

**Economic and Social Council**Distr.: General
27 June 2023

English only

Economic Commission for Europe**Conference of European Statisticians****Seventy-first plenary session**

Geneva, 22–23 June 2023

Item 9 of the provisional agenda

Timeliness, granularity and frequency of official statistics**Real-time indicators in the United Kingdom – lessons learned
and next steps****Prepared by the United Kingdom***Summary*

The COVID-19 pandemic has accelerated the development and use of real time indicators by statistical agencies, government policymakers, business and media. This reflects both the need for timely and granular indicators at a time of crisis, and the growing availability of high frequency or ‘big’ data and data science methods.

This document discusses the factors driving the growing use of real time indicators, based on the United Kingdom’s recent experience. Since 2020 the Office for National Statistics (ONS) have produced a regular weekly suite of indicators covering business, workforce, transport, consumer behaviour, housing and energy.

We give four use case examples: informing the UK government’s pandemic response, providing insights on the cost-of-living crisis, assessing the impact of recent industrial action, and embedding real-time indicators into National Accounts quality assurance and production. Finally, the paper outlines some recent developments at the ONS on building our capacity for high quality financial transaction data analysis.

The document is presented to the CES session on “Timeliness, frequency and granularity of official statistics” for discussion.

I. Introduction

1. Real time indicators (RTI) are not new. Analysts have used partial – but timely – data to glean early insights into economic and social trends for decades. Leading indicators, PMIs, and other activity and sentiment indices have a long history, as does a range of other high frequency data such as those from financial markets.
2. But until recent years they have not been widely adopted or published by national statistical agencies.¹ Real time indicators seldom meet the standards for accuracy, reliability and representativeness one would expect for ‘official statistics’.
3. But RTIs have proven timely, granular and rich in detail, making them a useful supplement (not replacement) for official statistics – particularly in times of national crisis, such as the 2020 pandemic, and also at times of potential economic downturn.

A. Preconditions for acceleration of real time indicators

4. The coronavirus (COVID-19) pandemic accelerated several existing trends, including the take-up of online shopping and remote or hybrid working. Likewise, it was a catalyst for many governments to make greater use of RTIs, as existing official statistics were found to be insufficiently timely or granular, or simply unable to answer key policy questions, such as whether people were social distancing.
5. But two other factors have also been pivotal in their rise:
 - The growth of high frequency or ‘big’ data, both from administrative sources and commercial or third-party providers;
 - The development of **data science** techniques, enabling unique data collection via APIs, web scraping from the internet, and other methods.
6. Combined, these three factors have enabled government statisticians, analysts and others to develop, publish and analyse real time economic, social (and health²) indicators at scale that was previously not possible.

B. The United Kingdom context

7. The rapid adoption of real-time indicators in the UK was a response not only to the pandemic but also to an earlier call by Bean (2016) for the modernisation of economic statistics by exploiting private and public sector data sources and using new data science methods and tools.
8. In response to the Bean report, the ONS hired more analysts, established a Data Science Campus to build data science capability in government, and set up the Economic Statistics Centre of Excellence to collaborate with academic researchers. We also started working with other government departments to make better use of administrative data, and with financial transaction data providers.
9. Alongside this work, and partly in response to criticism of the performance of our National Accounts estimates in identifying turning points during the 2008-09 global financial crisis, the ONS developed a GDP monthly estimate (output based).
10. In 2019, the Campus initiated a ‘Faster Indicators of UK Economic Activity’ project to identify close-to-real-time big data and administrative datasets that represented useful

¹ A notable exception being the monthly *Business Cycle Development* bulletin, later renamed the *Business Conditions Digest*, produced by the US Bureau of the Census between 1961 and 1990. This was based on research by Wesley Mitchell, Arthur F. Burns, Geoffrey H. Moore, Julius Shiskin, and others, many of them associated with the National Bureau of Economic Research (NBER).

² Although outside the scope of this paper, mention should be made of the ONS [Coronavirus \(COVID-19\) Infection Survey](#). The rollout of this survey in 2020 enabled the UK to gauge the spread of the infection for a representative population in close to real time, as well as providing insights on the emergence of new variants, rates of re-infection, and the effectiveness of COVID-19 vaccines.

economic concepts, create a set of indicators that allowed early identification of significant economic changes, and provide insight into economic activity at a level of timeliness and granularity not possible with official economic statistics.

11. So by the time the pandemic arrived in early 2020 we already had some of the building blocks to enable us to rapidly build up our suite of indicators. What was particularly helpful was the willingness of a wide range of organisations to provide us with data to help in the government's pandemic response (ONS, 2020).

