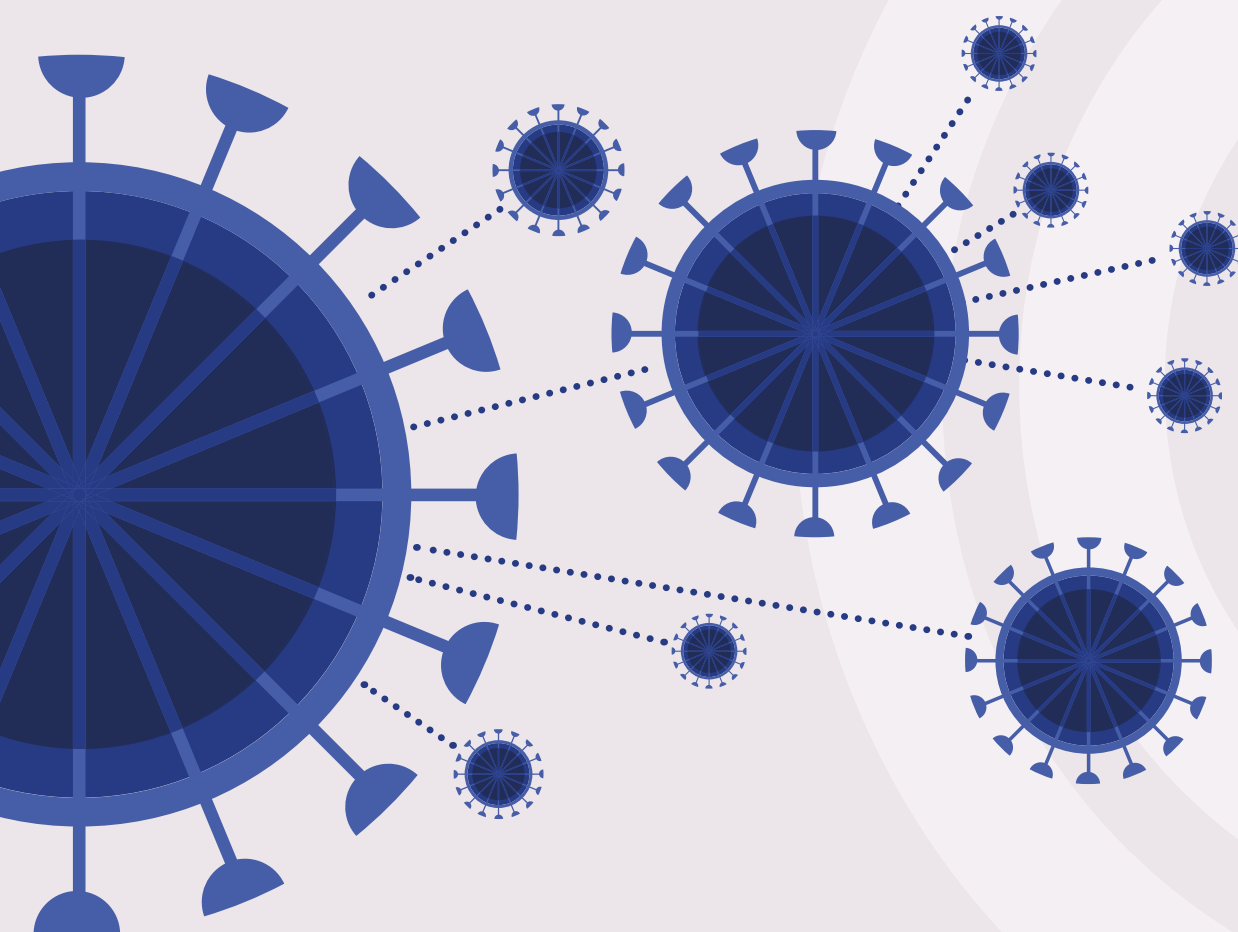


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Prices and inflation in a pandemic - a micro data approach

