International comparisons of the measurement of non-market output during the coronavirus (COVID-19) pandemic

A joint Office for National Statistics – Organisation for Economic Co-operation and Development exploration of international differences in the methodologies used to measure non-market output and analysis of the implications for international comparisons of gross domestic product during the coronavirus (COVID-19) pandemic.

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Notice

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We have corrected the output data for Chile. Originally the figures provided for the change in industries O, P and Q included other service activities. This has been corrected to remove other service activities, changing the output growth for Chile in Figures 5 and 7. We apologise for any inconvenience caused.

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1 . Main points

- A variety of methodologies are employed by national statistical institutes (NSIs) to measure changes in the volume of non-market output, with direct input indicators generally used for public administration and defence and direct output indicators predominant for education and common for healthcare.
- International comparisons of non-market output, and by extension gross domestic product (GDP), over the coronavirus (COVID-19) pandemic have been complicated by methodological differences.
- Education services proved particularly difficult with a few countries implementing adjustments to estimates of output where it was perceived that the move to a remote learning environment led to a reduction in education output.
- Despite differences in the methodologies used by different NSIs, there is a relationship between the intensity of the coronavirus pandemic in a country and the scale of the negative impact on non-market output, particularly for healthcare.
- Additional discussions and refinement of the concepts used in the measurement of non-market services, especially for education, would assist in ensuring greater consistency between countries and likely benefit cross-country comparability.

2 . Coronavirus (COVID-19) and non-market services

The coronavirus (COVID-19) pandemic and the measures taken to control its spread have had severe impacts on economies across the world. Restrictions on contact and travel reduced the accessibility of many goods and services, and in some cases spurred transformation in how goods and services were delivered.

The coronavirus pandemic has also significantly affected the provision of non-market services, such as healthcare and education. The non-market sector is characterised by providing goods and services without economically significant prices, a feature that poses challenges to measuring its economic output.

Various approaches are available to meet these challenges, the use of which varies between countries and between components of non-market output. The coronavirus pandemic has presented further measurement challenges, which may have particularly affected the comparability of non-market output measures across countries, and thus the comparability of gross domestic product (GDP) measures.

Main aims

This article aims to inform on the range of approaches currently applied by national statistical institutes (NSIs) to measure non-market output. It investigates how different approaches may have contributed to differences in the measured growth of non-market output and GDP over the coronavirus pandemic through 2020 and 2021.

This article provides a brief overview of the methodologies available, examines approaches applied by NSIs with a focus on a group of NSIs interviewed as part of this project, and compares growth rates of industries that are predominately non-market, taking into account possible differences between countries in the impact of COVID-19 (proxied by relative excess mortality rates).

For the project, the Organisation for Economic Co-operation and Development (OECD) and the Office for National Statistics (ONS) interviewed national account compilers from the respective NSIs in Australia, Canada, Italy, Ireland, France, Germany, Norway, the UK and the US. While this article discusses implications for the interpretability of non-market output, it does not aim to recommend specific compilation practices. This may be the topic of a follow-up study.

Government expenditure and non-market industries

The composition of government final consumption expenditure (GFCE)[1] and non-market industries may vary across countries, dependent on how specific goods and services are provided. For instance, healthcare may account for a large proportion of GFCE in countries with public healthcare systems, but only a small proportion in those with mostly private systems. To provide more detail to differences between countries, this article focuses on the compilation of output for the three International Standard Industrial Classification (ISIC) industries most commonly captured in GFCE, that is:

- Public administration, defence and social security services (ISIC section O)
- Education (ISIC section P)
- Human health and social work activities (ISIC section Q)

While these three industries are predominantly non-market in most countries, within all three industries market activity also occurs and some NSI's may use a different compilation methodology to measure the market component. Overall, measurement methodology of market output (even in predominately non-market industries) is more consistent across countries and so warrants less investigation.

Cross-country differences affecting comparisons of GFCE or the output of the three industries most commonly captured in GFCE exist because:

- the coronavirus pandemic impacted countries with slightly different timing
- economic and health policy responses from governments were not always comparable
- the methodology used to measure components is not always consistent across countries

From a user perspective, ideally the factors contributing to differences in growth rates between countries should be delineated as much as possible.