12. But there were key questions which administrative and commercial data sources could not answer. We did not know how businesses were responding to the pandemic, nor households. In response, the ONS established a voluntary fortnightly [Business Impact of COVID-19 Survey](#) (BICS)³ and the existing [Opinions and Lifestyle Survey](#) (OPN) household survey shifted from monthly to weekly data collection.

13. These proved to be timely and flexible survey instruments, enabling us to ask a wide range of questions during the pandemic and after. As well as gauging how households and businesses were faring, policymakers and analysts from across government worked with us to identify suitable questions on current policy issues.

14. Both surveys have provided such a useful supplement to our existing statistical outputs that the ONS decided to continue to produce them post-pandemic.

15. Over the next three years, the real-time project has continued to evolve and adapt to respond to other challenges being experienced in society and the economy. Today, there is a large suite of real-time indicators, covering various areas such as business insights and workforce, consumer behaviour, transport, and energy. These indicators rotate in and out of publication according to policy need. In 2022, the name of the release was changed to Real-time Indicators to align with international terminology.

II. Case study 1: Working with the Bank of England on real time financial transactions data

16. The Bank of England (BoE) monitors daily CHAPS (Clearing House Automated Payments System) payments made by credit and debit card payment processors to approximately 100 major UK retail corporations. This dataset is considered a reliable indicator of consumer spending in supermarkets and large stores, especially during the pandemic when cash transactions decreased, and card payments became more prevalent. To ensure accurate and appropriate use of the data, ONS collaborated with BoE to establish protocols for data delivery. Aggregated data, rather than unit level data, were provided to ONS, and BoE reviewed and approved the final commentary and wording used in the ONS release. BoE also supplied a comprehensive [background document](#) on the methodology to help users understand the strengths and limitations of the data.

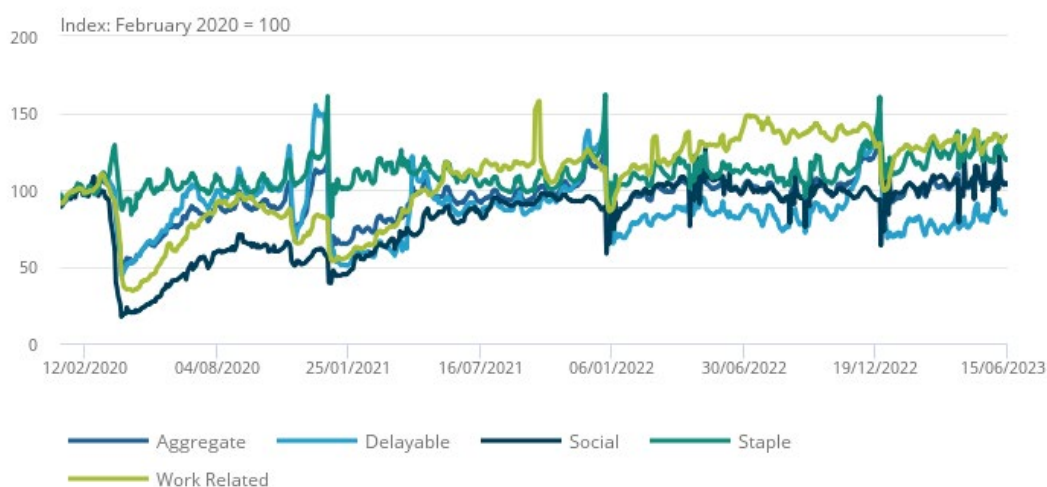
17. The CHAPS data are now published weekly and include daily indices by five spending categories: aggregate, delayable, social, staple, and work-related, along with month averages. These indices are indexed to February 2020 as a pre-pandemic baseline and presented as a seven-day rolling average to smooth out volatility around weekends. Additionally, a monthly indicator is produced and used to track the official monthly ONS Retail Sales Index. However, it is important to note that the data have limitations, such as the lack of seasonal adjustment and the impact of inflation, which is not removed from current prices. These limitations can result in a large increase in spending at the end of each month and around bank holidays. As the indicators continue to develop, efforts will be made to address these limitations, such as adding elements of seasonal adjustment and deflation where possible.

³ Later renamed the [Business Insights and Conditions Survey](#).