Richard Davies



Prices and inflation in a pandemic – a micro data approach

CEP COVID-19 ANALYSIS

Richard Davies, February 2021

Summary and recommendations

- The Covid-19 crisis has caused instability across the economy, including to prices and inflation. Since the onset of the crisis, price volatility—the proportion of prices changing between months—has been higher than in any comparable period since 1991. This briefing examines 36m consumer prices covering 1988-2020 to assess the sources of this volatility at the level of individual goods and services, regions, and types of firm. A companion paper presents the dataset, background literature, and technical results in full.
- On average one-fifth of consumer prices change each month. Historically, shocks have caused this share to rise, as more firms adjust their prices. So far, the pandemic has led to price volatility: an increase in the regularity of *both* cuts and hikes in prices. Crises in 1992 and 2008 had similar effects. By contrast, the 2016 EU referendum result was straightforwardly inflationary, leading to more price rises and less price cuts.
- At a sectoral level, the biggest changes have been in lockdown-sensitive sectors including hospitality, recreation, and culture. Yet the 30 most impacted individual items are from a wide variety of sectors: the prices of contact lenses, books, pineapples, and takeaway food have all become significantly more volatile than pre-pandemic. Prices for services (e.g. haircuts, plumbing) have changed much less, consistent with the historical pattern.
- VAT changes have a considerable price impact. Across the 32-year period VAT adjustments produced the most volatile single months on record. The VAT holiday introduced in August 2020 matched this pattern, driving significant price reductions. Many of these appear to have been short lived, with the number of price rises increasing shortly afterwards.
- Prices of identical goods diverge by region. To date the impact of Covid-19 appears to be similar across UK regions, with some differences emerging in London. Given the ‘localisation’ of lockdown policies towards the end of 2020, and shortages in Northern Ireland, the regional price impact will be important to track in coming months.
- Firm size matters. Large firms’ prices are almost twice as flexible as those of small firms. This pattern, seen in response to Covid-19 also holds in the long run data.
- The open data approach adopted by the ONS allows these questions and others to be tracked in close to real time. In line with this, the data used in this briefing and the related background paper is being made available online.

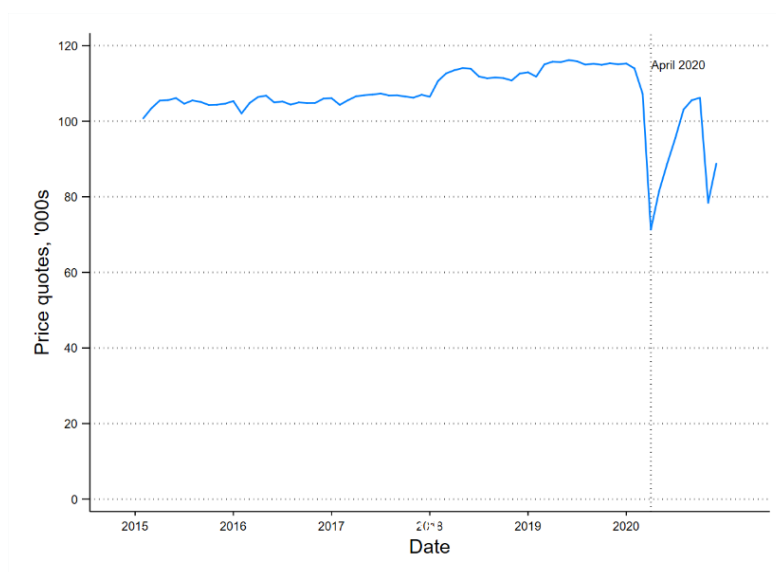
Introduction

The Covid-19 lockdowns and recession are the most exceptional economic events in living memory and will impact the economy for years to come. One vital channel is via price changes. Price rises and cuts alter real wages, influencing consumer spending power. They have knock-on effects, via the official consumer price index (CPI), on regulated payments and costs including pensions, inflation-protected bonds and utilities. The degree of price flexibility in an economy also influences the impact of monetary policy.¹ The way prices are evolving is thus a vital question in understanding the economic impact of pandemic. While some Covid-19 related questions will take years to answer, the availability of ‘micro’ data for the UK means that the impact on prices is something we can track in close to real time.

The price data used in this briefing come from records collected and published by the Office for National Statistics (ONS). The monthly ‘price quote’ files track the item sold, the shop selling it, and the UK region in which it is located. Data are available between February 1988 and December 2020. The final clean dataset contains 36m observations.²

The extraordinary impact of Covid-19 can be clearly seen immediately in a graph showing the availability of data. Much of the data is collected ‘by hand’, as ONS agents travel to shops and collect the prices using scanners. Despite various crashes and crises since the late 1980s this process continued—but in many cases it was not possible during the Covid-19 lockdowns. The monthly number of price quotes fell from an average of around 115,000 in 2019 to 71,000 in April 2020 as business were forced to close. This lower level of price collection persisted for three months before abating. The latest data shows another drop as lockdowns have been re-introduced (Chart 1).

Chart 1. Price quote availability, 2015-2020



¹ See Nakamura et al (2018).

