50% in the United Kingdom from the month covering late March and most of April (Chronopoulos, Lukas & Wilson, 2020). In similar economies, studies find a statistically significant inverse relationship between stringency of COVID-19 restrictions and travel, entertainment, and restaurant spending – as shown by Baker et al. (2020) – and also accommodation, clothing, education and health – evidenced by Byrne et al. (2020) respectively. Such negative relationships are also observed in this paper, albeit over the entirety of the pandemic period.

As a result of premature publication, some early papers also fail to fully consider the *'lockdown fatigue'* or increasing non-compliance as a result of prolonged unsustainable social and economic suppression, reported by Yeyati and Sartorio (2020).

III. Economic Models, Theory, and Empirical Methodology

A. Economic Models and Theory

Economic models and theories provide valuable insight into expected relationships between variables, and consumer behaviour. Readers will likely be familiar with Alfred Marshall's foundational contributions to economic literature. Basic static supply and demand models, and the famous Marshallian demand function – are of particular interest.

Critiquing the simplicity of the basic model and assumptions, whereby *"in every case the more of a thing [that] is offered for sale in a market the lower is the price at which it will find purchasers"* (Marshall, 1890), the statement also implies reduced availability of goods results

in transactions between producer and consumer at greater prices. Overall, theory would imply that in closing specific sectors, the supply schedule would shift upwards to such a position where the new equilibrium begets lower quantity and higher price. Realistically, there is a distinction to be made between the theoretical environment of supply cuts in a competitive market (outlined by Marshall), and the forced, exogenous supply shock as a result of government intervention in the real world. COVID-19 restrictions severely limited some segments of the economy (such as automotive and fuel sectors) and completely obliterated others – mainly comprising "social" expenditures.

Therefore, inference is not straightforward. Stringent restrictions imply complete failure of market mechanisms. Despite the supply schedule shifting upwards, logic dictates simultaneous movement of the demand schedule. The degree of demand schedule adjustment is likely primarily a result of elasticities – greater inelasticity associated with sectors providing necessities and utilities. We expect to observe greater prices/spending in these sectors, alongside minimal (or no) restrictions impact. In contrast, "delayable" expenditure on clothing and furnishings would be deemed as elastic (flatter demand schedule), especially with a priority-shift away from discretionary purchases as a result of uncertainty (Byrne et al., 2020).

Demand has multiple forms – important when attempting to predict the magnitude of causal relationships between variables. The "social" sector of the economy (travel/events/"eating-out") is a perfect example for elaboration. This sector saw an almost total annihilation of supply during the first lockdown, making two variations of demand even more distinguishable. The first may be interpreted as latent demand – defined as *"currently desired demand that is not realized because of a wide variety of constraints"* (Clifton and Moura, 2017). This is the unobservable individual demand stemming from natural social inclinations, severely limited constraints of UK Government-imposed restrictions. The second is the effective (or realised) demand, which John Maynard Keynes alluded to as the visible point at which the aggregate demand and aggregate supply schedules intersect (Keynes, 1936). This is the observable degree of demand within the economy – albeit constrained by lockdown and restrictions. Logic would dictate that latent demand would far exceed effective demand in economic sectors that felt the greatest restrictions. Expenditure may decrease in the pub, restaurant, and fast-food sector as a result of pandemic restrictions, leading to suppressed supply and effective (realised) demand – but latent demand would be unobservable (unless

studied) and far greater. This stresses the requirement for careful consideration when utilising traditional models, such as those outlined by Marshall (1890) which make little allowance for latent demand and policy-driven shocks to market activity.

This is a crude assessment of a simple static model, but highlights areas for improvement, important for future policy-making. Well-regarded literature also points to the speed at which changing factors may be totally absorbed by the market. Ordinarily, it is given that in the short-term, demand prevails in manipulating market values, and in the long-term, the cost of production wields greater control (Marshall, 1890). This insight may shed light on discrepancies in findings between research published around mid-2020 (following the first lockdown), and subsequent publications – particularly from 2022 onwards (when the majority of the pandemic period had been observed) – and this paper.

Using this intuition, one may infer that across the entirety of The Pandemic, short-term demand fluctuations (or even panic-buying periods) observed by Baker et al. (2020), Chronopoulos, Lukas, and Wilson (2020), and Byrne et al. (2020) in comparable literature, may subside, and underlying trends (such as inflation impacting spending patterns to a greater degree) may become more observable.

Ergo, considering preceding points, one may expect an explosive reaction when restrictions relax between lockdown periods and particularly where latent demand may be described as having exceeded effective demand when restrictions were stringent. An example would be witnessing rebounding dining-out and events expenditure with simultaneous opening-up of the economy, resulting from pent-up demand. The degree to which restrictions are eased to cause such a response is questionable, but logically, individuals will exhibit increased demand for such activities after being subjected to harsh controls for so long, with expected returns to lower expenditure after an initial rush.

Marshallian models lack time components, so equilibrium adjustments take place in a single point in time under inflexible conditions of fixed constraints and preferences. Eichenbaum, Rebelo, and Trabandt (2021) detail an effective dynamic two-way interaction model, combining epidemiological SIR framework and economic theory. This multi-period model incorporates rational, forward-looking behaviour with considerations for intertemporal consumption changes under varying pandemic conditions. It importantly captures the endogenous response to the exogenous shock of a pandemic (in stark contrast to Marshallian

models). Findings point to pandemics impacting both aggregate supply and demand within the economy with a key observable dynamic between individual voluntary decision-making (lower overall consumption and work-hours) to reduce fatalities, and corresponding worsening of the recession. This highlights the important consideration that although restrictions may be imposed upon a population, severity varies by individual perceptions – with those most susceptible to the virus self-selecting out of the workplace and also spending less on consumption overall.

Using this framework, one expects a much greater impact of lockdown restrictions upon sectors with the most interpersonal contact (e.g. the restaurant, entertainment and travel sectors of the economy). With the two-way model inferring that more stringent measures aid welfare, albeit at the cost of deeper recessions (Eichenbaum, Rebelo, and Trabandt, 2021), there is little consideration of elasticities. Therefore, as previously mentioned, it may be the case that there is less of an impact in essential sectors, contradicting the overall findings of the model. On the other hand, the impact may be less in customer-facing non-essential sectors if there is room to adapt to a digital, online-delivery business model.

Behavioural economic models and theories also shed light on potential pandemic behaviour – enabling inference of relationships between key variables. Many individuals hold present-bias – defined as *"present-focused preferences"* (Laibson et al., 2023) – despite some findings in earlier literature that maturation can dissolve some of the natural desire for instant rewards (Strotz, 1955). Consequently, time-inconsistent preferences may be observed.

The Quasi-Hyperbolic Discounting Model outlined by Cartwright (2018) following successful implementation by DellaVigna and Malmendier (2006), provides great insight into consumer behaviour. The authors show that most individuals are prone to overweighting present utility and make sub-optimal decisions as a result of unrealistic expectations. Applying this to the COVID-19 pandemic, present-biased individuals may have overspent on essentials (like those in the staple category detailed below) as a precaution, overweighting immediate utility despite the risk of overstocking, and being assured of reliable supply chains. In the short-run, authors (outlined in the literature review) indicated this was the case, but effects may diminish over the medium-long term.