Figure 1

Aggregate CHAPS-based indicator of credit and debit card purchases

A backward looking seven-day rolling average, 13 January 2020 to 15 June 2023, non-seasonally adjusted, nominal prices

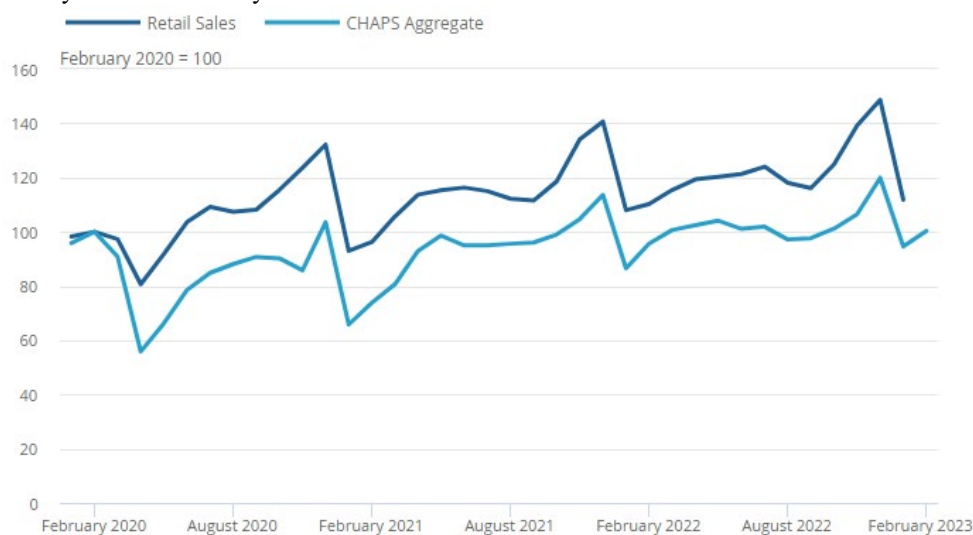


Source: Office for National Statistics and Bank of England calculations; Bulletin: [Economic activity and social change in the UK, real-time indicators](#), real-time indicators; Dataset: [UK spending on credit and debit cards](#)

Figure 2

Retail sales data follow a similar trend to the CHAPS index of aggregate credit and debit card spending

February 2020 = 100, non-seasonally adjusted, nominal prices and retail sales values, January 2020 to February 2023



Source: Office for National Statistics and Bank of England calculations; Bulletins: [Economic activity and social change in the UK, real-time indicators](#) and; [Retail sales, Great Britain](#); Datasets: [UK spending on credit and debit cards](#) and [Retail Sales Index](#)

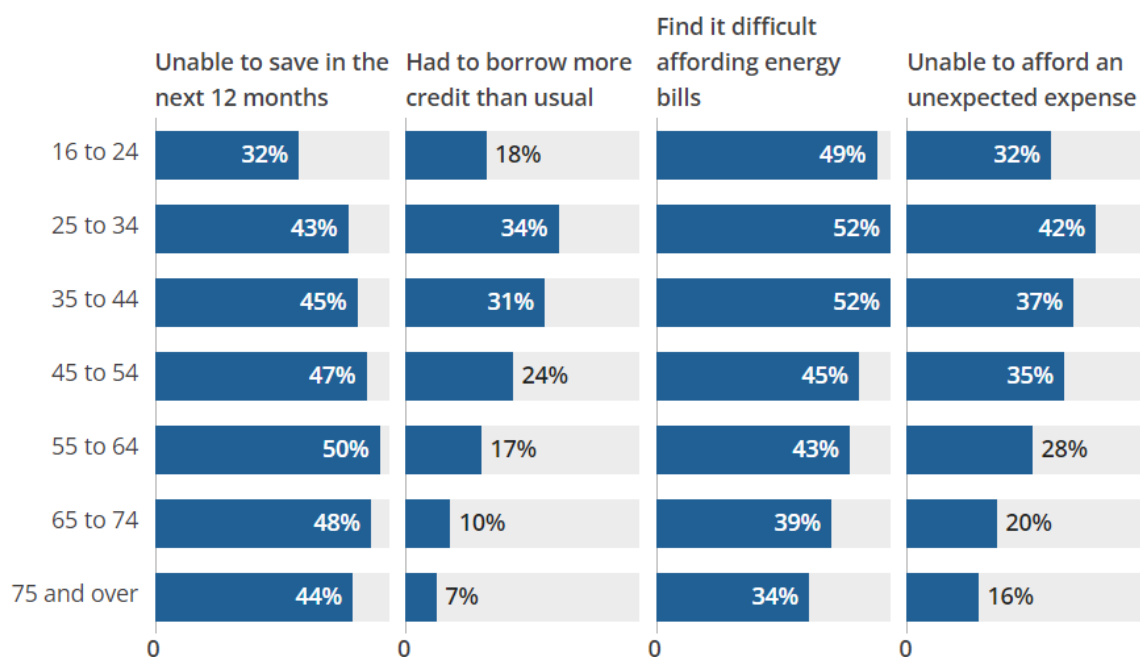
III. Case study 2: Using real-time indicators to analyse the costs of living

18. Our regular household and business surveys, alongside the presentation]other indicators such as financial transaction data, have been used extensively over the past year or two to provide insight into the impact of higher inflation on consumers and businesses.