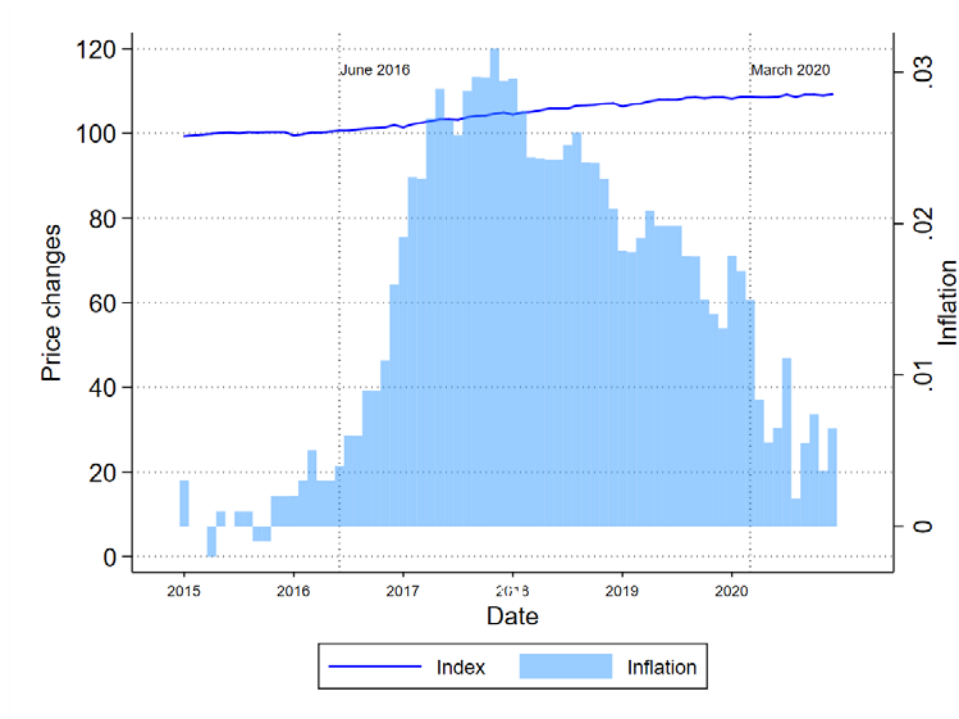
² The process by which the files were cleaned and corrected is set out in a companion paper, which also discusses the wider academic literature (Davies, 2021).

Economic shocks often have an impact on inflation. The EU referendum result, for example, led to a steady rise in price pressure with inflation rising from below 1% to over 3% over 18-month period (Chart 2). The underlying micro data show that this was due to a fall in the number of price cuts, and an increase in the number of prices that were rising. With the net balance of price changes tending to be increases, inflation quickly rose.³

So far, Covid-19 has been different in two ways. First, volatility. Inflation had been falling steadily since 2017 but the first quarter of 2020 saw a pickup: researchers using scanner data found a sharp reduction in sales. Inflation, a weighted measure of price changes, rose.⁴ Since then there have been swings in the inflation rate of up to a percentage point. This is large by historical standards. Second, disinflation. Following the initial spike, the pandemic has, at an aggregate level measured by the CPI, been disinflationary.

These patterns, together with the acutely sectoral and regional nature of the crisis raise important questions. How does Covid-19 compare to previous crises? Which types of goods have been most affected? Have regions of the UK had different experiences? What role has policy played?

Chart 2 Covid-19 and the headline CPI



³ See Dhingra and Sampson (2019)

⁴ See Jaravel and O'Connell (2020).

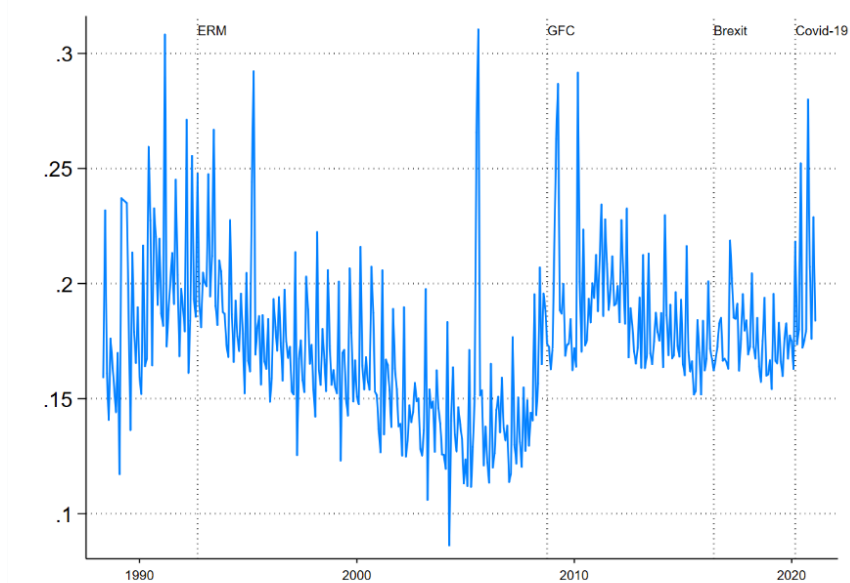
Price changes during the pandemic

The long-run micro data provides benchmark facts on price changes in the UK. Price changes are common: 19% of prices change month on month.⁵ Of these price changes, 45% were reductions and 55% were increases. Prices are more volatile over the short term (month to month) than they are at an annual horizon. The average annual rate of inflation over the sample is 2.7%, compared to this the median month-to-month price change is large, close to 13%.⁶ These facts are in line with international experience.⁷ The similarity in historical patterns suggests UK's Covid-19 experience may be indicative of that in other countries.

Covid-19 has generated significant and sustained price volatility. Since the onset of the crisis in March 2020 the proportion of prices changing was between months was 24%. This is higher than in 2008 or 2009 (the previous high, in 1991, was 25%).⁸ Some years have a single month in which many prices change (often reflecting a VAT shift, see below). The difference in 2020 is the repeated pattern of volatile months (Chart 3).⁹

Price changes were divided almost exactly equally between price rises and falls.¹⁰ This pattern appears to be closer to that experienced in 1992 and 2008 than the more recent EU referendum shock discussed above. In the periods following both these earlier crises there was a significant increase in *both* price rises and price cuts—volatility, but with no clear inflationary direction.