Linking the work of Cartwright (2018), DellaVigna and Malmendier (2006), and Eichenbaum, Rebelo and Trabandt (2021), we may infer desires for social activities (including

entertainment, events, travel, and dining-out) will decline not only because of the imposition of restrictions, but also underconsumption stemming from greater short-term perceived risk. When restrictions ease, time-inconsistent expectations could infer that individuals intend to make up for foregone social experiences but fail to do so as their preferences have changed across time. Such phenomena may be measured by studying lagged social expenditure over time (highlighted below). Similarly, present-bias may be observed if spending on delayable expenditure increases significantly with a mere relaxation of restrictions. Individuals may plan to postpone purchases on items such as clothing and furniture until safely and certainly out of the uncertain period, but such an accumulating desire to spend may be released with some reduction in lockdown constraints.

Contrary to the Permanent Income Hypothesis (Friedman, 1957) suggestion that consumers will borrow when income and wealth temporarily declines, some economists argue that in times of heightened economic uncertainty, consumers will save, anticipating worsening of conditions (Jones, 2018). This precautionary saving acts as a self-insurance policy and is analogous to operating under borrowing constraints. Milton Friedman's theory (and the concept of intertemporal consumption smoothing) would point towards use of borrowing as a mechanism to keep consumption constant, however, modern arguments imply that expenditure is likely to be impacted under uncertainty, especially under credit constraints and risk-aversion. Savings are therefore more likely to be viewed as *"defensive mechanisms"* against worse outcomes (Yazdanparast and Alhenawi, 2021). Therefore, across the entirety of the pandemic, one would expect to see declines across social, delayable, and work-related expenditure regardless of the degree to which income has fallen. In the event that one observes a notable decline in expenditure as a result of COVID-19 restrictions, however, it would not be as simple as rejecting the consumption-smoothing predictions. Instead, one should consider this, but also the exogenous constraints that limited consumption, even if demand existed.

To summarise, foundational Marshallian supply-demand theory provides useful insights for economic market behaviour, under basic and strict assumptions, with imposed pandemic restrictions likely to cause simultaneous shifts of both schedules – the degree to which depends on sectoral elasticities. The model lacks consideration of latent demand (which may explain potential suppressed expenditure and explosive rebounds when restrictions ease), and also exogenous pandemic shocks – the endogenous effects of which are considered in later

two-way dynamic models. Models and theories from behavioural economic research shed greater light on expected effects of panic-buying and time-inconsistent preferences. Modern precautionary saving theories also challenge predictions of Friedman's Permanent Income Hypothesis (1957), especially under conditions with heightened risk, borrowing constraints, and uncertainty regarding future income.

B. Empirical Methodology

(i) Data Description

This paper uses data from two credible sources enabling straightforward substitution of dependent variables (as detailed in the methodology section). The first is the *"UK Spending on Credit and Debit Cards by Consumption Category Series"* from the Bank of England with calculations by the Office for National Statistics (ONS, 2024c). This dataset is comprised of seasonally-adjusted (but nominal) weekly expenditure-group indices with a 2023 average value base. To add specificity, the aggregate expenditure time-series index considers transaction history of a representative sample of around 100 UK companies across a quadrennium encompassing the COVID-19 Pandemic – this paper uses 156 weeks of the data from the start of January 2020 to coincide with the length of other series.

For clarity, we must provide disambiguation over consumption categories. Firstly, the 'staple' index refers to businesses that provided essentials during the period outlined (i.e. food and utility companies). Secondly, 'delayable' expenditure refers to businesses who have been deemed to fall outside of the above definition, instead being associated with discretionary purchases on items such as clothing and furniture. Thirdly, 'social' expenditure encompasses all spending on travelling and dining at restaurants. Lastly, 'work-related' transactions refer to expenditure associated with companies that provide public transportation and automotive necessities like fuel.

Also provided by the ONS (with calculations), the second source for dependent variables is Revolut (ONS, 2024d). Unlike the above, this is not seasonally adjusted. This dataset enables capture of spending behaviours of almost five million UK consumers – however, it is important to consider that the habits of these users may be somewhat "younger and more metropolitan" than the average citizen (ONS, 2024d). Furthermore, this dataset comprises

solely debit card transactions, whereas CHAPS data included those made via credit cards – some measurement differences may arise as a result of pandemic attitudes to debt with the latter (or frugality with just the former).

The Revolut time-series dataset also splits card spending by sector. These include the "automotive fuel" sector and the "pubs, restaurants and fast food" (also including nightclubs) sector. Revolut defines the retail category as the clothing, department, and "mixed-retail" stores – important as definitions may vary elsewhere. Additionally, there are indices for entertainment (which includes most events that require membership purchases, tickets, and tourist attractions), and food and drink expenditure (mostly supermarkets and convenience stores). Such a segregation of data enables sector-specific focus; valuable to comprehend the impact of COVID-19 restrictions for future policy-making.

The explanatory variable of interest is the Stringency Index, constructed by the Oxford Coronavirus Government Response Tracker (OxCGRT) project and provided by Our World in Data (2023). The OxCGRT utilizes a comprehensive range of 19 indicators (Hale et al., 2021). It incorporates school and workplace closures, freedom of movement (or lack of), and "public information campaigns" to provide an estimation of restriction severity (Roser, 2021). The series used from this dataset is the UK weighted-average Stringency Index – converted from daily to weekly-average frequency.

Other controls include CPIH inflation (ONS, 2024b) and a seasonally-adjusted monthly unemployment rate series (ONS, 2024a). This has been converted to weekly frequency, like the Coronavirus Job Retention Scheme (CJRS) statistics from HMRC (2021) – highlighting the number of citizens on the UK furlough scheme per day. This has also been transformed to millions of individuals (for ease of future interpretation).

News and broadcasting services were heavily relied upon during the pandemic, delivering constant updates to the public. Capturing changes in consumer sentiment, we use GfK's Consumer Confidence Index. This variable (henceforth abbreviated to 'CCI') enables insight into aggregate behaviour by considering household's future expectations, their financial positions, and their ability to make large domestic purchases (Harari, 2025). To enhance coefficient robustness, CCI was centred (thus reflecting average pandemic-level confidence), and a quadratic transformation has been created to capture non-linear relationships.

(ii) Data Analysis

	Min.	Max.	Range	Mean	Median	S.D.	Skewness	Kurtosis
Aggregate Expenditure*	57.770	105.820	48.050	89.375	93.030	11.247	-0.959	0.184
Delayable*	68.460	139.280	70.820	102.470	103.335	14.996	0.222	0.259
Social*	24.330	113.210	88.880	78.345	84.335	23.190	-0.650	-0.626
Staple*	75.820	104.100	28.280	90.680	90.440	4.417	-0.295	0.872
Work-Related*	32.370	112.230	79.860	78.118	80.340	20.580	-0.500	-0.746
Automotive and Fuel**	40.590	205.790	165.200	118.475	115.460	36.197	0.170	-0.407
Entertainment**	6.100	125.730	119.630	52.768	58.070	28.833	-0.023	-1.238
Pub, Restaurants, and Fast-Food**	7.920	130.580	122.660	72.757	81.350	32.904	-0.366	-1.001
Retail**	56.290	216.790	160.500	129.438	130.015	28.376	-0.008	0.496
Restrictions	0.000	87.960	87.960	43.345	43.640	27.871	-0.064	-1.443
CPIH	0.500	9.600	9.100	3.854	2.400	3.219	0.595	-1.266
Unemployment	3.600	5.300	1.700	4.381	4.200	0.523	0.447	-1.205
Furlough	0.000	8.837	8.837	2.154	1.173	2.644	1.028	0.027
CCI(c)	-23.154	18.846	42.000	0.000	-1.154	12.689	-0.071	-1.223
CCI(c)^2	0.024	536.101	536.077	159.976	117.639	143.507	0.626	-0.576

Table Notes: N = 156 observations (weeks); '*' denotes Bank of England CHAPS expenditure indices (dependent variables). '**' denotes Revolut expenditure indices (dependent variables) that were not seasonally adjusted. (c) denotes centred variables (pandemic-level averages). Furlough is given in millions of individuals. See data description section for details on unit measurement and transformations.

