

Capital stocks and fixed capital consumption QMI

Quality and methodology information for the capital stocks and fixed capital consumption release published twice a year, detailing the strengths and limitations of the data, methods used, and data uses and users.

Contact:
Marianthi Dunn and Kris
Johannsson
capstocks@ons.gov.uk
+44 1633 455643

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1 . Output information

- National Statistic: yes
- Data collection: administrative sources and business surveys
- Frequency: twice a year
- How compiled: Perpetual Inventory Method (PIM)
- Geographic coverage: United Kingdom
- Related publications: GDP, Blue Book, National Balance Sheet, Business Investment

2 . About this Quality and Methodology Information report

This Quality and Methodology Information (QMI) report contains information on the quality characteristics of the data (including the European Statistical System's five dimensions of quality) as well as the methods used to create it.

The information in this report will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and users of the data
- understand the methods used to create the data
- decide suitable uses for the data
- reduce the risk of misusing data

3 . Important points

- We release two Capital stocks and fixed capital consumption publications each year; the first (typically published around April) presents preliminary results and is an experimental statistic. The second (typically published around December) is a National Statistic.
- Capital stocks estimates are presented in net and gross values by industry, asset and sector, and estimates for consumption of fixed capital are also available by industry, asset and sector; these are available in current prices and chain volume measures, and estimates are available from 1995 onwards.
- In 2021, the Office for National Statistics (ONS) introduced preliminary estimates of capital stocks and consumption of fixed capital, making the data available seven months earlier than previously published.
- In 2019, the ONS reviewed the capital stocks compilation process, introducing a series of improvements in the compilation of these National Statistics; the developments incorporated international guidance from [the Organisation for Economic Co-operation and Development's \(OECD\) Measuring Capital Manual published in 2009](#).
- The estimates in the capital stocks and fixed capital consumption publication released in December may vary from those included in the Blue Book of the corresponding period. This is because the capital stocks release includes the final supply use balanced gross fixed capital formation (GFCF) estimates when calculating estimates of gross stock, net stock and consumption of fixed capital.

4 . Quality summary

Overview

Capital stocks and fixed capital consumption is a publication that is released twice a year containing annual estimates for capital stocks in gross and net values broken down by asset, industry and sector of the economy. The data are presented in current prices and chain volume measures. The assets covered in this release include dwellings, other buildings, other structures, land improvements, transfer costs of ownership of non-produced assets, other machinery and equipment and weapons systems, intellectual property products and cultivated biological assets.

Use and Users

Estimates of capital stocks and consumption of fixed capital have many uses. They are used internally by the Office for National Statistics (ONS) in the:

- estimation of gross domestic product (GDP) to measure the value added of the non-market output sectors (central and local government, and non-profit institutions serving households) – capital consumption forms part of the sectors' contributions to the economy, and it is also the only component of gross operating surplus for these sectors
- sector accounts, where estimates of capital consumption are used to convert the gross-based estimates, such as gross domestic product or gross disposable income, into the net estimates such as net disposable income
- estimation of public sector finances, the profitability of UK private companies, health productivity and capital services

Capital stocks and consumption of fixed capital estimates are also used by other government and administrative departments, such as the Bank of England, the Office for Budget Responsibility (OBR) and Her Majesty's Treasury (HMT) for policy analysis and budgetary forecasting. These organisations use the estimates to monitor economic performance and inform monetary and fiscal policy decisions. These estimates are also used by the business and research communities, academia, the media and the general public as well as international organisations such as the [Organisation for Economic Co-operation and Development \(OECD\)](#) for international analysis and comparisons across countries.

Strengths and limitations

Capital stocks and consumption of fixed capital estimates are produced following international guidance such as the [UN System of National Accounts \(SNA\) 2008](#), the [European System of Accounts \(ESA\) 2010](#) and the Perpetual Inventory Method (PIM) described in the [OECD's Measuring Capital Manual](#). This is deemed to be a conceptually better methodology for estimating consumption of fixed capital and capital stocks, compared with business accounts or tax records that may, for example, value the assets on a historical basis. The PIM aims to value the costs of replacing the asset and therefore uses information such as capital investment flows (gross fixed capital formation), deflators, retirement profiles and asset service lives, by type of asset and industry.

The estimates in the capital stocks and fixed capital consumption released in December may vary from those included in the Blue Book of the corresponding period. As a result of timetable constraints in the annual Blue Book compilation cycle, it is not possible to incorporate final supply use balanced estimates of gross fixed capital formation in the production of capital stocks estimates in the Blue Book. Therefore, estimates of gross stock, net stock and consumption of fixed capital in the capital stocks publication may differ from those in the Blue Book.