Chart 3. Share of prices changes compared to previous month, 1988-2020



Notes: Percentage of prices changing between months. The chart excludes a spike that occurred in January 2011 caused by a VAT change. VAT is discussed in detail below.

⁵ The figures in this paragraph are the long-run averages *excluding* the Covid-19 period, i.e. all data up to March 2020.

⁶ The average annual rate of inflation given here is CPIH for 1989-2019 inclusive. Source: ONS.

⁷ See for example, Klenow and Malin (2010). A full comparison is set out in an accompanying paper (Davies, 2021).

⁸ The proportion of prices changing varies through the year, so here I am comparing Q2-Q4 inclusive to make yearly comparisons.

⁹ There are 16 months (out of 395, or 4%) since 1988 in which more than a quarter of prices changed—both April and August 2020 are in this group

¹⁰ In the first 10 months 50.2% were rises, 49.8% falls.

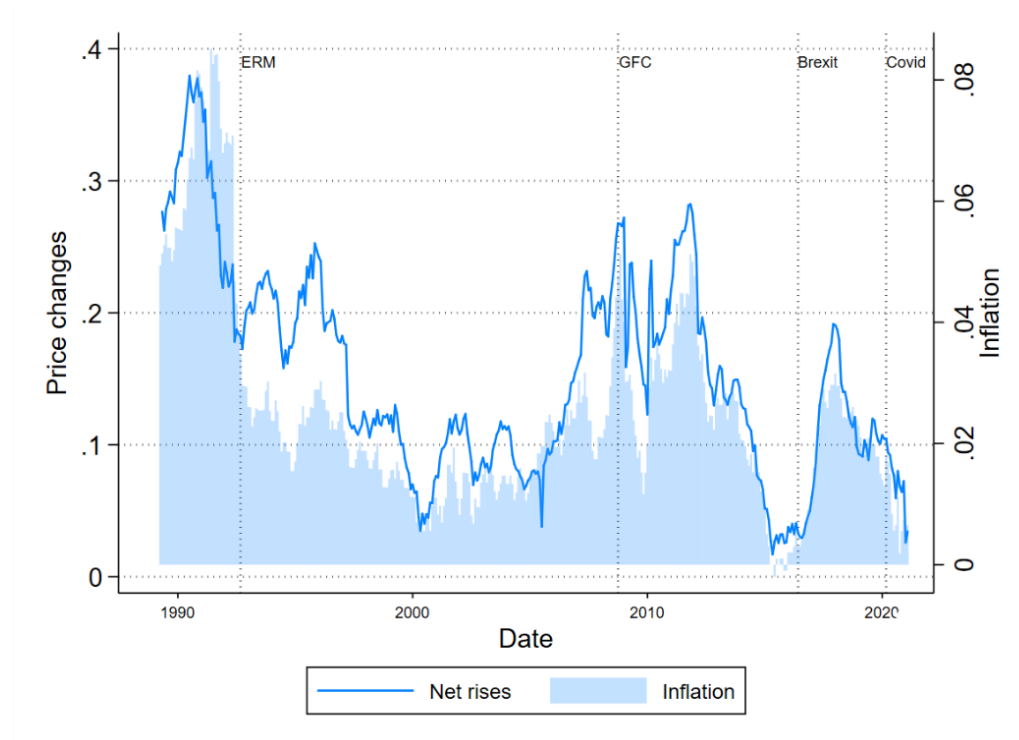
From price changes to inflation

As in other countries the UK's official inflation rate is calculated using a Consumer Price Index (CPI) which weights goods and services according to consumption patterns. Goods and services which account for a greater share of household expenditure have a greater influence on inflation rates. The weights, at a sectoral level, range from almost 30% for housing and utilities to under 2% for communication.¹¹

This raises the possibility that the pattern of price changes assessed at a micro level may not always be aligned with inflation. For example, if prices in a highly weighted sector rose a lot, this could more than offset widespread small price reductions across all other goods. In this situation most individual prices would be falling, but inflation would rise.

In fact, the intuitive pattern—that inflation will rise/fall when the balance of prices are doing the same, tends to hold. The chart below plots the net balance of annual price rises (the share of prices rising, minus the share falling) against inflation. Weighting issues aside, the net balance of price rises is strongly related to inflation. This measure has dropped sharply since the onset of the crisis, with inflation falling too (Chart 4).