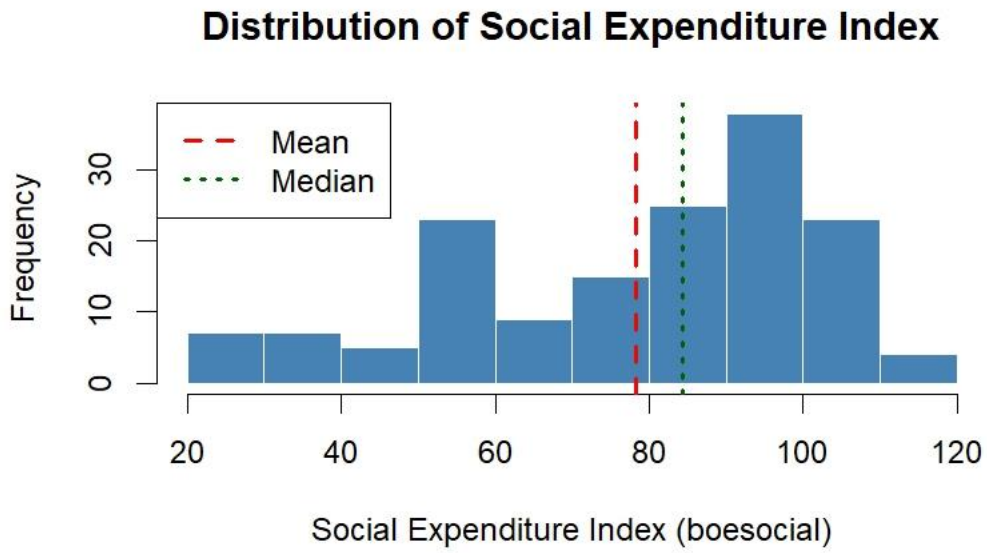
Retail and auto-fuel indices possess the greatest range in our dataset, possibly because Revolut data was not seasonally adjusted and therefore perhaps susceptible to dramatic changes in expenditure patterns (e.g. cycles of lockdowns and re-openings). The maximum retail value was observed at the height of annual expenditure around Christmas periods. Later, such effects are controlled for.

Conversely, the fairly stable Staple Index exhibits the lowest range – logical and expected as this comprised inelastic transactions with essential goods companies. Remaining dependent

variables, the majority of which do have high ranges, highlight the instability during the pandemic period via expenditure volatility.

Many variables displayed flatter, platykurtic distributions (indicated by negative kurtosis values). Some regressands, however, had negative skewness, implying concentration of larger values with some fringe low values, perhaps expected with the early pandemic crash.

Centred CCI has a large range and standard deviation, indicating great swings in consumer sentiment – reflective of changing attitudes towards restrictions (and stringency degree). We also note that the UK-weighted Restrictions stringency index reaches a height of 87.96, signalling the consideration of the best and worse phases of the pandemic. CPIH had a low mean and median in comparison to its maximum value, highlighting that the data includes some kind of inflation shock.



This histogram illustrates both distribution and negative skewness of weekly social expenditure throughout The Pandemic. Below-average values were uncommon but dragged the tail of the distribution to the left, suggesting that the triennium witnessed supressed social expenditure during times of lockdown or very stringent restrictions. Overall, restriction intensity was not maintained across the years, but the impact was noticeable. The heightened frequency density bars to the right of the illustration may indicate some recovery and resurgence during the periods of easing restrictions, whereas the spike ~40-50 points perhaps indicates a lockdown mode (most frequent band of values).

Figure III.1

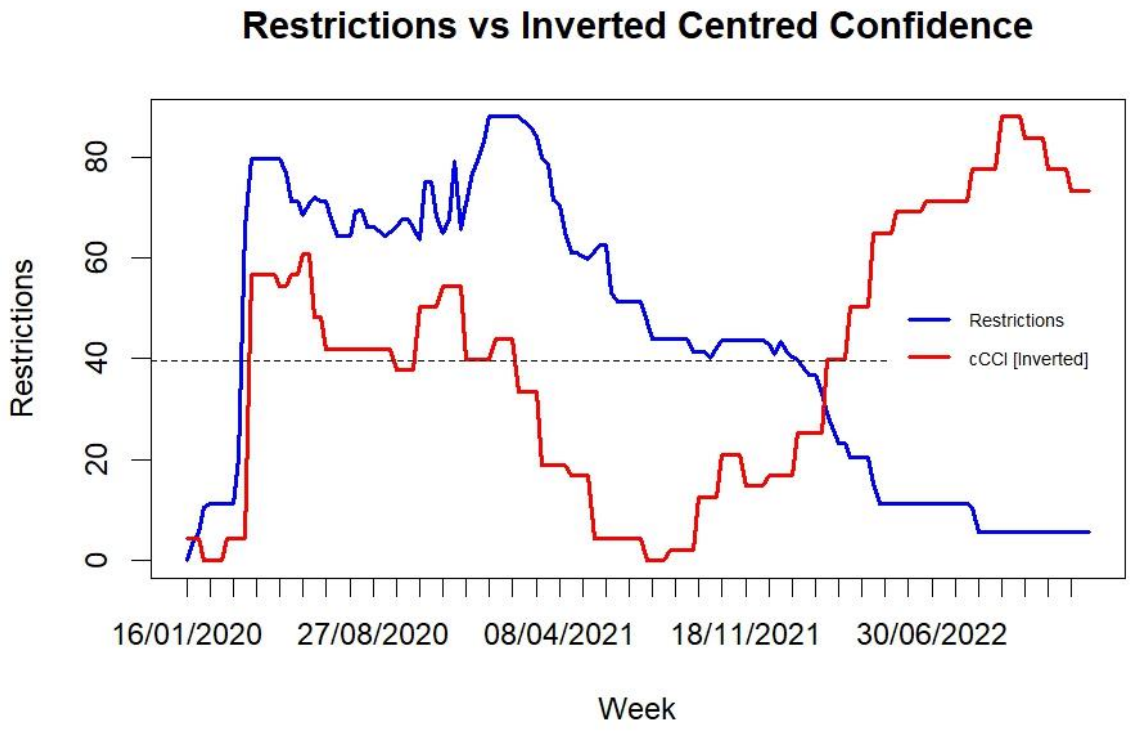


Figure III.1 highlights the inverse relationship between COVID-19 restrictions and centred CCI. The latter (red line) is inverted to demonstrate pattern similarity for the majority of the pandemic. The dotted line indicates pandemic-average confidence level. Such a graphical illustration evidences the expected inverse relationship between the variables. With the imposition of the first lockdown in March 2020, consumer confidence plummeted. Confidence increases (shown by a drop in the red line) as restrictions are eased. One may also notice how CCI declined with the sudden imposition of March restrictions – but the most severe lockdown period witnessed no such corresponding drop in confidence. One possible explanation is 'lockdown fatigue'. This may point to individuals not taking restrictions as seriously, having been subjected to them for prolonged periods, as discovered by Yeyati and Sartorio (2020). Research suggests diminishing effect of lockdowns, especially after four months of severe restrictions, may be a result of increasing non-compliance stemming from unsustainable economic and social suppression (Goldstein, Yeyati, and Sartorio, 2021).