Figure 3

Adults 25 to 34 years more financially vulnerable than other cohorts

Proportion of people reporting the factors contributing to financial vulnerability by age group, Great Britain, September 2022 to January 2023



Source: Office for National Statistics and Bank of England calculations; Bulletins: [Economic activity and social change in the UK, real-time indicators](#) and; [Retail sales, Great Britain](#); Datasets: [UK spending on credit and debit cards](#) and [Retail Sales Index](#)

19. Indicators from the Opinions and Lifestyle Survey (OPN) have been used to track people's experiences of changes in their cost of living and household finances in Great Britain. Alongside regular [cost of living insights](#), it has been used to analyse the proportion of the population affected by an increase in their cost of living, ask them what action they were taking in response, assess characteristics associated with financial vulnerability or energy and food insecurity, and whether people experienced shortages of goods such as food, medicine, or fuel when shopping.

20. For some time, we have asked businesses in our fortnightly BICS whether they faced costs pressures, if so whether they were planning to absorb or pass on those costs, and if so, then the reason for their price rises.

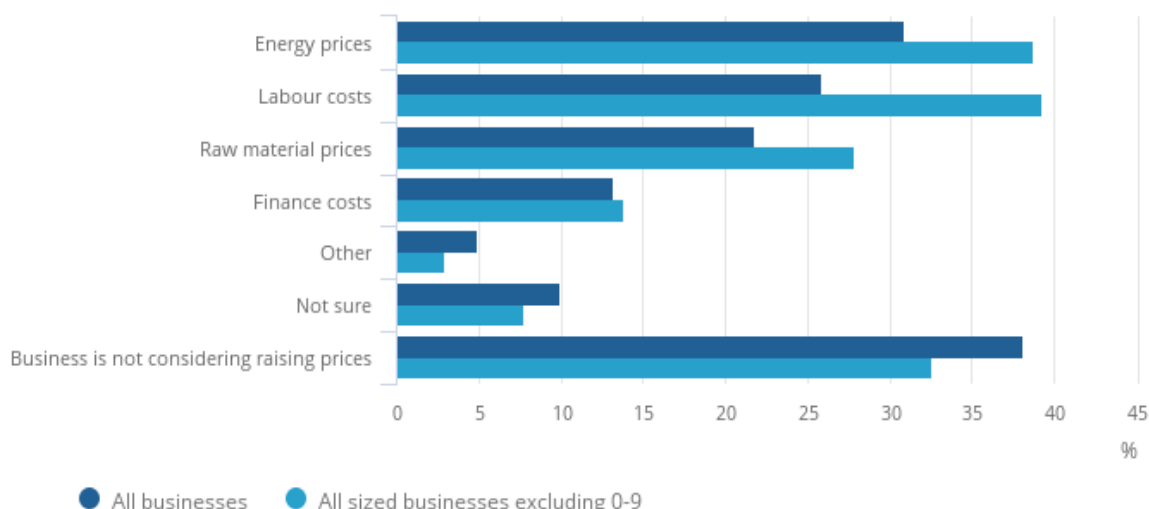
21. When asked in early May 2023, more than one in six (18%) trading businesses expected to raise the prices of goods or services they sell in June 2023, down from 23% for May 2023.

22. Businesses were asked what, if anything, was causing them to consider raising their prices in June 2023. Almost a third (31%) of trading businesses reported energy prices as the top reason for why they are considering doing so. In contrast, 38% reported they are not considering raising prices.

Figure 4

Larger businesses are considering raising prices more than smaller businesses because of energy prices

Reason for price rises, businesses currently trading, broken down by response option, weighted by count, UK, 2 to 14 May 2023



Source: Business Insights and Conditions Survey from the Office for National Statistics; Bulletin: [Business insights and impact on the UK economy: 18 May 2023](#); Dataset: [Business insights and impact on the UK economy](#)