Chart 4. Net balance of price rises and inflation, 1988-2020



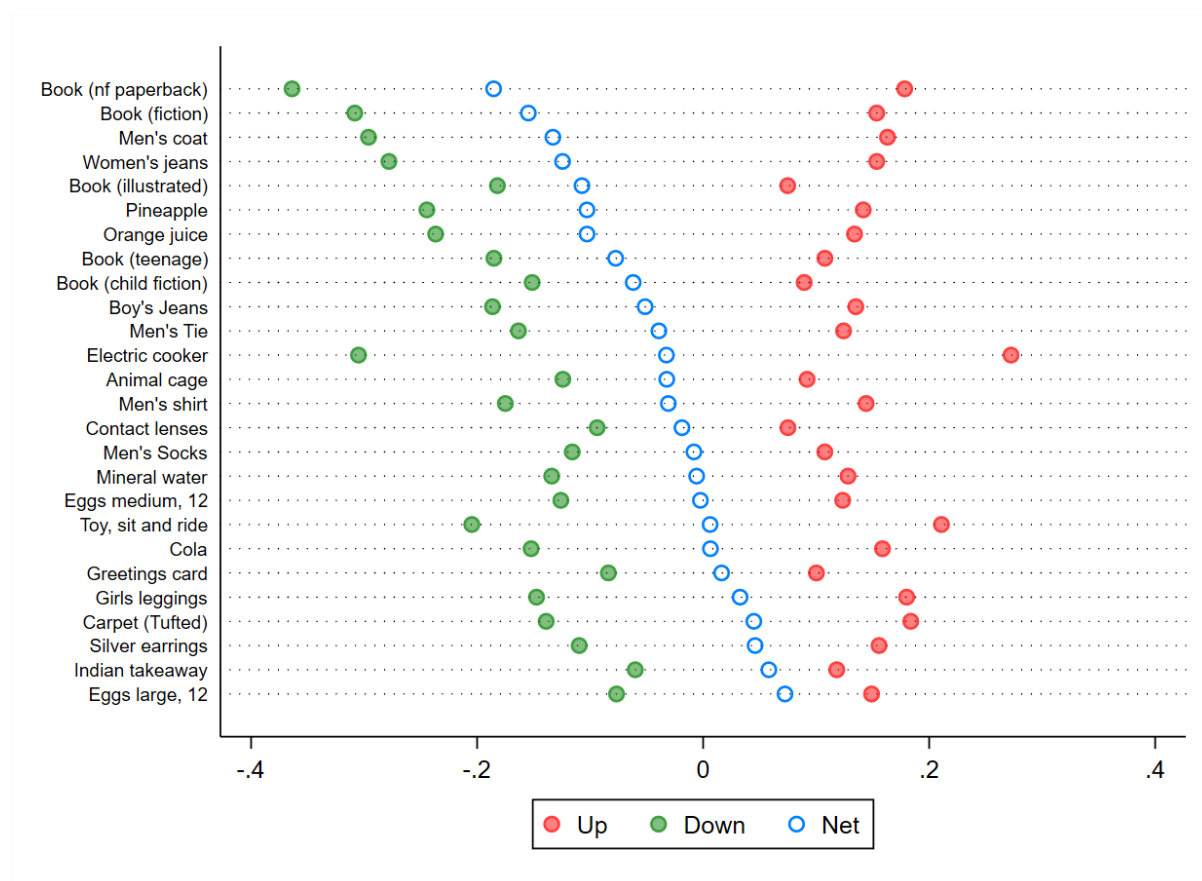
¹¹ When referring to CIOPOP divisions in this paper I use shortened names for brevity. The full names and precise weights are “Housing, water, electricity, gas and other fuels” (29.6%) and “Communication” (1.7%).

Price changes by type of good

The Covid-19 lockdown has had an uneven sectoral impact: some sectors have been unable to operate at all, while in others business has continued. In line with this, price changes have been more common in some sectors. The largest increases in the share of prices changing have been seen in recreation and culture, the restaurant and hotel sector, and clothing. Several important sectors, including food and drink, and alcohol and tobacco, have seen little increase in the frequency of price changes compared to the pre-Covid period (Chart A1, annex).

Turning to individual products the data show that some change price regularly. Top of the list, both pre- and post-pandemic, are fuel prices (kerosene). The chart below looks at the ‘most impacted’ goods: the 30 products whose frequency of price change has risen most *relative* to previous pricing patterns. A wide range of goods and services are in this list. Examining these highly impacted goods shows that there has been a big increase in the regularity of *both* price cuts and price rises. On balance, price cuts have been slightly more common, with the net balance of changes negative just over half of these goods (Chart 5).