Despite mirroring fluctuations in restrictions for most of the pandemic, confidence did begin to decline again despite restrictions easing. Apparent from late 2021/early 2022, the UK still

had some restrictions in place as a result of the 'Plan B' measures announced by The Government to combat spread of the Omicron variant (IfG, 2022). The worst phase of the Omicron epidemic was from late-December to mid-January (Elliot et al., 2022). Despite most of the UK returning to normal into 2022, Wales maintained some restrictions, explaining why the blue line of restrictions does not touch the horizontal axis. The great decline in CCI from this period onwards is likely a result of the Russia-Ukraine conflict (which escalated in February 2022), causing global supply chain issues, and confidence to plummet far below the pandemic-level mean. One reason for why confidence did not fall as far in the pandemic could be that Government support measures (e.g. the Furlough Scheme) may have improved individual's economic outlook somewhat. Another may be that full economic effects of the pandemic were not felt solely between 2020-2022, and that other factors come into play afterwards.

(iii) Regression Equation

Techniques vary throughout existing literature, from period-to-period expenditure level comparison (Chronopoulos, Lukas, and Wilson, 2020) to ordered logistical models (AbdulHussein, Cozzarin, and Dimitrov, 2022). Panel data approaches in the future would permit more complex models and analyses, and Differences-in-Differences frameworks may better imply causal relationships by estimating treatment effects before and after the pandemic. This paper, however, deliberately utilises a reliable ordinary least squares (OLS) regression model – similar to applications by Yazdanparast and Alhenawi (2022) – to test associations between expenditure categories and explanatory variables. We can determine whether each regressor had the effect implied by economic models and theory via statistical significance tests and interpretation of coefficient signs and values. This approach is more flexible than Differences-in-Differences, requiring no parallel trends assumption satisfaction, and less complicated than fixed-effects models, which rely on more stringent (and sometimes restrictive) assumptions. That being said, potential limitations include the risk of endogeneity, and the inability to account for unobservable time-invariant factors that fixed-effects designs would normally absorb.

Our model begins with a basic format comprising the aggregate expenditure index as the regressand, and the OxCGRT Coronavirus Restrictions Stringency Index as the regressor of

interest. Model complexity then increases, including control variables. By considering these, 'Restrictions' becomes more robust and immune to factors otherwise collected by the error term. We include variables that would otherwise be correlated with the regressand (and other regressors), attempting to avoid introducing bias by violation of the exogeneity assumption – and potentially model misspecification (Wilms et al., 2021). In addition to inducing coefficient bias, Omitted Variable Bias would also cause inconsistency (Antonakis et al., 2010). The intention is to observe *ceteris paribus* effects of restrictions on chosen expenditure-group regressors with precision. However, one should not hastily discard prior compelling arguments within econometric literature that state that *"[including] additional control variables may increase or decrease the bias, and we cannot know for sure which is the case in any particular situation"* (Clarke, 2005).

CCI (confidence) is centred to mitigate multicollinearity (indicated by inflated VIF values). This variant is used across all models, changing coefficient interpretation from a) the general percentage point increase/decrease in aggregate confidence having said effect on expenditure, to b) the general percentage point increase/decrease around the COVID-19 pandemic average having said effect on expenditure.

A 'Base Model' template then appears to form. This is the OLS regression model from which overall results can be drawn, and to which comparisons can be made. The construction process is repeated and adjusted (where necessary) for subsequent dependent variables. Once a strong model structure has been established, several tests are conducted and repeated until results are deemed statistically sound.

In formulating the Base Model, it became apparent that a quadratic transformation of the CCI was required to capture diminishing marginal effects of confidence on expenditure (which may indicate diminishing responsiveness to prolonged uncertainty), and to not reject the RESET null of correct specification. For seasonally-unadjusted data, eleven monthly control dummies were included (leaving January as the base month). Adjustments were made prior to the iterative regression testing (rigorous and methodical trials to ensure the model was correctly specified, robust, and reliable).

First series of tests include James B. Ramsey's Regression Equation Specification Error Test or 'RESET' (1969) for model misspecification. With a null hypothesis of no misspecification, a small p-value is indicative of the model requiring adjustments. In running this test at an

early stage (on a very unsophisticated model), it was evident that adaptations were necessary. Upon passing the RESET, said models appear to be clear of omitted explanatory variables and incorrect functional forms (Ramsey, 1969), however, it is also vital to note that the RESET does not indicate which type of specification is most appropriate.

The Durbin-Watson Test (1950) was specifically employed to detect first-order autocorrelation. The null hypothesis (H_0) of no autocorrelation was used as outlined by Durbin and Watson (1950) in *Biometrika*, inferring that error terms between two time periods are uncorrelated (and $\rho = 0$). A large p-value was desired to rule out serial correlation (i.e. not reject the null hypothesis). In all models, some degree of first-order serial correlation was discovered at the early stages. It was vital to avoid autocorrelation to prohibit introducing bias – which Cochrane and Orcutt (1949) highlight can be present in both correlated error terms, and the biased estimators of coefficients themselves.

Combatting instability, residual PACFs were performed, highlighting if (and how) variables were correlated with their past-period values. At these periods (indicated by large visible spikes), lags were introduced to stabilise the model, and by extension, coefficients. Oftentimes, this solved both specification and autocorrelation issues. To observe and mitigate potential correlations over longer time periods, the Breusch-Godfrey Test was also employed.

The fourth test was the Breusch-Pagan test with a null of homoskedasticity, and he alternative of heteroskedasticity in error terms. Some models (work-related, and pub, restaurant, and fast-food expenditure) exhibited large p-values (>0.05) and homoskedasticity (constant variance of the error term). The rest displayed heteroskedasticity, ergo, robust standard errors were used. Alternatively, GLS may be employed as a solution.

The above were repeated (where necessary) to pass model selection tests. Statistically insignificant variables were also dropped to avoid skewing standard errors and ensure the explanatory variable of interest was as robust as possible.

The final 'Base Model' for aggregate expenditure may be presented as:

$$AE = \beta_0 + \beta_1 RESTRICTIONS + \beta_2 CPIH + \beta_3 UNEMPLOYMENT + \beta_4 FURLOUGH + \beta_5 CONFIDENCE_C + \beta_6 CONFIDENCE_C^2 + \lambda_i LAGS + \varepsilon$$

Subsequent models, allowing for further comparison, generally follow the following structure (albeit with some minor modifications such as omission of insignificant variables):

$$Exp.Category = \beta_0 + \beta_1 RESTRICTIONS + \beta_2 CPIH + \beta_3 UNEMPLOYMENT + \beta_4 FURLOUGH + \beta_5 CONFIDENCE_C + \beta_6 CONFIDENCE_C^2 + \lambda_i LAGS + \delta_i MONTHS + \varepsilon$$

Using these regression models, we test aforementioned relationships. We expect declines in most expenditure categories (and aggregate expenditure) because of restrictions – this methodology enables determination of the degree to which this actually occurred. We would believe social, delayable, and dining-out indices to be impacted to a greater degree than aggregate expenditure – given the focused clamp-down on such activities. Insignificant impacts of restrictions on dining-out would demonstrate perfect adaptability of businesses towards online-delivery business models. We investigate whether restrictions had impacts on staple expenditure (food and utilities). Research finds that panic-buying increased supermarket expenditure during the first lock-down period – with such models, we assess whether such panic-buying effects were prolonged or short-lived. We expect that increased pressure would be unsustainable, given 'lockdown-fatigue', monetary constraints, and changing conditions over time.