By using excess deaths to approximate the impact of COVID-19, the paper attempts to compare results and provide some insight into the impact of differences in methodology across countries.

Notes for: Coronavirus (COVID-19) and non-market services

1. GFCE consists of expenditure incurred by general government on both individual consumption goods and services and collective consumption services (2008 SNA section 9.117).

3 . Non-market output and GDP during the COVID-19 pandemic

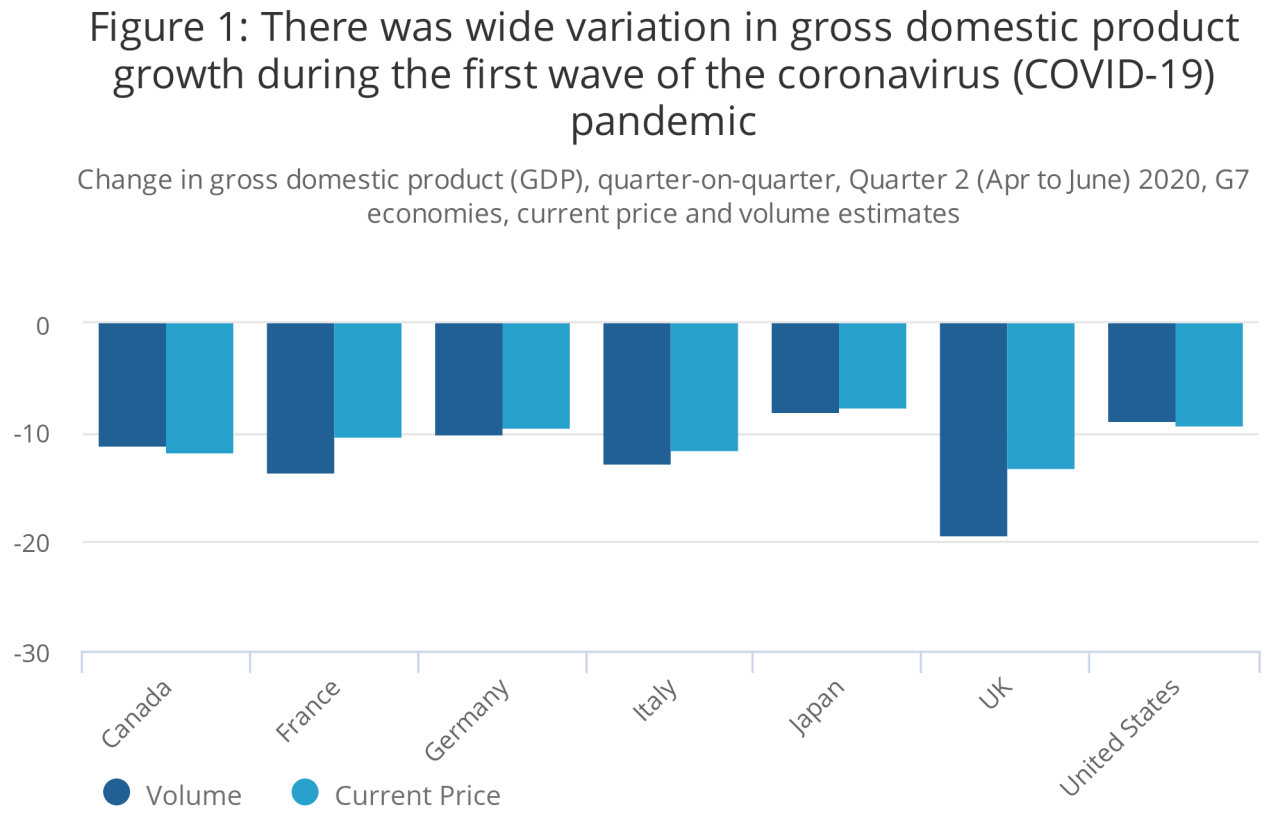
The need to understand how the coronavirus (COVID-19) pandemic may have affected the measurement of non-market output originates from the contribution of non-market output to differences in changes in gross domestic product (GDP) across countries during the early stages of the coronavirus pandemic.