Recent improvements

In April 2021, the ONS introduced preliminary estimates of capital stocks and consumption of fixed capital. This new experimental release aimed to produce earlier estimates of the capital stocks series; it was developed in response to stakeholder requirements, mainly the OBR and HMT, who use the data for budgetary forecasts.

In 2019, the ONS reviewed the compilation of the capital stocks and consumption of fixed capital estimates, introducing a series of improvements. Further details can be found in our [Changes to the capital stock estimation methods for Blue Book 2019](#) article. The main improvements included:

- reviewing and updating the asset lives for non-financial assets such as buildings, and machinery and equipment; as such, for the majority of assets, their life lengths have been shortened, leading to a downward revision to capital stock estimates and an upward revision to estimates of the consumption of fixed capital
- replacing straight-line depreciation with a wider choice of depreciation patterns (for example, geometric and hyperbolic) that more appropriately capture the loss in value of assets as they age
- updating the treatment of costs of ownership transfer so they are now written off over the period of ownership of the relevant assets instead of being written off as incurred
- improved treatment of consumption of fixed capital by assigning other volume changes such as war losses and classifications to the appropriate accounts
- reviewing and improving the quality of the industry breakdown of historical gross fixed capital formation (GFCF) data in the redeveloped capital stocks system
- replacing historical benchmark estimates covering certain institutional sectors, including government, public non-financial corporations and non-profit institutions, with newly estimated data

5 . Quality characteristics of the capital stocks and fixed capital consumption data

Relevance

The primary purpose of the capital stocks and fixed capital consumption publication is to produce estimates of gross stock, net stock and consumption of fixed capital by asset, industry and sector. Industry breakdowns are consistent with the [UK Standard Industrial Classification 2007 \(SIC 2007\)](#). Publication of these detailed breakdowns is consistent with international guidance within the [UN System of National Accounts \(SNA\) 2008](#), the [European System of Accounts \(ESA\) 2010](#) and the [Organisation for Economic Co-operation and Development's \(OECD\) Measuring Capital Manual](#). These breakdowns are also in response to requests by important stakeholders, such as the Office for Budget Responsibility (OBR), HM Treasury (HMT) and the Bank of England (BoE). The estimates are used by these customers for preparing budgetary forecasts and analysis to inform monetary and fiscal policy decisions.

In addition, estimates published in the release are used widely by the international research community, researchers, academia and the media.

Accuracy and reliability

The capital stocks estimates rely on data for gross fixed capital formation (GFCF), including business surveys and administrative sources.

Timely publication of these statistics needs to be balanced against their accuracy and reliability. This results in a trade-off between timeliness and accuracy.

Statistical revisions arise for three main reasons:

1. Changes in data inputs, which are flows of capital investment measured as GFCF and deflators.
2. Changes in methods, where improvements have been identified in the way we estimate the outputs.
3. System and processing errors in the compilation process.

Most revisions reflect either the adoption of new statistical techniques or the incorporation of new information from respondents. Further information about revisions in the GFCF estimates can be found in our [Business Investment QMI](#).

Coherence and comparability

Capital stocks and consumption of fixed capital estimates are produced following international guidance, such as the [UN SNA 2008](#), making them coherent with the production, income, expenditure and capital components in national accounts. The estimates are also compiled using the principals of the OECD's Measuring Capital Manual and are therefore internationally comparable.

Data on gross stocks, net stocks and consumption of fixed capital by type of asset and industry are transmitted annually to the OECD and published on [the OECD's database](#).

Capital investment data, known as gross fixed capital formation (GFCF), used in the calculation of capital stocks and consumption of fixed capital estimates, derived by the Perpetual Inventory Method (PIM), can vary when compared with those used in business investment and government sectors. Further information on these differences can be found in our [Capital stocks user guide](#).

Accessibility and clarity

Our recommended format for accessible content is a combination of HTML web pages for narrative, charts and graphs, with data provided in usable formats such as CSV and Excel. We also offer users the option to download the narrative in PDF format.

In addition, users can download the processing code for the PIM, which is available from the [ONS Github account](#). The PIM is the core production method for compiling estimates of capital stocks and consumption of fixed capital.