We can also test whether present-bias and time-inconsistent preferences appear visible during the pandemic in three ways: 1) Negative statistically significant staple index lags may indicate overspending on essentials and overweighting of immediate utility consistent with quasi-hyperbolic discounting as defined by Cartwright (2018) whereby agents overweight immediate consumption and reduce expenditure in future periods, 2) Insignificant lags of social expenditure categories would support putting off future experiences that were planned during lockdown (whilst significant, positive lags of social expenditure categories point to the release of pent-up demand), and 3) Positive lags of delayable expenditure could point towards present-bias and time-inconsistency upon easing of restrictions.

These inferences, amongst others, may be drawn from coefficient signs, values, and significance. A simple t-test (or glance at p-values) can indicate whether the variables had a statistically significant impact on the expenditure categories or not. The null hypothesis (H_0) implies that the coefficient is equal to zero, and thus insignificant at the given level. A large test statistic or small p-value would mean rejecting the null in favour of the alternative hypothesis (H_1)- indicating coefficient significance ($\beta_i \neq 0$).

IV. Results

Results Tables:

	Aggregate Expenditure	Delayable	Social	Staple	Work-Related
Intercept	57.332** (17.417)	122.229*** (31.260)	9.029* (3.606)	41.691*** (8.630)	-14.052 (10.118)
Restrictions	-0.119** (0.045)	-0.425*** (0.108)	-0.465*** (0.125)	-0.014 (0.016)	-0.132* (0.060)
CPIH	1.888** (0.665)	-2.323** (0.748)	-0.119 (0.240)	1.010*** (0.190)	5.235*** (0.954)
Unemployment	2.990^ (1.530)			4.653*** (0.912)	10.751*** (2.349)
Furlough(Millions)	-0.408 (0.479)		-0.571* (0.268)	-0.267^ (0.147)	
Confidence(c)	0.256** (0.093)	0.120 (0.107)			0.538*** (0.088)
Confidence^2(c)	-0.008*** (0.002)	-0.022*** (0.006)			-0.017*** (0.004)
Independent Variable Lag(s)			β_1 [1]0.444*** (0.123)		
Dependent Variable Lag(s)	[1]0.468*** (0.125) [8]-0.151* (0.061) [20]-0.103* (0.040)	[1]0.545*** (0.131) [8]-0.175** (0.063) [12]-0.112* (0.051) [20]-0.148** (0.049)	[1]1.086*** (0.064) [2]-0.169** (0.063)	[1]0.286* (0.118)	[1]0.425*** (0.082) [4]-0.031 (0.050) [8]-0.007 (0.044) [12]0.035 (0.044)
Seasonal Dummies	NO	NO	NO	NO	NO
Robust Standard Errors	YES	YES	YES	YES	NO
R^2	0.913	0.660	0.977	0.717	0.961
$\bar{R}^2$	0.907	0.639	0.976	0.708	0.959

Table notes: Coefficient significance code: '***' = 0.001; '**' = 0.01; '*' = 0.05; '^' = 0.10. Otherwise infers insignificance. Standard errors are reported in parentheses. Lag periods are

reported in square brackets. Please keep in mind that dependent variables are indices, and not Pound Sterling values. (c) denotes centred variables (around pandemic-level averages). Some regressors were omitted to make the explanatory variable of interest more robust.

	Automotive and Fuel	Entertainment	Pubs, Restaurants and Fast-Food	Retail
Intercept	10.035 (12.486)	48.238*** (7.447)	38.494*** (10.536)	87.061*** (18.835)
Restrictions	-0.274*** (0.075)	-0.419*** (0.080)	-0.256* (0.101)	-0.162 (0.166)
CPIH	2.839** (1.079)	-	2.786* (1.090)	6.419*** (1.156)
Unemployment	8.969** (3.000)	-	-	22.578*** (3.715)
Furlough(Millions)	-0.965^ (0.547)	-1.308* (0.641)	-	-6.786*** (0.981)
Confidence(c)	0.081 (0.096)	-	0.188** (0.066)	-
Confidence^2(c)	-0.017** (0.006)	-	-0.018** (0.006)	-
Independent Variable Lag(s)	-	-	-	-
Dependent Variable Lag(s)	[1]0.571*** (0.083)	[1]0.488*** (0.081)	[1]0.643*** (0.066) [10]-0.072 (0.047) [20]-0.078*	[2]-0.281** (0.085) [6]-0.091 (0.074) [12]-0.023 (0.051) [16]-0.020 (0.047)
Seasonal Dummies	YES	YES	YES	YES
Robust Standard Errors	YES	YES	NO	YES
R^2	0.967	0.943	0.973	0.881
$\bar{R}^2$	0.963	0.937	0.969	0.862

Table notes: Same as above. Significance: '***' = 0.001; '**' = 0.01; '*' = 0.05; '^' = 0.10.

A. Base Model

The Base Model reveals three key findings: 1) Restrictions significantly reduce aggregate household expenditure throughout the pandemic; 2) Overall inflation did not curtail expenditure – reflecting inelastic demand for essentials; and 3) the impact of confidence on overall spending levels is concave with diminishing effects.

With aggregate expenditure index as the regressand (representative of the wider economy), we observe that restrictions correspond to a strongly statistically significant ($p<0.01$) decrease in aggregate expenditure. Economic intuition, set out in early workings by Marshall (1890), and findings outlined in studies by Janzen and Radulescu (2022), Baker et al. (2020), and Byrne et al. (2020) would lead us to expect this inverse relationship. We infer that 10% greater restriction stringency corresponds to a 1.2 percentage point decrease in overall expenditure. Furthermore, the maximum UK weighted average restrictions value (87.96%) implies an aggregate expenditure decline of ~10.4 percentage points. Reviewing the disastrous first quarter of 2020, the ONS reported that GDP fell by 10.4% (Scruton, 2020). Two-thirds of GDP(E) is household consumption (OBR, 2025). So, although not directly comparable (given GDP includes more than consumption), the restrictions coefficient aligns surprisingly well with the decline reported by the ONS – reinforcing the robustness and reliability of the model.

With equal statistical significance, we infer that a 1% increase in inflation corresponds to a 1.9 percentage point increase in aggregate expenditure, suggesting that despite rising prices throughout The Pandemic, overall inelasticity and inflexibility of demand (perhaps with emphasis on essential goods and utilities) remains. That may mean that individuals were forced to expend to such a degree on such items (as opposed to elastic, delayable spending), that this coefficient is positive.