Although differences in the rate of GDP growth across countries are not unusual, the relative size of the differences observed in Quarter 2 (Apr to June) 2020 (for example, 9.5 percentage points between the UK and Germany) is extremely unusual, with COVID-19 fully entrenched in all G7 economies at this time.

This analysis focuses on Quarter 2 2020 when the first and most restrictive confinements were in place and a majority of OECD countries observed their largest, COVID-19 related impact on GDP. Figure 1 shows marked differences in GDP growth, especially for the headline volume estimates. In some countries, substantial variation is also visible between the growth rates of volume and current price estimates of GDP, possibly suggesting different price-level changes in countries during the coronavirus pandemic.

Figure 1: There was wide variation in gross domestic product growth during the first wave of the coronavirus (COVID-19) pandemic

Change in gross domestic product (GDP), quarter-on-quarter, Quarter 2 (Apr to June) 2020, G7 economies, current price and volume estimates



Source: Organisation for Economic Co-operation and Development – Quarterly National Accounts database

Notes:

1. Data extracted on 4 February 2022.

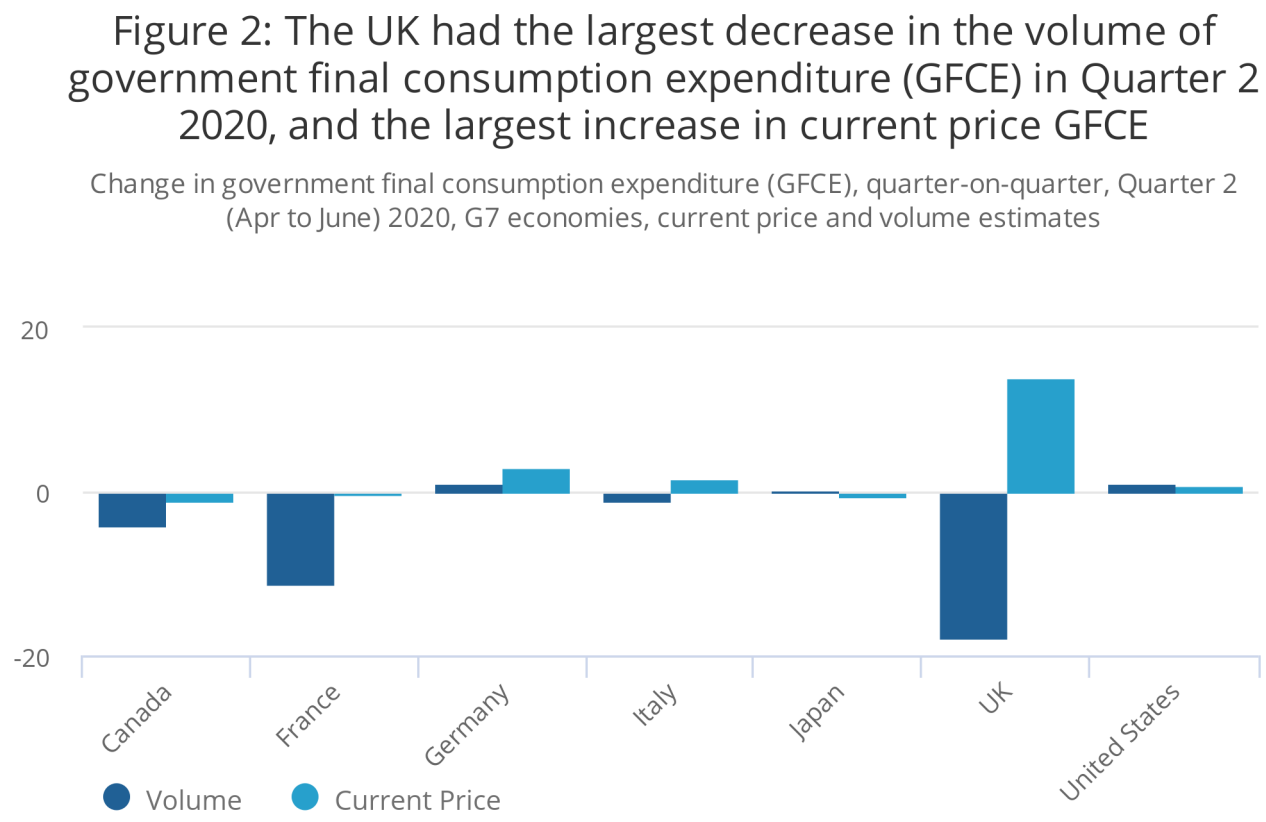
Looking at the expenditure components of GDP (see the article International comparisons of GDP during the coronavirus (COVID-19) pandemic for more detail), part of the difference in GDP growth arises from substantial variation in government final consumption expenditure (GFCE).