IV. Case study 3: Industrial action and economic activity

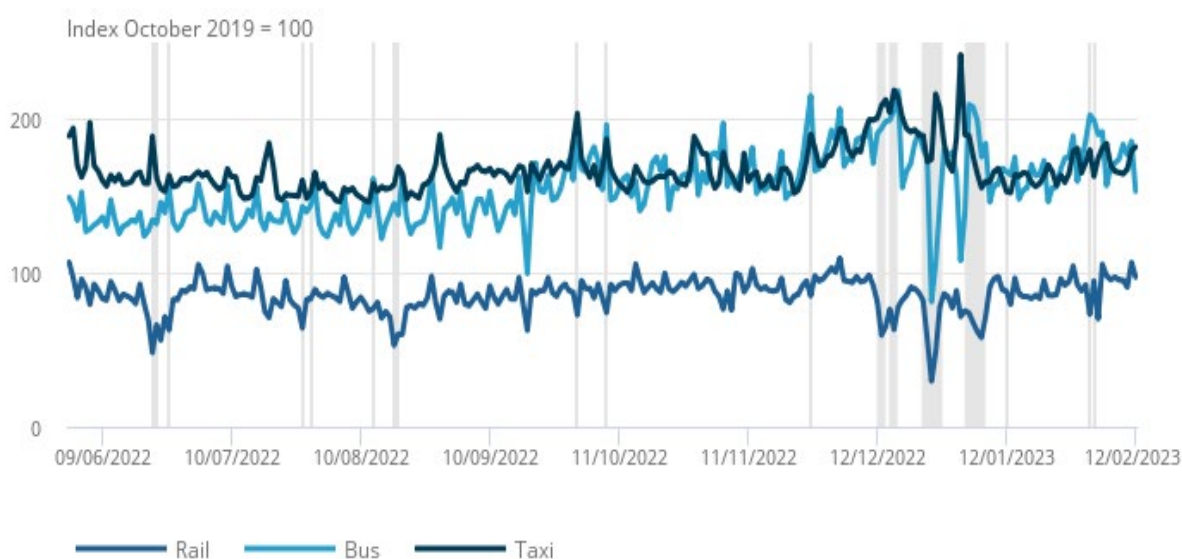
23. Since June 2022 there has been a significant increase in working days lost due to industrial disputes, with strikes occurring across a range of industries, including many parts of the rail and bus networks, postal workers, civil servants, teaching staff and NHS staff. We used real time indicators to explore their impact.

24. Although consumers could not travel on many parts of the rail network on strike days, total travel spend fell only slightly on these dates. Subcategories of travel spending show some evidence that rail spending decreased on days where there were rail strikes, with these declines offset by increased spending on buses and taxis (Figure 5). This could indicate that rail strikes led to displacement of spending towards buses and taxis as consumers sought to mitigate the impact of strikes.

Figure 5

Spending on rail decreased around strike days

Revolut card spending on transport by category, June 2022 to February 2023, October 2019 day of the week average = 100, UK



Note: Vertical grey bands represent rail strikes that occurred from June 2022 to Feb. 2023

Source: Revolut – Office for National Statistics (ONS) calculations; Bulletin: [The impact of strikes in the UK: June 2022 to February 2023](#); Dataset: [Revolut spending on debit cards](#)

25. Our analysis also drew on in-store transactions at Pret A Manger stores located in railway stations, which saw falls in most of the weeks when rail strikes took place across the period.

26. Likewise, our Opinions and Lifestyle Survey (OPN) reported that around 1 in 10 people (11%) surveyed had their travel plans disrupted by rail strikes in the February 2023, compared with 19% and 18% during the previous two strike periods.

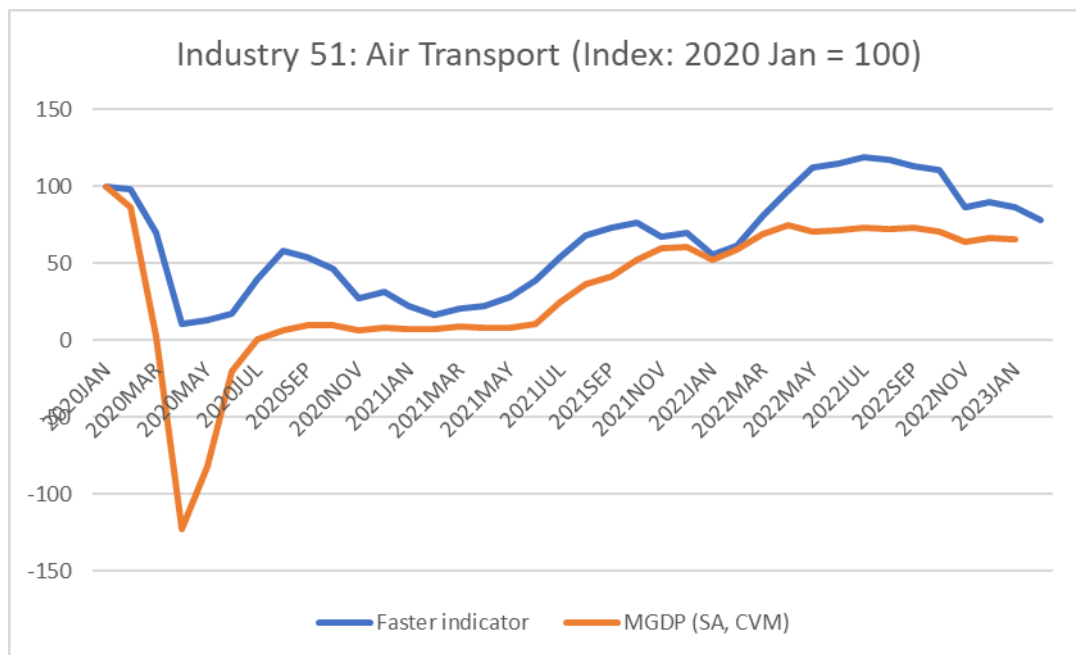
27. None of these insights would have been possible without those indicators.