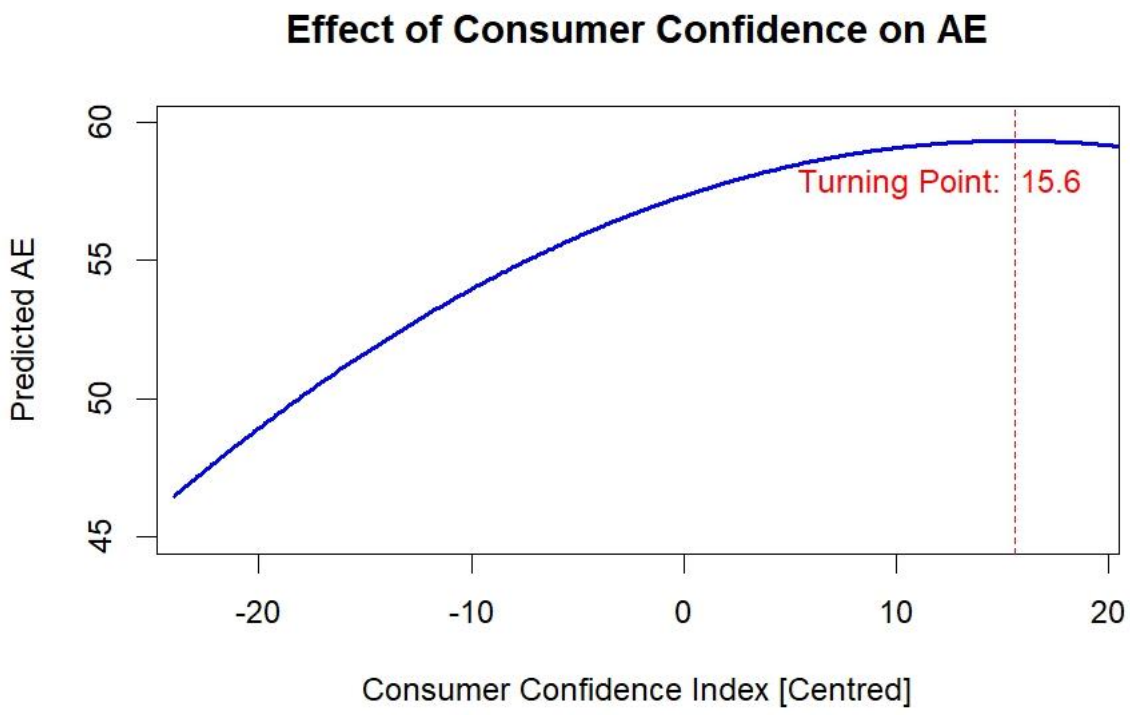
‘Unemployment’, only statistically significant at the 10% level shows that increasing the unemployment rate by 1% would be associated with a 3 percentage point increase in aggregate expenditure. Perhaps counterintuitive, as one would expect that job losses result in lower income and expenditure, explanations for the positive correlation between the two include government stimuli, or greater expenditure on benefit payments. It is worth remembering that many households felt the need to spend more on essentials regardless of

employment status. Alternatively, this may reflect limitations of the model and influence of omitted variable bias (OVB) as highlighted by Antonakis et al. (2010).

Furlough was statistically insignificant, indicating that despite strong evidence of precautionary saving, as defined by Jones (2018), such phenomena are only observable at a sectoral level featuring products with greater price and income elasticities of demand.

Centred CCI produces fascinating Base Model results. We would expect increasing aggregate expenditure from greater confidence, with reductions in uncertainty catalysing transactions. The model implies that increasing the CCI by 1% above pandemic-level average corresponds to an increase in aggregate expenditure by 0.256 percentage points. To ensure correct model specification, we outlined how including a quadratic transformation of CCI can aid in capturing non-linearity. Both CCI and CCI^2 were statistically significant from at least the 1% level, with positive and negative coefficients indicating a concave function.

Figure IV.1



Utilising both CCI variations, we show concavity and diminishing returns to confidence on expenditure. We illustrate a turning point of 15.6 – implying that beyond 15.6% above

pandemic-level average confidence, marginal increases in consumer sentiment have diminishing effects. Increasing CCI by 1% no longer raises aggregate expenditure by the same amount as the previous percentage increase. Such inference may help future policymakers strike a balance between national restrictions and economic activity should a similar situation arise and also highlights the importance of improving confidence early – perhaps via information campaigns (albeit with optimism yielding diminishing returns).

The Base Model incorporates three dependent variable lags for stability – all minimally significant at the 5% level. The immediate-term lag implies that if aggregate expenditure in week $t-1$ increases by 10%, one would expect the value in week t to be 4.6% greater. This short-term positive correlation may stem from the effect of panic-buying/stockpiling of goods and having to wait until the following period (week) when inventories were replenished to purchase essentials.

The medium-term, 8-week horizon lag shows a different relationship with the dependent variable. If aggregate expenditure in week $t-8$ is 10% greater, we would expect it to be ~1.5% lower in week t. This suggests attitudes changed over the medium-term. One may note that the Furlough Scheme was also introduced exactly two-months into the dataset. Many on the scheme did not receive the same levels of income that they had been accustomed to with their annual salary, as a result, individual appeared more cautious with expenditure, questioning furlough and pandemic/restrictions duration. This would be a more gradual effect, as opposed to the aforementioned insignificant instantaneous impact.

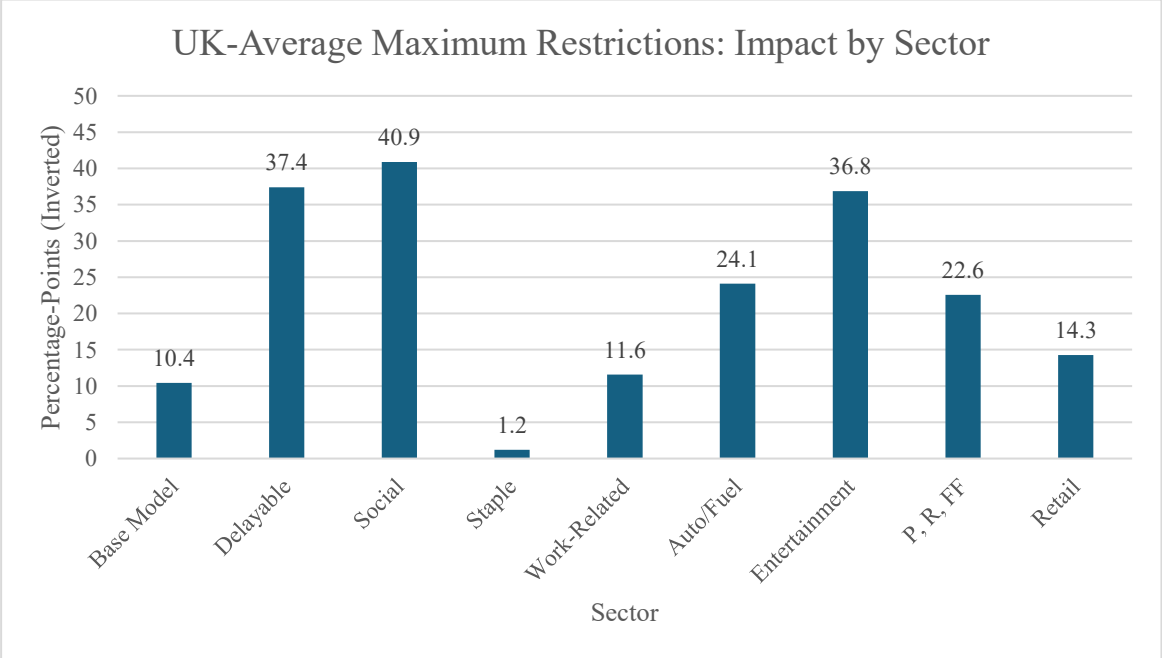
The longer-term 20-week lag is consistent with this interpretation. With sustained unemployment and uncertainty in the economy, it appears that people make fewer discretionary purchases overall, although adjustments in behaviour and attitudes take place (and are absorbed by markets) over time. One may also observe prolonged supply-chain issues if expenditure in some sectors of the economy declined as a result of lack of inventories.