GFCE predominantly consists of services that are provided by governments for free or at prices that are not economically significant, referred to as non-market services (2008 SNA, section 2.40). Non-market services may include goods and services purchased at market price on behalf of households, who then receive them free or below economically significant prices.

Across G7 economies, the UK observed the largest increase in current price GFCE in Quarter 2 2020, while recording the largest decrease in volume terms (see Figure 2). In the other G7 economies – where GDP changes were more modest – movements in current price and volume GFCE have been more closely matched.

Figure 2: The UK had the largest decrease in the volume of government final consumption expenditure (GFCE) in Quarter 2 2020, and the largest increase in current price GFCE

Change in government final consumption expenditure (GFCE), quarter-on-quarter, Quarter 2 (Apr to June) 2020, G7 economies, current price and volume estimates



Source: Organisation for Economic Co-operation and Development – Quarterly National Accounts database

Notes:

1. Data extracted on 4 February 2022.

The fall in volume GFCE in the UK, and to a lesser extent in France, in Quarter 2 2020 negatively affected real GDP growth. Figure 3 shows that the negative contribution for France and the UK in Quarter 2 2020 is offset in the third and fourth quarter, although quarterly growth remains more variable than in other countries.

Figure 3: The UK and France had substantial rebounds in government final consumption expenditure after a fall in Quarter 2 2020

Contribution (percentage points) of government final consumption expenditure (GFCE) to real gross domestic product (GDP) growth (quarter-on-quarter), Quarter 1 (Jan to Mar) 2020 to Quarter 3 (July to Sept) 2021, selected OECD economies, seasonally adjusted

Notes:

1. Data extracted 4 February 2022.

Download the data

.xlsx

The coronavirus pandemic's effect on non-market services were similar in most OECD[1] countries, with many experiencing an extended period of remote learning for schools and significant compositional shifts in healthcare services. Therefore, variations as observed in Figures 2 and 3 may involve differences in the measurement of non-market output and may not only reflect the impact of the coronavirus pandemic.

Most countries expect higher revisions of national accounts data than average for the period covering the coronavirus pandemic. In some cases, this is because shifts in measurement practice produced methodological splits between annual and quarterly national accounts. Even when methodological changes did not occur, differences between the indicators used for annual and quarterly compilation may have been exacerbated because of COVID-19. Because of this, a review of the non-market output ultimately recorded by countries once all annual data has been included may well prove useful to confirm that the trends observed above are still in place.

Notes for: Non-market output and GDP during the COVID-19 pandemic

1. The OECD (Organisation for Economic Cooperation and Development) consists of the following countries: Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, UK and US.

4 . Methods used to measure non-market output

As non-market services are provided for free or at prices that are not economically significant, the measurement of their output poses unique challenges because of the lack of market prices. However, as noted by Schreyer (2010), regardless of whether services are provided by market or non-market units:

“The measured volume of non-market services should be the same as the one for measurement of the volume of market services, and vice-versa, as long as the services are the same.”

Therefore, different methods may be used to measure non-market output, given that the results closely approximate those that would have been observed if the service were provided by the market.

For many non-market services, there is ambiguity in quantifying what constitutes production. Are firefighters producing more output if they attend more fires, or is their state of readiness production in itself? If it takes the same inputs to incarcerate 10 prisoners as 11, should production increase with this additional inmate? What constitutes one unit of education output? Is it based on inputs, student numbers, or the quantity of learning conveyed?