Chart 5. Direction of change and net balance – 30 most impacted items



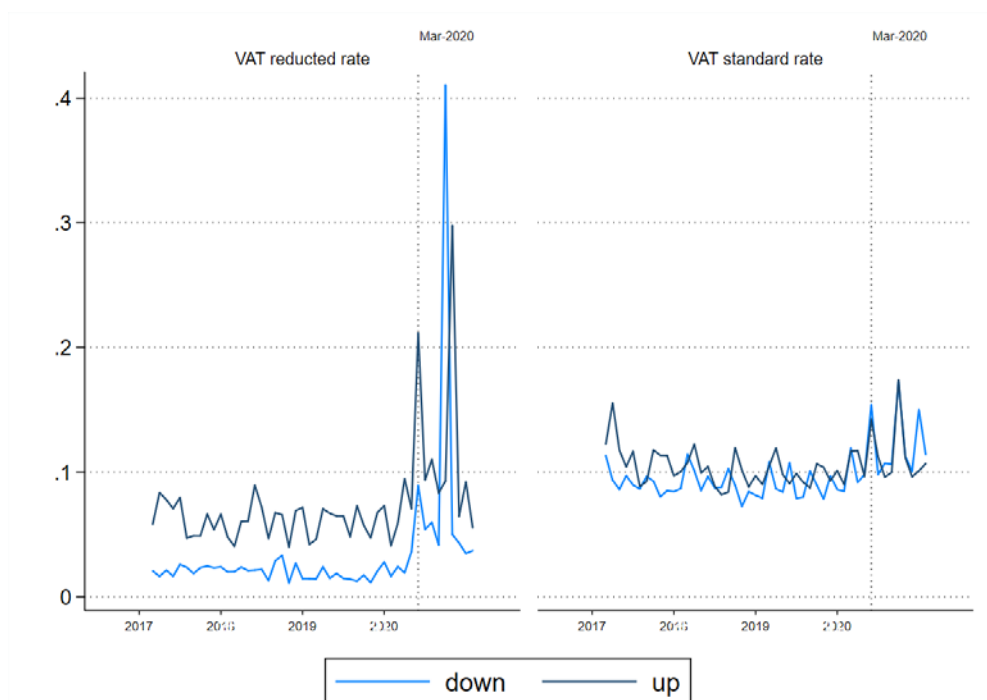
Note: The chart shows the 30 CPI items with the largest increase in the proportion of prices changing, compared to pre-pandemic period (2017-2020).

The role of VAT

Tax policy has been active and has impacted on prices in the UK. In July, the UK government announced a temporary VAT reduction from 20% to 5%.¹² Compared to an economy-wide VAT stimulus used in 2008, this reduction is more targeted, applying only to industries hardest hit by lockdown rules. This includes food and (non-alcoholic) drink sold in pubs, cafes and restaurants, hotel room and admissions to attractions including theatres, concerts, zoos and museums. This focused cut is also larger than the more general one used in 2008 (15 percentage points versus 2.5 percentage points).

The micro data allow comparison of consumer products that benefit from the tax reduction along with those that do not.¹³ Plotting the monthly price changes of these two groups produces a striking image (Chart 6). Pre-Covid, items subject to the VAT reduction changed prices less than other consumer products. This changed with the pandemic. First, there was an increase in the prevalence of price rises as lockdown was imposed. Second there was a spike in price reductions in August 2020 as new VAT regulations and the government's Eat Out to Help Out scheme came into force.¹⁴ A third peak then occurred as some firms seem to have unwound these price reductions. The emergency tax relief appears to have a large impact, but this may have dissipated quickly.

Chart 6. The Covid-19 VAT reduction



Note: Proportion of prices changing prices, by items that received Covid-19 related VAT holiday

¹² For a description of the policy, see: <https://www.gov.uk/government/publications/revenue-and-customs-brief-10-2020-temporary-reduced-rate-of-vat-for-hospitality-holiday-accommodation-and-attractions>

¹³ This was done using the ONS's description of each good and comparing this to HM Treasury guidance.

¹⁴ See ONS (2020). My analysis that the ONS study differ in terms of coverage: I attempt to track all VAT-reduction eligible items; they focus on only those items eligible for *both* the EOHO scheme and VAT cut.

Regional pricing

CPI data are typically used at a UK-wide level. For example, the calculation of regional real wages uses local pay rates divided by a *national* price aggregate. The micro data show that, at least for some goods, using national aggregates masks regional variation, with some firms varying the prices of identical goods across regions.¹⁵

The micro data allows an analysis of regional experience post Covid-19. Overall, the patterns of change across NUTS-1 regions are similar, with spikes as the first lockdown was imposed, and larger spikes in August as the VAT cut came into force. The data do point to some emerging regional variation: in London and the South East price rises are more prevalent, whereas in the North and Midlands, price reductions have dominated (Chart 7).

Chart 7. Regional price flexibility, 2017-2020



During the autumn wave of Covid-19, the home nations put in place localised restrictions. More recently, there have been reports of significant shortages of goods in Northern Ireland and disruption of supply chains in Scotland caused by the implementation of new trading arrangements with the EU.¹⁶ Tracing the differential impact of lockdown on prices and inflation across the home nations may be important in coming months.

¹⁵ In particular the level, rate of change, and distribution of some identical goods varies by region. Regional differences seem to be related to regional incomes. See Davies (2021) for details.