We report that the adjusted coefficient of determination for most models exceeds 90% for completeness, although should be interpreted cautiously considering the nature of time-series data.

B. Expenditure Categories

	Base Model	Delayable	Social	Staple	Work-Related
β_1	**-0.119*****	-0.425***	-0.465***	-0.014	-0.132*
Restrictions (X_1) increase by 10%	**-1.186pp**	-4.251pp	-4.648pp	-0.138pp	-1.316pp
Restrictions (X_1) increase by pandemic maximum	**-10.436pp**	-37.393pp	-40.885pp	-1.214pp	-11.575pp
	Automotive and Fuel	Entertainment	Pubs, Restaurants, and Fast-Food	Retail	
β_1	-0.274***	-0.419***	-0.256*	-0.162	
Restrictions (X_1) increase by 10%	-2.739pp	-4.189pp	-2.564pp	-1.621pp	
Restrictions (X_1) increase by pandemic maximum	-24.091pp	-36.847pp	-22.550pp	-14.260pp	

Table notes: Coefficient significance code: '***' = 0.001; '**' = 0.01; '*' = 0.05; '^' = 0.10. Otherwise infers insignificance. Please keep in mind that dependent variables are indices, and



not Pound Sterling values. β_1 is the coefficient of Restrictions (X_1). Pandemic level maximum of this variable is a weighted average for the UK (87.96). 'pp' denotes percentage point increases/decreases in the dependent variable (listed above).

Deeper sectoral analysis of Pandemic restriction impacts on household expenditure provide vital insight into which areas of the economy are likely to be hardest hit should another pandemic (or comparable situation) occur.

Importantly, the impact of restrictions on staple expenditure was statistically insignificant. This index comprises essential-good providing companies, mostly supplying food and utilities. Consistent with theory, where individuals prioritise spending on covering basic needs, this lack of statistical significance indicates that panic buying was merely unsustainable short-term stockpiling which had no real significance on overall trends – possibly a result of lockdown fatigue as defined by Yeyati and Sartorio (2020). Chronopoulos, Lukas and Wilson (2020) discovered that a week into the first lockdown, grocery expenditure per household was £30 higher than at the start of January 2020. Additionally, Baker et al. (2020) and Byrne et al. (2020) highlight the (at least initial) positive correlation between restrictions and grocery-sector spending. However, such high levels would be recognised unless the index is heavily overweighted with utility companies. It appears more likely that panic-buying-induced volatility was short-lived. Another explanation (beyond lockdown fatigue) could be that throughout the pandemic, businesses adapted to an online-shop/home-delivery system, pulling excess expenditure away from food companies, rediverting it towards somewhat-recovered pub, restaurant, and fast-food sectors. Alternatively, panic-buying expenditure levels on food and groceries may have been offset by a decline in this spending category during periods of lesser restrictions. Here, individuals moved away from cooking at home, and in some situations, were able to dine out.

For staple expenditure, inflation appears a statistically significant determinant of greater spending. An increase of 2% in CPIH corresponds to a *ceteris paribus* 2.02 percentage point rise in the staple index, highlighting inelasticity associated with essential goods purchased to cover basic needs. Like aggregate expenditure, realised demand for staple products did not fall because of restrictions, but increased despite inflation – reflecting the longer-term supply-side production costs highlighted by Marshall (1890). We observe an inverse relationship between Furlough Scheme numbers, and essential expenditure (albeit at the 10% level), appearing to indicate that with lower cross-pandemic income, individuals adjust in such a way

to limit their spending – likely building a savings buffer for times of potentially greater future uncertainty. This is consistent theory proposed by Jones (2018) and early findings by Yazdanparast and Alhenawi (2021). Despite some early evidence of borrowing to finance expenditure on essential goods (supporting Friedman's 1957 Permanent Income Hypothesis) – as reported by Baker et al. (2020) and indicated by Celik, Ozden, and Dane (2020a) – it appears that across the Pandemic, individuals are unlikely to borrow amid such uncertainty to maintain consumption levels. Instead, intertemporal consumption smoothing may be seen in extended precautionary saving of furlough income. Future studies on the relationship between furlough schemes and household debt may provide more clarity.

Insignificance of 'Restrictions' means that any present-biased and time-inconsistent preferences, as defined by Cartwright (2018) and captured by DellaVigna and Malmendier (2006), are not conclusively observed across the entirety of the pandemic period. The sign of the lagged staple index variable is positive and significant at the 5% level – indicating that expenditure did not decline in future periods as a result of overweighting immediate utility and overspending in the present – as this theory may predict.

Despite statistically insignificant findings with respect to the staple index, one should remember intra-categorical expenditure and behavioural changes, as recorded by Celik and Dane (2020b), may still exist over the period. Overall, with comparisons against the Base Model of aggregate expenditure, it appears that across the entirety of the pandemic, staple expenditure was one sector that was unaffected by restrictions.

We observe a statistically insignificant 10% increase in restriction stringency associated with a 1.6 percentage point decline in retail expenditure index sales. From the supply-side of the economy, the furlough scheme may have helped job retention and ensured businesses could remain open – as recorded in European countries by Janzen and Radulescu (2022). Additionally, greater digitalisation of this sector (catalysed by the pandemic) and increasing growth in online retail, as documented by Bahaj, Piton, and Savagar (2024), may indicate that by moving away from customer-facing models and focusing on delivery, spending habits were unaffected by restrictions. Such adaptability would show an industry fighting against exogenous, government-imposed supply restrictions and exploring alternative options to increase effective demand (and realise latent demand) as much as possible. The negative, statistically significant two-week retail expenditure lag may also point towards greater levels of precautionary saving amid heightened uncertainty, with consumers seeking to save over

time as uncertainty grows into the pandemic. This theory appears to be supported by the strong inverse relationship between retail expenditure and the furlough scheme – with an increase of one million individuals on furlough associated with a 6.8 percentage point decrease in spending. From the regression model, one may infer that inflation, unemployment, and furlough are the main determinants of changes in retail expenditure across the pandemic.

The delayable index, capturing some of the retail sector, but also furnishing companies was one of the most affected. From above, both a 10% and pandemic maximum increase in restrictions are associated with a *ceteris paribus* 4.3 and 37.4 percentage point decrease in delayable expenditure respectively. Unlike the inference with the pure retail category, furnishings are normally much more costly, and individuals are more likely to want to view stock in-person prior to purchasing (consider ordering a t-shirt online against visiting a store to test the comfort of a new three-piece suite). This, coupled with the aforementioned precautionary saving as an insurance against worsening circumstances as described by Jones (2018), the demand-elasticity of the sector, and limits to digital adaptation (one can only view so much online), can be key reasons for such a significant impact of restrictions.

Such findings are consistent with those of Eichenbaum, Rebelo, and Trabandt's 2021 model, as with greater emphasis on customer-facing sales, lockdown restrictions have greater impacts on expenditure. Additionally, statistically significant findings for the whole period show an extension of the early inverse relationship recorded by Byrne et al. (2020). Importantly, the strong significance of the lagged dependent variable supports the modern theories of present-bias and time-inconsistency. A positive immediate-term one-week lag and negative effects extending into the medium-term may indicate an explosive reaction to pent-up demand when restrictions ease, despite consumers opting to be financially frugal during high-restriction periods. Subsequent effects indicate this short-term expenditure is unsustainable. The above, in comparison with the overall economy, make delayable expenditure the second hardest hit sector in this analysis. When restrictions are severe, the delayable expenditure group of companies are likely to be impacted to a degree over three times greater than the economic-sector average.