Another conceptual challenge is how to assess changes in the quality of some non-market services. Many countries, including all EU member states and the UK, follow the guidance of the European System of Accounts (2010), which directs that estimates of non-market output not be adjusted for any change in quality. However, some non-EU countries may try to capture this within their estimates. In this regard, the distinction between quality and quantity change is also not always very clear. For example, does the quantity of education change if a class is divided and taught separately by a greater number of teachers, or would this result in a change in the quality of education?

While this article focuses on the compilation methods rather than the conceptual questions, some of these questions have become identifiable points of difference in how countries assessed the impact of the coronavirus pandemic on the delivery of non-market services.

The practical guidance for compiling non-market output is set out in key national accounts references, including:

- the 2008 System of National Accounts (SNA)
- the European System of Accounts 2010
- the Eurostat Handbook on prices and volume measures in the national accounts (2016)
- the OECD handbook Towards Measuring the Volume Output of Education and Health Services (2010)

This section briefly outlines current guidance for measuring current price and volume estimates of non-market output.

Current price estimates

The 2008 SNA (PDF, 9.1MB) defines market output in current price terms as “the value of goods and services sold at economically significant prices” (section 6.99). For units only producing non-market output, the 2008 SNA suggests that output may be valued in current price terms as the sum of the total costs of production. These costs include (section 6.130):

- intermediate consumption
- compensation of employees
- consumption of fixed capital
- other taxes (less subsidies) on production

This approach implies that for nominal non-market output, gross operating surplus is assumed to be equal to consumption of fixed capital (depreciation), thereby making net operating surplus equal to zero.

In the special case of units that produce both non-market and market output, the non-market output component of such units is valued in current price terms as “the difference between the total costs of production minus the revenues from market output”. Following this guidance, there is little variation between countries in the methodology used for current price estimates of non-market output.

Volume estimates

The measurement challenge is far greater when measuring output in volume terms. The typical approach for the volume measurement of market services involves the deflation of the output measure in current prices.

In practice, deflators are typically applied at industry section or sub-section level or at the level of specific types of output, such as components of Consumer Price Indices (CPIs) or Producer Price Indices (PPIs). This has the benefit of ensuring volume estimates are all in the same price base and changes in the quality of products detected through prices are captured in the volume of output. However, quantity indicators, such as those based on employment data, may also be used for measuring market output, particularly for early quarterly estimates. Additionally, quantity indicators are often used for volume estimates of trade in goods.

The measurement of non-market output differs, as there is no explicit price from which to construct a deflator. Therefore, alternative methodologies must be sought. These can be grouped into four categories:

- deflation using output prices
- deflation using input prices
- direct output indicators
- direct input indicators

The first two categories are considered “indirect” methods as the volume estimate is created “indirectly” through first estimating the current price estimate and then deflating using a chosen proxy price index. The second two categories are considered “direct” methods as the indicator is used to directly move forward the volume estimate irrespective of the current price estimate.

Deflation using output prices

Deflation using output prices is the approach most similar to the conventional approach to measuring the volume of market services. As non-market prices are non-existent, this approach involves deflating the output of non-market services using deflators constructed from price data associated with market output produced, such as components of CPI or PPI.

When applying this method, compilers should be mindful that the composition of services provided by the market and non-market sector might vary. For instance, hospital service providers in the market sector may provide a different range of elective surgery (such as cosmetic surgery and treatments with long waiting lists in the non-market sector) than non-market providers. Therefore, the output deflator calculated for the market sector may not be representative of the services provided by the non-market sector.

Similarly, growth in prices and costs for market services will be subject to market forces such as competition, whereas for non-market services cost growth will usually be influenced by budgets and government policies on efficiency. Therefore, the use of output prices is most suitable when the composition of market and non-market services are relatively similar, although even then, its use implies that the relationship between expenditure and volume is the same between the market and non-market sector.

Deflation using input prices

Deflation using input prices involves deflating the output of non-market services using deflators constructed from price data associated with the inputs used, predominantly labour inputs and intermediate consumption (goods and services consumed as inputs during production).

Using input prices may be more accurate than using output prices because of the level of disaggregation at which these prices can be applied. The limitation of this approach is that, by definition, volume output growth will be measured at the same rate as volume input growth and so this approach assumes that there is no change over time in productivity for non-market services.

