Article

Chain-linking in the UK National Accounts: Blue Book 2022

An explanation of the impacts the coronavirus (COVID-19) pandemic has had on the output and expenditure structures of the UK economy over this period. These affect how we compile volume estimates of gross domestic product (GDP) through chain-linking. Includes proposed changes we will be making to Blue Book 2022 in response to these impacts.

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1 . Overview

The coronavirus (COVID-19) pandemic has had a profound impact on the output and expenditure structures of the UK economy over 2020 and 2021, reflecting its effects on the supply and demand of goods and services. This has been shown in our estimates of gross domestic product (GDP) for these periods. However, it also has a wider impact on how volume estimates of GDP are compiled. This is because we produce these volume estimates through the process of chain-linking. This reflects the structures of the UK economy for that year as the value shares of output or expenditure in the economy are updated every year.

However, there is a lag of around two years in how quickly we can update these weights. As such, when we produce real-time volume estimates of GDP for these latest periods, we also need to use an approach called a " fixed-base tail". This is because it takes time for the weights for the latest years to be reflected.

The current practice is for this "fixed-base tail" to be for the period that follows those years that have been fully balanced through the annual Supply and Use Tables (SUTs) Framework process. For example, our most recently fully balanced SUT estimates are for 2019, and were published in October 2021. The latest volume GDP estimates for 2020 and 2021 are based on these fully balanced output and expenditure structures of 2019. That is, the 2019 structures form the weights for the aggregated volume series for 2020 and 2021. These volume estimates would then be chain-linked in the future as we roll forward the last base year, thereby picking up new weights for subsequent years as the base year is moved forward.

Changes in the structure of the economy have historically taken place over a long period of time so a "fixed-base tail" has minimal impacts. However, the coronavirus pandemic has had a profound impact on these output and expenditure structures for 2020 and 2021 in particular. Given the size and magnitude of these changes, this has made us consider how we recognise this impact within our compilation approach for the UK National Accounts. We explain why we have chosen not to update the weights this year to avoid introducing significant distortions arising from the pandemic into the UK National Accounts, and how this will be resolved in the future.

2 . The challenge of the coronavirus (COVID-19) pandemic

One impact of the coronavirus (COVID-19) pandemic is the recording of new types of COVID-19 activity. For example, capturing the effects of the NHS Test and Trace programme (Test and Trace) on economic activity. Figure 1 provides a hypothetical example to help illustrate this challenge of a fixed-base tail approach through the pandemic, where there would be a known under- and over-weighting of its impact in our volume estimates of gross domestic product (GDP). Each row refers to that Blue Book vintage of volume of GDP, showing the periods in which annual chain-linking or a fixed-base tail is in effect.

The challenge is that any new activity that did not exist in the last base year (2019) would not feed into the volume estimates in the tail. This is because any new volume index would have a zero value in the last base year, as this would be prior to the pandemic (Figure 1). That is, there would be an under-weighting of Test and Trace in 2020. This explains why we have had to incorporate adjustments [note 1] to our volume estimates of GDP so they are reflected in these tail years, which currently cover the pandemic period. This expert intervention approach has helped us minimise the expected revisions once annual chain-linking has been carried out.