Social expenditure, including business transactions centred around travel and eating-out, was unsurprisingly the most affected by pandemic restrictions. At the height of the pandemic, one would expect a decline in sectoral expenditure by over 40 percentage points – almost four times greater than shown in the Base Model. This is also consistent with the model findings of

Eichenbaum, Rebelo, and Trabandt (2021) whereby individuals (especially the most susceptible to the virus) self-select out of consuming social experiences, with simultaneous recession exacerbation.

However, despite the above, one may look beyond the instantaneous effect of restrictions and consider the effects of unrealised latent demand – as defined by Clifton and Moura (2017). We observe strong evidence of the diminishing effects of lockdowns, supporting the literature and findings of Goldstein, Yeyati, and Sartorio (2021), and 'lockdown fatigue' as defined by Yeyati and Sartorio (2020). With a strong negative immediate impact of restrictions, and positive lagged recovery, we observe what might be described as a 'Rebound Effect' – the visible compensation for suppressed pandemic expenditure once restrictions begin to ease. Interpretation of the coefficients imply that a 10% increase in the stringency of restrictions in the previous period corresponds to a *ceteris paribus* increase in social expenditure by 4.4 percentage points in the present. Additionally, captured delayed effects imply that after one period of high expenditure, social spending is likely to remain high, albeit with a reduction in intensity (and perhaps a correction) from the second period onwards. Such results also indicate consumer's present-bias in immediately expending upon ease of restrictions (and not delaying experiences despite lingering risk of infection), and time-inconsistent preferences as outlined by Cartwright (2018) in the way that despite intending to remain cautious, individuals overconsumed and in subsequent periods readjusted to consider budget constraints, intertemporal consumption, and returning to precautionary saving as defined by Jones (2018). We may also capture some effect of individuals succumbing to COVID-19, having caught the virus in the present or period 1, and then having to isolate in period 2. We also note insignificance of inflation and imply that the more individuals on the furlough scheme, the more social expenditure declines, indicating precautionary saving in times of uncertainty.

Pub, restaurant, and fast-food expenditure was also greatly impacted by Coronavirus restrictions, with pandemic-era maximum stringency associated with a decline of over 20 percentage points in expenditure. Although damaging to the sector and twice as bad as results in the Base Model, this indicates a recovery with a lesser impact than the ~50% decline initially reported by Chronopoulos, Lukas and Wilson (2020) in the first lockdown. The inverse relationship, also discovered early by Baker et al. (2020), is not as severe as the overall social expenditure decline detailed above. This provides indication of this specific

facet showing better recovery, perhaps catalysed by the adaptability of businesses to harsh conditions, a proposition supported by Baker et al. (2020) and Relihan et al. (2020, quoted in AbdulHussein, Cozzarin, and Dimitrov, 2022) who reported a significant increase in food delivery expenditure.

We also observe a positive relationship between inflation and expenditure in the pub, restaurant, and fast-food sector, perhaps indicating that despite rising prices, individuals value the experience of dining-out more than the associated greater costs. Furthermore, when confidence in the economy improves, there is an associated boost in expenditure – however, we observe diminishing returns to confidence, as seen in the Base Model. The signs of the lagged coefficients also imply that we witness not only 'lockdown fatigue' and the 'Rebound Effect' when restrictions ease but also present-biased and time-inconsistent behaviours (as outlined above), indicating a large degree of unrealised latent demand during severe lockdown periods.

In a more succinct overview of remaining models, we observe findings similar to the social model in the entertainment expenditure model. With some overlap between definitions of the two, the slightly lesser impact upon entertainment expenditure may be a result of the inclusion of travel-related expenditure of the former. Nonetheless, the early inverse relationship between restrictions and entertainment spending, as reported by Baker et al. (2020), is clearly apparent. Other relevant variables may be interpreted as above.

Work-related and automotive and fuel models are also similar in definition, with the key difference being that the former includes public transport transactions. As such, the significant, but lesser impact of restrictions on work-related expenditure indicates a degree of reliance on public transport despite The Pandemic. A 10% tightening in restriction stringency was associated with a 1.3 and 2.7 percentage point decline in expenditure for each respective index.

Unlike above interpretations which infer behavioural patterns and consumer behaviour, these two categories are more directly associated with whether individuals were allowed to work or not. These models indicate that should the price level increase, expenditure will follow suit – expected given the inelasticity derived from individuals having to work. Unsurprisingly, the unemployment rate also has a greater effect on work-related and automotive expenditure than restrictions, and positive short-term (one-period) lags highlight continued increased

expenditure (likely a result of the economy returning to normal). The work-related model noticeably shows a strong impact of consumer confidence, whereas the automotive model does not. This may mean that as confidence increases, expenditure on public transport (as opposed to other methods) increases, and individuals are more comfortable interacting with each other, thus lessening the decline in this sector – consistent with the findings of the two-way model implemented by Eichenbaum, Rebelo, and Trabandt (2021).

V. Concluding Remarks

To summarise, this paper investigated how COVID-19 restrictions impacted household expenditure across sectors in the UK. Using models and theory, including the Permanent Income Hypothesis (Friedman, 1957), demand elasticities, latent versus realised demand, and behavioural economics, we expected prioritisation of essential goods as noted by Chronopoulos, Lukas, and Wilson (2020), Baker et al. (2020) and Byrne et al. (2020) – perhaps funded via debt or government transfers – and a complete collapse in social/entertainment/dining sectors depending on the degree of human-interaction as implied by Eichenbaum, Rebelo, and Trabandt's (2021) two-way model. Technological adaptation and lockdown fatigue, as defined by Yayeti and Sartorio (2020) meant some early-recorded relations may not persist.

Empirical results confirm that restrictions significantly reduce household expenditure, with aggregate expenditure declining by over 10 percentage points at peak UK stringency values. Notably, the social and elastic delayable sectors suffered disproportionately greater declines – with the former experiencing a 40 percentage point reduction. Contradicting early publications of Baker et al. (2020) and Byrne et al. (2020), we found no significant change in staple (essential) expenditure – likely reflecting both unsustainability of early panic-buying and lockdown fatigue. Additionally, it appears that technological adaptation and the expansion of the online retail space reported by Bahaj, Piton, and Savagar (2024) increase supply in the sector to such an extent that restrictions are statistically insignificant. Households also dramatically reduce retail expenditure when on the Furlough Scheme. Despite early evidence of borrowing to finance essential expenditure, consistent with Friedman's (1957) theories, introduction of furlough payments implies financing future consumption via saving this income rather than borrowing.

Based on these findings, we recommend the following actions: 1) Invest in digital infrastructure for the most vulnerable sectors to ensure provision of goods/services against future shocks; 2) Rapidly implement furlough-type schemes – especially if debt levels are already worryingly high and loan forbearance unlikely – this discourages further borrowing; and 3) Deliver transparent and confidence-boosting information campaigns to prevent extreme declines in aggregate expenditure. Future research could further explore relationships between household debt and furlough, intertemporal consumption decisions, and the supply-side impacts of digitalisation on provision of goods and services.

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