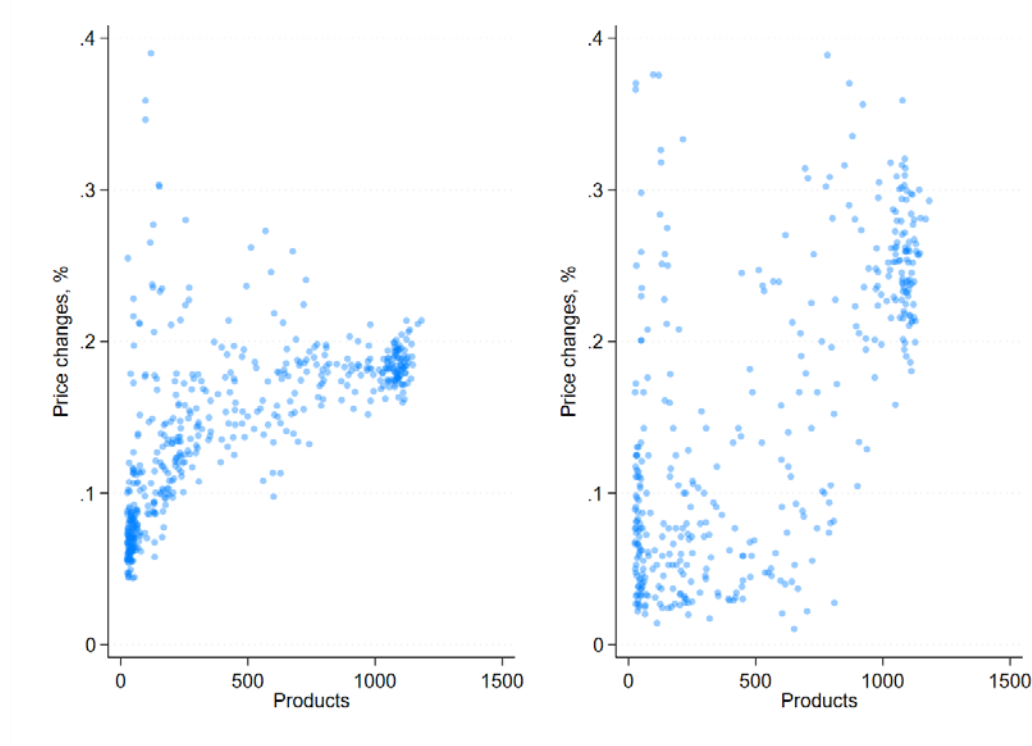
¹⁶ On Northern Ireland shortages, see Bogle (2021); on fishing supply chains in Scotland see Roy (2021).

Firm size effects

The size of a firm appears to influence pricing behaviour.¹⁷ While standard measures of size—employment, or revenue—are not available I construct indirect measures based on the prices collected from firms. Businesses that have wider ‘menus’ of goods on which prices are collected are more likely to change prices. There is considerable heterogeneity among smaller firms, with some hardly changing any prices, and others being the most active in altering their prices. As firms get bigger, the distribution tightens: the regularity of price changes is much more similar among firms that sell many products (Chart 8, left-hand panel). Overall, large firms providing 1000+ products change their price around twice as often as the median small firm.

This pattern persists during the Covid-19 period (Chart 8, right hand panel). There may many explanations for this: larger firms may have better technology and be able to update prices based on supply chain pressure, for example. Large firms may also be subject to competitive and political pressure and face an obligation to pass on VAT cuts. One interesting question for further research is whether, if Covid-19 triggers a secular shift towards on-line consumption from larger firms, this might alter the degree of price flexibility in the economy.

Chart 8. Price changes by size of firm (pre- and post-Covid)



Notes: Each dot represents a single shop. X-axis is the mean number of product lines with prices recorded, Y-axis the mean number of prices that are changes on the previous month's price for the same item.

¹⁷ I measure size in three related ways: the number of products/services for which prices are available, the number of regions present and the number of price quotes collected by the ONS. These are described in detail in the accompanying paper, Davies (2021). On all three similar patterns result.

Implications for policy and further research

Price indices are an example of how headline economic measures mask underlying information. This paper delves into the UK CPI presenting a new dataset and discussing stylised facts on how firms have changed their prices in the face of the pandemic. For policymakers, the paper helps understand the ongoing pandemic. At the time of writing the micro data suggest:

- In an average pre-Covid year 19% of prices change. This rose to 24% with the onset of the pandemic, the highest proportion since 1991. Consumers have faced an increase in *both* price cuts and price rises. The ERM and GFC crises of 1992 and 2008 led to a similar pattern of price changes. By contrast the 2016 EU referendum led to an increase in price rises but a *decrease* in price cuts.
- UK prices show considerable short-term flexibility. VAT changes are responsible for the most volatile months on record. The recent Covid-related VAT holiday fits with this historical pattern, driving a significant reduction in the number of prices in August. Many of these reductions, however, may have quickly unwound.
- Regional prices diverge in their level and distribution. The impact of Covid-19 appears to be broadly similar across UK regions, though with some differences emerging in London and the South East. Given the ‘localisation’ of lockdown policies at the end of 2020, the regional impact will be important to track in coming months.
- Firm size matters. Large firms’ prices are twice as flexible small firms’. This is true both in the long-run and in the response to Covid-19. This is indirect evidence that firms of different size may be less willing or able to change prices. There may be long-run implications for price flexibility given a potential shift towards on-line consumption.
- High frequency data may help. While the size of changes and items weights are important, a simple measure—the net balance of price rises—appears closely correlated with inflation. This suggest tracking net price rises (including using new web scraping techniques) may provide useful real time indicators.