V. Case study 4: Embedding real-time indicators into National Accounts quality assurance and production

28. As well as being used by a wide range of policy and decision makers, academics and the public, real-time indicators have a role to play within the ONS as well. For instance, when [compiling monthly GDP \(Gross Domestic Product\) for the UK](#) the ONS will look at the real-time indicators within any given industrial sector as evidence for any movements we are seeing in the aggregated UK monthly GDP data. For example, if we are looking at the restaurant sector we will compare the movements we are seeing in monthly GDP with the OpenTable restaurant reservation dataset, the comparison of air transport, and for elements of retail spending we will look at the spending categories within the various consumer spending indicators we have on a real-time basis including CHAPS and Revolut.

Figure 6

Monthly GDP estimates for air transport are quality assured using real-time UK flight indicators for the industry



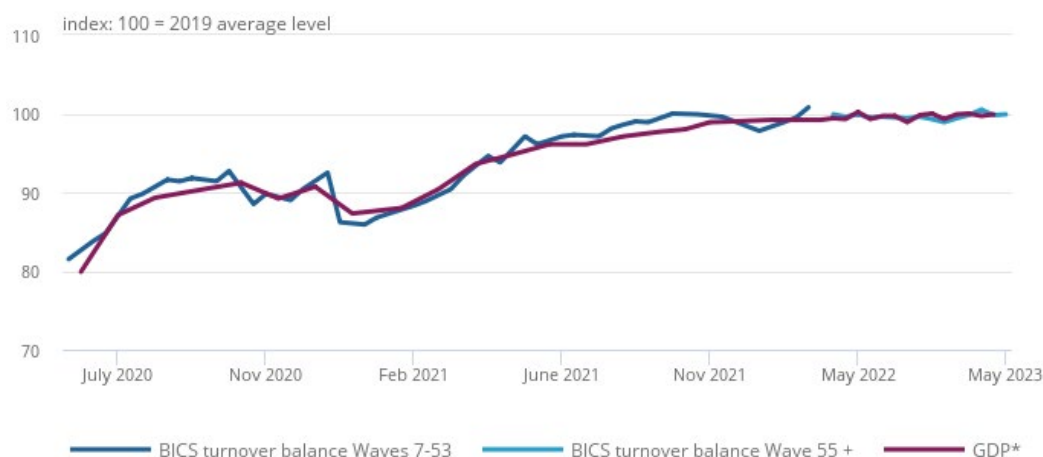
Source: GDP monthly estimate from the ONS and flight data from EUROCONTROL; Datasets: [Daily UK flights](#) and [Monthly GDP time series](#)

29. This innovation has progressed to such a degree that we now publish within the weekly real-time indicators release a chart showing how the fortnightly BICS data on business turnover (compiled into a standardised balance estimate) compares with an equivalent aggregation of monthly GDP (excluding those sectors which BICS does not sample such as the government dominated industries of health and education, denoted by GDP*). We do the same with the CHAPS monthly data and the Retail Sales Inquiry datasets as well, and the correlation has proved to be reliable.

Figure 7

Business Insights and Conditions Survey (BICS) turnover balance standardised and monthly GDP* estimates

Index: 100 = 2019 average levels, UK, 1 June 2020 to 31 May 2023



Note: Change in BICS question in February 2022

Source: Business Insights and Conditions Survey and GDP monthly estimate from the ONS;

Bulletins: [Business insights and impact on the UK economy](#) and [GDP monthly estimate](#);

Datasets: [Business insights and impact on the UK economy](#) and [Monthly GDP time series](#)

30. All of this leads ONS to believe that there is a role for real-time indicators to enhance or supplement the data collection of ONS indicators, providing we are aware of the limitations of the real-time indicators which can be in their collection methods, their coverage, or their compilation methods.

VI. Real time indicators and statistical quality

31. One way of assessing the usefulness of real time indicators is to examine them through statistical quality frameworks, such as the well-known Eurostat (2003) dimensions of statistical quality. Of those dimensions, the strength of most RTIs are their relevance and their timeliness.