If Test and Trace was then hypothetically only to have taken place in 2020, then the impact of a fixed-base tail approach would be further compounded in the future. In Blue Book 2022, which is to be published in October 2022, our usual practice would be for the last base year to move from 2019 to 2020. However, we would move from a scenario where the impact of Test and Trace was not included in the GDP volume estimates to one where we would be overweighting its economic impact in the tail years. This is if Test and Trace was no longer taking place (Figure 1).
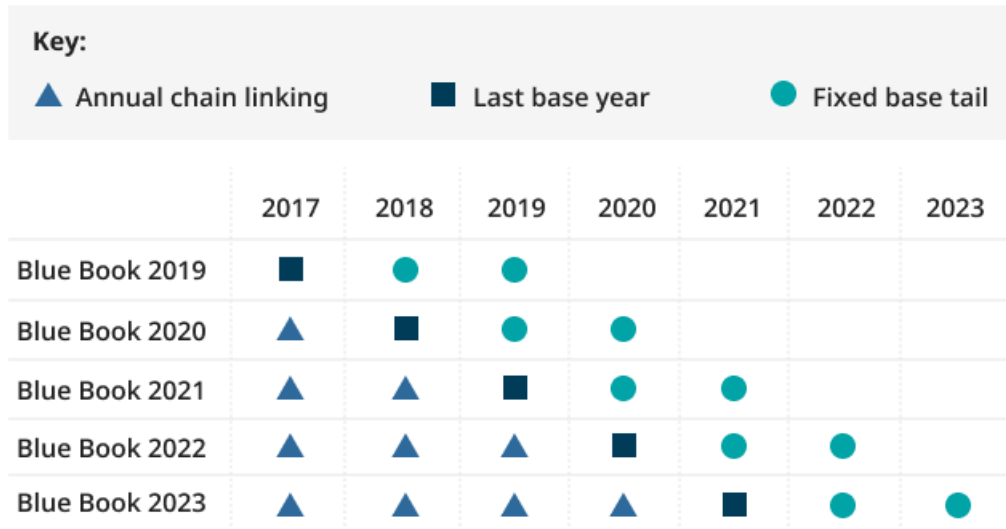
It is only once the latest estimates have been chain-linked and volume estimates have been produced in the previous year's prices that that this weighting impact would be resolved.

Notes for: The challenge of the coronavirus (COVID-19) pandemic

1. A full record of the volume estimates of Test and Trace and vaccination programmes is published as part of GDP estimates.

3 . Weighting of the NHS Test and Trace Programme: a hypothetical example

Figure 1: Hypothetical illustration of recording Test and Trace in the UK National Accounts and the treatment of the base year

Key:		
▲ Annual chain linking	■ Last base year	● Fixed base tail

	2017	2018	2019	2020	2021	2022	2023
Blue Book 2019	■	●	●				
Blue Book 2020	▲	■	●	●			
Blue Book 2021	▲	▲	■	●	●		
Blue Book 2022	▲	▲	▲	■	●	●	
Blue Book 2023	▲	▲	▲	▲	■	●	●

Source: Office for National Statistics - Chain-linking in the UK National Accounts: Blue Book 2022

Notes:

1. The base year is where the current price values are used to weight the price and volume measures, which is updated every year under chain-linking. This reflects the structure of the economy in the respective year. The reference year is the year in which the chain volume measure is equal to the current price value or where the index number is 100.

2. The last base year was rolled forward by one year to 2019 in Blue Book 2021. There is a fixed-base tail for the periods thereafter, which up until Blue Book 2022, would cover volume estimates of quarterly gross domestic product (GDP) for 2020, 2021 and 2022.

3. For illustrative purposes, this is based on the Test and Trace expenditure that only has an impact in 2020 so that the hypothetical impact on over- and under-weighting can be seen. More information is available on the theoretical and practical treatment of measuring the economic output of COVID-19, including testing, tracing and vaccinations.

Figure 1 shows the impact of over- and under-weighting of the NHS Test and Trace Programme (Test and Trace) in this hypothetical example, where it only takes place in the year 2020 for illustrative purposes.