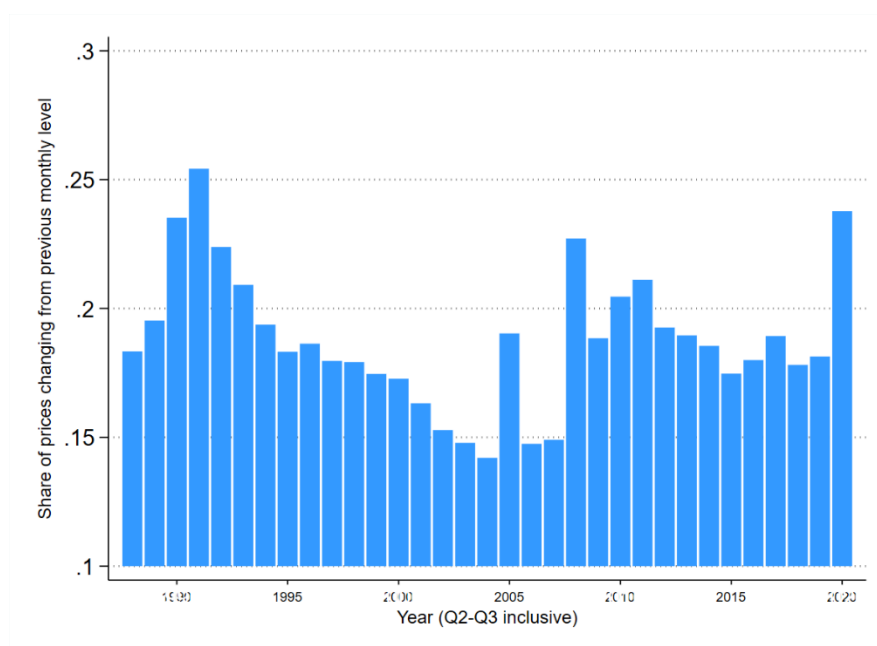
For researchers, this brief and the accompanying occasional paper adds to a rich literature on micro-data pricing studies by describing and making public a new dataset for the UK. The data is updated monthly and spans 32 years covering the ERM crisis, the GFC, various tax shocks, and the EU referendum. The accompanying paper confirms several results seen in other countries, providing new UK facts on the frequency and size of price adjustment.

This analysis relies on the open-data approach adopted by the ONS. In line with this policy, I intend to update the database regularly, making it available for researchers, students, or the public to use.¹⁸

¹⁸ Access the data at: <https://richarddavies.io/research/prices>

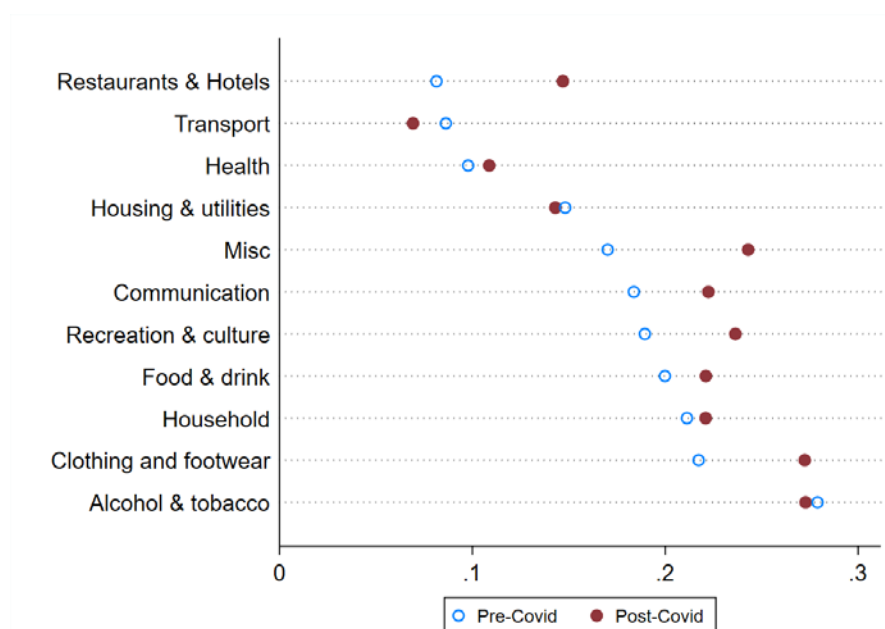
ANNEX – CHARTS AND TABLES

Chart A1. Price volatility: percentage of prices changing compared to previous monthly level 1988-2020



Notes: To make years comparable with the 'post Covid' period, the chart is drawn for the proportion of comparable prices, and for the periods Q2-Q4 inclusive for each year.

Chart A2. Percentage of prices changing, by CIOCOP division.



Notes: The chart shows the proportion of prices changing by CIOCOP division. The pre-Covid period used is 2017-2019 inclusive. The post-Covid period is defined, as above, as Q2 2021 onwards.

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