Table 1

The five dimensions of statistical quality

<i>Quality dimension</i>	<i>Key questions for real time indicators</i>
Relevance	Do they meet users' needs? Are there significant gaps?
Accuracy and reliability	How close are estimates to true value? How consistent?
Timeliness	Time lag between period estimated and release date?
Coherence and comparability	Can they be reliably combined in different ways? How do they compare between regions, sectors, over time?
Accessibility and clarity	Easy to obtain? Formats? Metadata? Easy to understand?
Granularity and richness	Are there a lot of variables for analysis? Does the level of detail enable subnational or other breakdowns?

Source: Eurostat (2003)

32. However, there is arguably a dimension missing from this framework which reflects a third RTI strength: **granularity and richness**. Many indicators provide additional data

enabling possibilities for analysis which are absent from official statistics. Online job advertisement data, for example, contains extensive meta-data which enables detailed occupational and spatial analysis. Likewise, large financial transactions data can enable real time analysis at vlocal geographies, or within specific time periods.

33. The ONS has used granular indicators data to examine issues such as the impact of local coronavirus lockdowns on consumer spending, the impact of the 10pm curfew for hospitality sector on consumer behaviour, and trends in the growth of remote or hybrid working job vacancies. The have provided valuable and timely insights which official statistics or admin data were unable to provide.

VII. Current outputs and development plans

34. As we have moved into the post-pandemic world, our weekly bulletin has adapted to provide insights into emerging economic and social trends within the UK. This has resulted in expansion of the published suite of indicators, but also the continuous review of our users' needs in terms of each indicators frequency of publication.

35. Our suite of real-time indicators (ONS 2021-2023 is actively monitored to ensure they continue to be relevant and useful to both policymakers and the public. For example, in response to the surge in European energy prices in 2022 following the Russian invasion of Ukraine we started publishing the daily and weekly average price of gas traded in Great Britain, and later added the system price of electricity.

36. **Annex A** provides our full list of indicators. They are published according to different scheduling, reflecting the frequency of the indicator and the level of user demand.

37. ONS is committed to further improvements of our current suite of real-time indicators. One area which is of particular importance is the application of **seasonal adjustment** to our high-frequency indicators as we are now reaching a point where there exists a long enough back series to start this process.

Table 2

Development work plan for UK real-time indicators

<i>Scope item</i>	<i>Category</i>
Onboarding of anonymised utility bill data, with the objective of publishing aggregated data on gas and electricity usage and analysis to assess cost of living.	New indicator
More granular geographical data (e.g., for online job adverts and other labour market indicators)	New indicator
Monthly regional renter affordability	New indicator
Enhancing indicators for shipping to use cargo manifests and the port of origin	New indicator
Aggregated insights from anonymised telecoms data	New indicator
Standalone interactive data dashboard	Bulletin improvement
Increased regularity of dataset publication (datasets to be published throughout the week when they are available, rather than being tied to a set weekly bulletin)	Bulletin improvement
Application of seasonal adjustment for high frequency series	Bulletin improvement

Source: Office for National Statistics

38. There are also internal projects underway within ONS to enhance our current indicators, reflecting user feedback and methodological reviews into the collection and processing, to ensure they are as robust as possible.

39. In tandem with continuing to improve current suite of real-time indicators, we are also looking to add new data sources to our release in response to emerging economic and social challenges within the UK. Table 2 gives a brief overview of possible future indicators.

VIII. Next steps

40. There are practical steps we can all take as government statisticians and analysts to realise the opportunities of ‘big data’.

41. The use of real-time indicators in official statistics continues to gain momentum. The recent UN meeting of the Group of Experts on National Accounts (April 2023) covered a wide range of topics and discussion on the real-time agenda from different countries. It is clear from those discussions that real-time indicators are here to stay, but the challenge becomes how best we can utilise these new data sources in conjunction with the traditional, and official, outputs from National Statistics Institutes.

42. However, we are likely still in the early stages of real time indicators “providing a new tool for empirical macroeconomics” (Chetty, et al, 2020). Looking ahead, the ONS are pursuing work in several areas in addition to maintaining and expanding our current suite of indicators.

43. First, we are working with our [Data Science Campus](#) and academic colleagues on how best to apply **nowcasting** techniques for economic indicators, including the potential creation of composite indicators which can bring together strength of signal from related indicators.

44. Second, building on our **financial transactions data** work across a range of providers over the past five years, we recently announced a new [data partnership with Visa](#) (ONS, 2023b) to understand UK consumer spending patterns on an aggregated and anonymised basis and help the ONS better measure UK household expenditure, improving the quality of our national and subnational statistics.