The capital stocks and consumption of fixed capital releases and time series datasets are available to download free from the ONS website at 9.30am on the day of publication and conform to the standards set out in the UK Statistics Authority's Code of Practice for Official Statistics. Time series used in the capital stocks and consumption of fixed capital statistical bulletin and time series datasets carry unique identifiers for ease of use. The statistical bulletin also includes commentary on the main dataset trends in addition to relevant graphs and tables.

In addition to this Quality and Methodology Information (QMI) report, basic quality information can be found in the [Capital stocks user guide](#).

For information regarding conditions of access to data, please refer to:

- the ONS's [terms and conditions](#) for data on the website
- information about [copyright and reuse of published data](#)
- information about [how we publish statistics](#)
- the [Virtual Microdata Laboratory](#) where you can access microdata
- the [ONS accessibility statement](#)

Timeliness and punctuality

Capital consumption and capital stocks estimates are published as National Statistics around eight to ten months after the end of the reference year, and approximately two months after the annual Blue Book publication. These estimates are published with more detailed breakdowns in the capital stocks, capital consumption and non-financial balance sheet publications, as National Statistics.

In response to user requirements, since April 2021, capital consumption and capital stocks estimates are published as preliminary annual measures at approximately four months after the end of the reference year, as experimental statistics.

For more details on related releases, the [GOV.UK release calendar](#) is available online and provides advance notice of release dates. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the [Code of Practice for Official Statistics](#).

Concepts and definitions (including list of changes to definitions)

Estimates of capital stocks and consumption of fixed capital use the international concepts in the [UN SNA 2008](#), the [European System of Accounts \(ESA\) 2010](#) and the [OECD's Measuring Capital Manual](#).

Industry breakdowns are consistent with the [UK Standard Industrial Classification 2007 \(SIC 2007\)](#).

Sectors are consistent with the national accounts sectors as institutional producers of the economy, for example:

- private non-financial corporations
- financial corporations
- government (including central and local government)
- public corporations
- households
- non-profit institutions serving households

Geography (including list of changes to boundaries)

Capital stocks and consumption of fixed capital estimates are produced by the ONS for the UK.

6 . Methods used to produce the capital stocks and fixed capital consumption data

Capital stocks estimates are calculated using the Perpetual Inventory Method (PIM). This involves cumulating gross fixed capital formation (GFCF) across time and accounting for retirement and depreciation. Further information is available in our [Capital stocks user guide](#).

How we collect the data, main data sources and accuracy

The main data sources for estimating capital stocks data series are GFCF, which measures acquisitions minus disposals of fixed assets (produced assets that are used repeatedly or continuously in production processes for more than a year) and costs associated with the ownership transfer of these fixed assets.

Given that estimates of capital stock cumulate investment that can be over a hundred years old, it is necessary that we have a long time series broken down by asset, industry, and sector. Estimates of GFCF from 1828 to 1996 used to calculate capital stock differ from published estimates of GFCF.

The [Business Investment QMI](#) details the methodology used to estimate GFCF from 1997 onwards.

The data sources for the private sector include the Quarterly Acquisitions and Disposal of Capital Assets Survey, the Annual Acquisitions and Disposal of Capital Assets Survey, and the Annual Business Survey. Data sources for the government sector include the online system of central accounting and reporting (OSCAR), statistical data collections conducted by the Department for Levelling Up, Housing and Communities and the devolved administrations for Scotland, Wales and Northern Ireland.

How we process the data

The PIM requires GFCF expressed in equivalent prices, therefore we use a set of deflators to convert current price GFCF estimates into constant prices. After using the PIM to derive constant price estimates of capital stocks and consumption of fixed capital, current price estimates are then calculated by using the same set of deflators.

Changes in estimates of net capital stock are usually the result of additions from GFCF and reductions from capital consumption (depreciation). However, other changes in volume can affect estimates of capital through catastrophic losses (for example, war losses) and reclassifications (where the owner of capital is classified to a different sector).

The difference between estimates of net and gross estimates of capital stock is that gross estimates do not account for the loss in the value of assets over time (depreciation) for assets that remain in use.