In Blue Book 2021:

- 2019 is used as a last base year

- for periods up to and including 2019, volume estimates of gross domestic product (GDP) are based on the structures of those respective years

- the fixed-based tail of 2020 and 2021 is informed by 2019

- Test and Trace has no weight for years up to and including 2019, as it would not be reflected in those structures for these pre-coronavirus (COVID-19) pandemic years

- Test and Trace should be recorded in a volume estimate of GDP in 2020; however, it has no weight in the last base year of 2019 so there is an underweighting of Test and Trace

- no Test and Trace is taking place in 2021 in this hypothetical example, so there are no challenges around weighting

In Blue Book 2022:

- a last base year of 2020 would be implemented if there was no change in how we produce volume estimates of GDP

- for periods up to and including 2020, volume estimates of GDP are based on the structures of those respective years

- 2020 would now inform the fixed-based tail of 2021 and 2022

- Test and Trace would still not be reflected in volume estimates of GDP for years up to and including 2019, as it would not be reflected in those structures – Test and Trace correctly has no weight in these years before the pandemic

- Test and Trace would now be recorded in a volume estimate of GDP in 2020 so there is the correct weighting of Test and Trace

- No Test and Trace is taking place in 2021 and 2022 in this hypothetical example, but there would be an overweighting of Test and Trace for these years as it is reflected in the weights of the last base year of 2020

In Blue Book 2023:

- a last base year of 2021 would be used if there was no change in how we produce volume estimates of GDP

- for periods up to and including 2021, volume estimates of GDP are based on the structures of those respective years

- 2021 would also inform the fixed-based tail of 2022 and 2023

- Test and Trace would only receive a weight in the year of 2020, while there would be a zero weight in the last base year of 2021; this would correctly inform volume estimates of GDP for 2022 and 2023 so Test and Trace would be correctly weighted for all years

This hypothetical impact of under- and over-weighting is a much broader challenge, reflecting how wide-ranging the industry-level effects of the coronavirus pandemic. For example, there have been particularly pronounced impacts on "high-contact" industries. This reflects how these types of industries have been more affected by the public health restrictions and voluntary social distancing that have been in place over 2020 and 2021.

We record volume estimates of how much gross value added (GVA) is produced by each industry. Figure 2 captures the extent to which there has been a change in the relative industry performance from one year to the next. It demonstrates the change in the distribution of the level of GVA produced by each industry. The more wide-ranging the industry-level impacts, the higher this change in dispersion from one year to the next. It is capturing the relative changes in the output that is being produced by each industry over time. For example, if the output of all industries changes by the same amount in a period, then there would be zero change in this dispersion indicator.

Figure 2 shows that there is always some level of dispersion that takes place from one year to the next. However, the change in industry-level estimates of GVA in response to the pandemic in 2020 and 2021 has been much larger than previously experienced. This reflects how coronavirus restrictions had more of an impact on those industries more reliant on in-person contact. This highlights the challenge of having these years as the last base year as part of a fixed-tail approach.
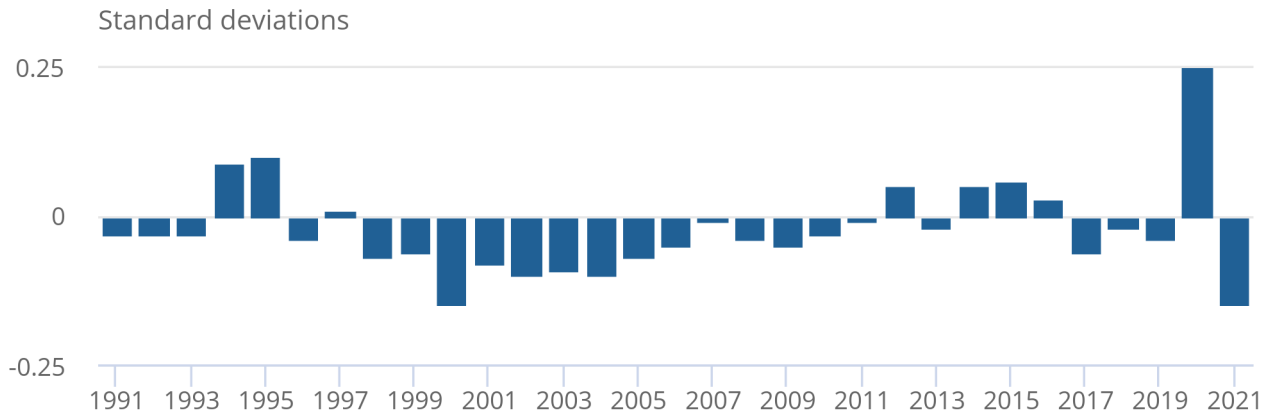
In Blue Book 2022, the current practice would have seen the last base year be updated to 2020. The output and expenditure structure of 2020 would provide the current price weights. It would have been used for the tail years to produce the initial estimates of volume GDP for the tail period of 2021 and 2022. However, Figure 2 shows that this approach would have potentially caused distortions of the volume change in GDP, once the full application of chain-linking is applied. A similar challenge would have been experienced if 2021 was chosen as the last base year to inform the fixed-base tail in Blue Book 2023.