45. Third, we have been looking at appropriate opportunities for **academic collaboration** either via our existing relationships with the [Economic Statistics Centre of Excellence](#) and [Alan Turing Institute](#), or new opportunities such as the ESRC [Digital Footprints](#) programme.

46. Fourth, while this paper extols the benefits of developing a suite of economic and social real time indicators to supplement official statistics, the single most useful new economic statistics both during the pandemic and since has proved to be **Monthly GDP**. This has enabled much more timely insight into economic trends than if we had still been reliant on quarterly National Accounts alone. I commend it to other countries for adoption.

47. Finally, we are always happy to work with **other national statistical agencies** on real time indicators, data science, or other areas of common interest. If you are interested, please do get in touch.

Annex 1

United Kingdom real time indicators by theme

Table 3
United Kingdom real time indicators by theme

<i>Indicator</i>	<i>Source</i>	<i>Frequency</i>	<i>Description</i>
Business insights and workforce			
Online job adverts	Adzuna	Weekly	Experimental online job advert indices covering the UK job market, using a snapshot of data from job advert aggregating website Adzuna
Redundancies	Insolvency services	Weekly	Advanced notification of potential redundancies from HR1 forms submitted by employers to the Insolvency Service's Redundancy Payments Service
Company incorporations, voluntary dissolutions, compulsory dissolutions	Companies House	Weekly	Data for company incorporations, voluntary dissolutions, and compulsory dissolution first gazettes in the UK
Data on sales and jobs in small businesses	Xero	Monthly	This is used to provide data on both sales and jobs in these small businesses. Sales are measured based on the face value of invoices issued by firms within each month (including via apps attached to the Xero account). Jobs are measured by the number of unique employees of a business who are issued a payslip in a month.
VAT new businesses and business turnover	HMRC	Monthly	Value Added Tax (VAT) diffusion indexes and new VAT reporters. Diffusion indices show changes in business turnover (total value of all sales and other outputs excluding VAT) and expenditure (total value of purchases and all other inputs excluding VAT) for both quarter-on-quarter and month-on-month.
Transport			
UK flights	EUROCONTROL	Weekly	Daily flights data comprising international arrivals and departures to

<i>Indicator</i>	<i>Source</i>	<i>Frequency</i>	<i>Description</i>
			and from the UK (including Crown dependencies) and domestic UK flights, but excluding overflights (flights that pass over UK territory)
Traffic camera activity	Regional LG bodies	Weekly	Daily traffic camera counts data for mobility indices covering the UK developed by ONS Data Science Campus (DSC)
Shipping visits	exactEarth	Weekly	Weekly and daily shipping data using the UN Global Platform and developed by DSC
Flights passenger number	Civil Aviation Authority (CAA)	Monthly	Air passenger numbers from Heathrow, only passengers on commercial airlines (on passenger only or combined passenger and cargo flights) are included in this indicator
Road traffic in Great Britain	Department for Transport	Monthly	The data is based on around 275 automatic traffic count sites across Great Britain. The samples of automatic traffic counters are stratified by area, road classification, and road management and have been designed to be representative of national traffic
Consumer behaviour			
CHAPS spending on credit and debit cards	Bank of England	Weekly / Monthly	Weekly and monthly CHAPS payments made by credit and debit card payment processors to around 100 major UK retail corporates
Revolut card spending	Revolut	Weekly	Card spend data from Revolut, a financial technology company with around 4.8 million users in the UK
Demand for fuel per transaction	VISA/BEIS	Weekly	Estimated quantity of automotive fuel demand per average transaction used to isolate real demand after adjusting for growth in fuel prices. This indicator captures how consumer demand for fuel changes in response to rising fuel prices per visit at pumps over time.
Retail footfall	Springboard	Weekly	Daily indices include footfall within three main

<i>Indicator</i>	<i>Source</i>	<i>Frequency</i>	<i>Description</i>
Weekly transactional data for Pret A Manger	Pret A Manger	Weekly	types of retail destination – high streets, shopping centres and retail parks Weekly transactional data, comparing weekly in-store transactions against the average level of the first four weeks of 2020. Used to give early indications of UK mobility and commuting trends.
Restaurant seated diners	OpenTable	Weekly	Data showing how seated diners from online, phone, and walk-in reservations compare with 2019
Housing and energy			
Energy Performance Certificate lodgements	MHCLG	Weekly	Data for new and existing dwellings in England and Wales, used to give early insights into the UK housing market.
System Average Price of gas	National Grid	Weekly	Daily and weekly changes in gas prices, using the system average price (SAP)
System Price of electricity	Elexon	Weekly	Daily average of the half-hourly system prices and averaged again over the preceding seven days to bring out the trends and smooth volatility.

Annex 2

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