1. Gross capital stock $_{KP_t}$ = Gross capital stock $_{KP_{t-1}}$ + GFCF $_{KP_t}$ + Other changes in volumes $_{KP_t}$ – Retirement $_{KP_t}$
2. Net capital stock $_{KP_t}$ = Net capital stock $_{KP_{t-1}}$ + GFCF $_{KP_t}$ + Other changes in volumes $_{KP_t}$ – Consumption of fixed capital $_{KP_t}$

where:

$_{KP_t}$ = constant prices in time t

$_{KP_{t-1}}$ = constant prices in the previous period

The Perpetual Inventory Method (PIM)

The PIM requires assumptions to be made about the age that assets will retire at and how this retirement will be distributed across a cohort of assets, to generate estimates of gross capital stock. Net capital stocks are calculated using an age-price profile that describes the changes in the price of an asset as it ages, and these are combined with a retirement profile.

The sectoral breakdown of the private sector, between private non-financial corporations, households and non-profit institutions serving households (NPISH), differs from the GFCF estimates used in business investment. General government estimates of GFCF differ slightly at a total level, and there are differences in the industry and asset breakdowns. Further information of these differences can be found in our [Capital stocks user guide](#).

Published estimates of GFCF do not break down estimates of “other buildings and structures” into “other buildings”, “other structures” and “land improvements”. In the capital stocks system, the Annual Acquisitions and Disposal of Capital Assets Survey (ACAS) is used to produce more granular estimates, so they can be assigned an appropriate asset life.

The ONS has a Non-Financial Assets Review project, in the National Accounts Improvement Programme, whose aim is to align and improve the different estimates of GFCF, inventories and valuables, GCF, capital stocks and capital services that are currently used.

Other changes in volume

Other changes in volume included in the capital stocks system consist of the economic appearance of assets, catastrophic losses (war losses), and changes in sector allocation such as the reclassification of housing associations.

Deflators

Deflators from 1997 onwards used in the capital stocks system are derived from those used to calculate GFCF. Product-level deflators are converted to asset-level deflators by weighting product-level deflators using GFCF, as the capital stocks system only contains asset-level detail.

Retirement profiles

Ahead of Blue Book 2019, new estimates of asset lives were produced and the methodology used to estimate these is described in our [Changes to the capital stock estimation methods for Blue Book 2019 article](#). The retirement of assets is normally distributed around the mean asset life, except research and development, where a Weibull distribution is used.

Depreciation profiles

Age-efficiency profiles describe the relationship between the age of an asset and its efficiency. It is then possible to derive the age-price profile using a real discount rate.

In the absence of empirical evidence on age-efficiency profiles in the UK, the decision was taken to use hyperbolic age-efficiency profiles in line with several other national statistical institutes (the US Bureau of Labour Statistics, Australian Bureau of Statistics and Statistics New Zealand). The parameters used for each asset's age-efficiency profile determine the extent to which the decline in efficiency is weighted towards the end of an asset's life, and these are in line with other national statistical institutes' practices.

Age-price profiles have been calculated from age-efficiency profiles using a real discount rate of approximately 4%. This is consistent with other national statistical institutes that use hyperbolic age-efficiency profiles and with the HM Treasury guidance regarding discount rates presented in the Green Book.

Two methods were used to produce depreciation profiles for a cohort of assets by combining the retirement function with the age-price profiles.

For most assets, age-price profiles are calculated for each asset life, from the minimum to the maximum. Each age-price profile is then weighted according to the likelihood that an asset has that life, and this is then used to calculate a depreciation profile for the cohort.

The second method uses the age-price profile for the longest-lived asset as the age-price profile for the cohort of assets, but the value then depreciates to zero upon retirement. This method is used for hardware, software, and cultivated assets.

How we quality assure and validate the data

The capital stocks and capital consumption estimates are quality assured using a variety of standard practices, such as movement analysis at sector and asset level. Any atypical movements are investigated with the source inputs to ensure the quality of the data to be published and to understand and explain the movements.

As the capital stocks and capital consumption estimates are used in the production of the national accounts and Blue Book estimates, and are produced according to the national accounts framework, they are subject to the same [revisions policy \(PDF, 71KB\)](#) as the Blue Book.

Quality assurance is a very important part of the compilation of these estimates and the main driver for agreeing the publication to be fit for the users' requirements.

How we disseminate the data

Estimates of net stocks, gross stocks and consumption of fixed capital are published on the ONS website and are accessible via HTML web pages for narrative, charts and graphs, while data series are available in CSV and Excel formats.

The Capital stocks and consumption of fixed capital release and time series datasets are available to download free from the ONS website at 9.30am on the day of publication. Time series datasets carry unique identifiers for ease of use.

In addition, users can download the processing code for the PIM, which is available from the [ONS Github account](#).