Figure 2: Large changes in industry structures in 2020 and 2021 reflect how we produce real-time estimates of volume GDP

Changes in the distribution of industry-level gross value added (GVA) weights

Standard deviations

0.25

0

-0.25

1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021

Source: Office for National Statistics - Quarterly National Accounts

Notes:

1. Captures the year-on-year change in the cross-industry standard deviation of changes in each industry's current GVA weight. This is taken at the section level (A to T). The more wide-ranging the impacts are on the output produced by industries, the higher this indicator of the change in dispersion.
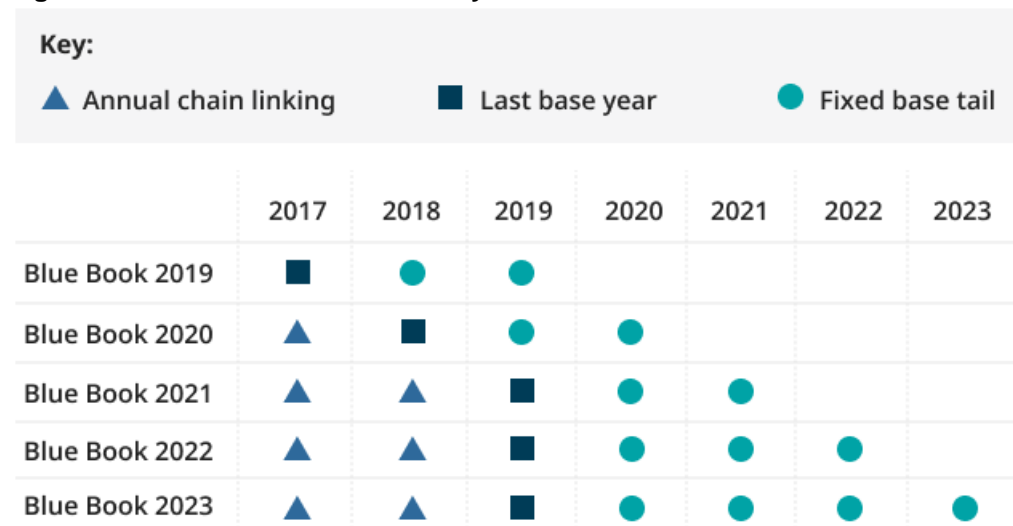
4 . Approach for Blue Book 2022

The [International Monetary Fund (IMF) guidance (PDF, 230KB)](#) recommends that 2020 and 2021 should not be used as base years for those countries that rebase every five years because of the impacts of the coronavirus (COVID-19) pandemic. For countries that undertake annual chain-linking, they should continue to use 2020 and 2021 as base years.

It is worth highlighting that the [2008 System of National Accounts (PDF, 9MB)](#) provides further guidance and highlights that "if individual prices and quantities fluctuate so that the relative price and quantity changes occurring in earlier periods are reversed in later periods, chaining will produce worse results than a simple index".