How we review and maintain the data processes

Data processes are reviewed annually using the Statistical Quality Maturity Model (SQMM). This is a coherent framework that assists output managers in identifying the actions they need to take to move the outputs to a higher level of statistical quality maturity.

7 . Other information

Glossary of terms

Capital stocks

Capital stocks represent the value of all fixed assets used in production in the economy that are still in use, such as machinery, dwellings and intellectual property products, such as software.

Economic assets

Economic assets are a store of value representing the benefits the economic owner will get by holding or using the asset or making the asset available for other producers to use over a period of time.

Fixed assets

Fixed assets are non-financial produced assets, which come into existence as a result of the production process, and which contribute repeatedly in the process of production for more than one year. For example, a machine on a production line or software used in production.

Gross capital stocks

Gross capital stocks tell us how much the economy's assets would cost to buy again as new, or their replacement cost. All the fixed assets in the economy that are still productive and in use are added up to calculate this, regardless of how old they are or how much they may have deteriorated since they were first used. This measure shows the value at the end of the year. This is mainly calculated as an intermediate step towards net capital stocks but individually provides a broad indicator of the productive capacity of an economy.

Net capital stocks

Net capital stocks show the market value of fixed assets. The market value is the amount that the assets could be sold for, which will be lower than the value of gross capital stocks. This reflects the fact that the assets will have had some wear and tear compared with a new asset. This measure shows the value at the end of the year. This measure is used in preference to gross capital stocks as it provides a valuation of assets in the economy after the removal of depreciation.

Consumption of fixed capital

The consumption of fixed capital is the decline in the value, or depreciation, of fixed assets in the economy over a time period. The decline in value can be because of wear and tear, assets no longer being used, or normal accidental damage. It can also be described as the quantity (or value) of the capital stocks that is used up in that period. While these data are interesting in their own right, their primary purpose is to move from various gross measures of economic flows to the corresponding "net" variable, in particular for production and income (net domestic product and net value added) and a number of demand variables, such as net investment.

Gross fixed capital formation (GFCF)

Gross fixed capital formation is the acquisition less disposals of produced fixed assets; that is, assets intended for use in the production of other goods and services for a period of more than a year. Acquisition includes both purchases of assets (new or second hand) and the construction of assets by producers for their own use. New buildings and dwellings, and major improvements to buildings and dwellings, are included in GFCF, but the acquisition and disposal of existing buildings and dwellings are not.

Comparisons with other data sources

Values of capital stock and consumption of fixed capital estimates produced in this National Statistics release differ from the corresponding Blue Book estimates, as the release includes the final supply use balanced GFCF estimates when calculating estimates of gross stock, net stock and consumption of fixed capital.

This is because the Blue Book production schedule is not able to accommodate GFCF supply use balanced estimates in the Perpetual Inventory Method (PIM) when calculating estimates of gross stock, net stock and consumption of fixed capital.

National balance sheet (NBS)

There are links between the net capital stocks estimates and the estimates shown for AN.11 Fixed assets in the non-financial section of the NBS. In the NBS, estimates of produced non-financial assets are taken directly from the current price net capital stocks for all sectors.

International comparisons

The ONS produces the capital stocks and consumption of fixed capital estimates in line with international guidance in the Organisation for Economic Co-operation and Development's (OECD) Measuring Capital Manual, the UN SNA 2008 and [European System of Accounts \(ESA\) 2010](#) that is using the internationally recommended PIM. Although the PIM as a modelling method is comparable across countries, the supporting assumptions, such as service lives of assets, depreciation and retirement functions, may vary across countries. This means that when comparing estimates across countries, users need to be aware of these differences.

UK estimates of capital stocks are also available on the OECD's website along with other country estimates. When comparing between countries, users should ensure they are comparing figures in the same currency and that there are no definitional differences noted.

Output quality trade-offs

Trade-offs are the extent to which different dimensions of quality are balanced against each other.

A trade-off of cost over potentially better-quality data is made by using a PIM to model capital stocks and capital consumption data instead of conducting a survey to gather this information directly from companies. However, the use of PIM model data is internationally recognised as the preferred method of measuring capital data with the assumption that little accuracy is lost by use of the model, since much of the data that companies could provide would not meet national accounts standards and definitions. The [OECD's Measuring Capital Manual](#) supports the use of a PIM over survey data.

In addition to this Quality and Methodology Information (QMI), basic quality information relevant to each release is available in the quality and methodology section of the relevant statistical bulletin.

Useful links

Our previous [Capital stocks and fixed capital consumption, UK releases](#) are available.