In the UK, we have a specific challenge because of how we use a fixed-base tail for the most recent periods. The fixed-tail approach used for real-time estimates is closer to a five-year rebasing method. Therefore, in line with international guidance, 2020 and 2021 will not be chosen as last base years for the moment. This approach is conditional on 2022 being the earliest point where the structural composition of the UK economy is likely to have returned to a "new normal".

Based on the information that we have available, we will keep 2019 as the last base year as part of [Blue Book 2022](#), effectively extending the fixed base tail (Figure 3). We will review this approach each year with a view to re-introduce our standard process of annual chain-linking once we are able to implement 2022 as the last base year, provided that is considered as "normal". This would reflect when the output and expenditure structures would not be significantly impacted by new coronavirus restrictions.

Figure 3: Treatment of the last base year in the Blue Book 2022 for the UK National Accounts

Key:
▲ Annual chain linking   ■ Last base year   ● Fixed base tail

	2017	2018	2019	2020	2021	2022	2023
Blue Book 2019	■	●	●				
Blue Book 2020	▲	■	●	●			
Blue Book 2021	▲	▲	■	●	●		
Blue Book 2022	▲	▲	■	●	●	●	
Blue Book 2023	▲	▲	■	●	●	●	●

Source: Office for National Statistics - Chain-linking in the UK National Accounts: Blue Book 2022

Notes:

1. Under the process of annual chain-linking, the base year would typically be moved forward by one year and volume GDP estimates up to and including that year would be produced based on previous year's prices. There is a fixed-base tail of two years under this process.

2. Blue Book 2022 will keep the last base year fixed at 2019 in which the fixed-base tail becomes longer so the impacts of the coronavirus pandemic have less of an effect on real-time estimates of volume GDP.

Figure 3 shows that this process avoids 2020 and 2021 becoming last base years. This is so that the most pronounced effects of the pandemic on the structural composition of the UK economy would not inform the volume estimates in the most recent periods. This is where headline volume estimates would be affected by the weighing of these current price weights for 2020 and 2021, where coronavirus restrictions would have had been most affected.

Now in Blue Book 2022:

- a last base year of 2019 would be kept

- for periods up to and including 2019, volume estimates of GDP are based on the structures of those respective years

- 2019 would inform the fixed-based tail of 2020, 2021 and 2022

- Test and Trace would still not be reflected in volume estimates of GDP for years up to and including 2019, as it would not be reflected in those structures – Test and Trace correctly has no weight in these pre-coronavirus pandemic years

- Test and Trace would not be recorded in a volume estimate of GDP in 2020 so there is not the correct weighting of Test and Trace – though volume adjustments would be there in practice

- No Test and Trace is taking place in 2021 and 2022 in this hypothetical example, but there would be no overweighting of Test and Trace for these years as there is no weight in the last base year of 2019

In Blue Book 2023:

- a last base year of 2019 would be kept

- for periods up to and including 2019, volume estimates of GDP are based on the structures of those respective years

- 2019 would inform the fixed-based tail of 2020, 2021, 2022 and 2023

- Test and Trace would still not be reflected in volume estimates of GDP for years up to and including 2019, as it would not be reflected in those structures – Test and Trace correctly has no weight in these pre-pandemic years

- Test and Trace would not be recorded in a volume estimate of GDP in 2020 so there is not the correct weighting of Test and Trace – though volume adjustments would be there in practice.

- No Test and Trace is taking place in 2021, 2022 and 2023 in this hypothetical example, but there would be no overweighting of Test and Trace for these years as there is no weight in the last base year of 2019.

5 . Related links

Chain-linking methods used within the UK National Accounts
Methodology | Last revised 10 October 2016
This is a technical reference article, which describes unchaining and chain-linking methodology used in the production of volume measures within the UK.

Proposed changes to be implemented in Blue Book and Pink Book 2022
Article | Released 13 January 2022
Planned scope and content of the UK National Accounts, the Blue Book and UK Balance of Payments, the Pink Book 2022 editions.