Consequently, the input price approach is generally considered inferior to the direct output indicators method discussed below. However, the use of input prices to deflate output may be appropriate where the variety of services provided is too large to enable groupings for relatively homogenous activity types that can be counted using direct output indicators.

Direct output indicators

At its simplest level, use of direct output indicators involves changes in the level of output volumes. It is driven by non-monetary indicators related to the service provision in question, independently of the service expenditure[1]. The indicators used explicitly relate to the output, such as student numbers or medical appointments. The 2008 SNA, section 15.122 states that the use of direct output indicators is the recommended approach for non-market services where the appropriate data are available.

Where a service provides a range of outputs of varying value, weights usually need to be applied. For instance, hospital services can vary greatly in value, with a major surgical operation requiring a greater weight in assessing the volume changes of healthcare services than a brief outpatient consultation.

For non-market output, where there is an absence of economically significant prices to distinguish and weight different activities, costs may be used instead. In this regard, a common direct output indicator is the cost-weighted activity index, where growth in more costly activities has a greater effect on the quantity change in output although the overall impact is still dependent on the weight that is given to this activity. Because of this, compilers should be mindful of changes in the composition of services over time. This issue is particularly pertinent during the coronavirus pandemic, where many services, such as elective surgery, were restricted, and new services, such as COVID-19 testing, were created.

Direct input indicators

Direct input indicators also use non-monetary indicators to assess the change in output, independently from its monetary level. However, unlike those focusing on specific outputs, these indicators focus on volumes of inputs, such as staff numbers or staff hours.

As with direct output indicators, when input indicators refer to inputs of differing costs, such as employees at different pay bands, it may be appropriate to calculate a cost-weighted index by weighting staff numbers by the respective costs of different staff groups. It is important to note that the specific choice of input indicator could lead to significant differences. For example, as shown during the coronavirus pandemic, the use of employee numbers and employee hours worked are both considered direct input indicators but may produce very different results in the situation of furloughed employees.

Furloughed employees include those that are temporarily stood down from undertaking duties but are still receiving some or all of their standard pay. While payments are paid by the employer, during the coronavirus pandemic employers with furloughed workers were usually the recipient of government support schemes designed to maintain the employer-employee relationship. This includes the Kurzarbeit in Germany, the Chômage Partiel in France, Jobkeeper in Australia, the Coronavirus Job Retention Scheme (CJRS) in the UK and the temporary wage subsidy scheme in Ireland.

As with other measurement approaches focused on inputs, this approach does not allow for changes in productivity over time. Therefore, the use of output indicators is preferred.

Considerations in the choice of non-market output methodology

The choice of methodology will depend on the nature of the service provided and data availability. Chief among the differences in service provision is the distinction between those that are individually consumed, that is received by specific individuals (such as education and healthcare), and those that are collectively consumed, that is received simultaneously by a (section of) society as a whole (such as policing or national defence).

In general, the activities that define individually consumed non-market services, such as surgical procedures and school lessons, are easily identified. Where adequate data are readily available, direct output indicators are typically preferred. In contrast, identifying the discrete activities of collectively consumed non-market services and acquiring the data needed to produce a direct output indicator is often more difficult so input indicators may be needed for collectively consumed non-market services.

In practice, National Statistics Institutes (NSIs) are constrained in what methodologies they employ for non-market output by the timeliness and quality of available data. If more data becomes available over time, methods may change accordingly, improving volume estimates. This may also cause revisions, particularly when specific events affect the provision of non-market services (such as the coronavirus pandemic).

Comparability of non-market output measures

The different methodological approaches may well bring about difficulties in comparability between non-market volume output measures across countries. For instance, input-based measures may not account for productivity improvements that output indicators would capture. An example in healthcare would be a cure for which a technological improvement allowed for an increased number of treatments per day to be performed by a single doctor. If one country uses the “direct input indicators” approach and another similar country uses the “direct output indicators” approach, in the case of unchanged number of doctors, the first country would not see a change in volume estimates while in the second country, volume estimates would increase.

Methodological choices may also generate different results depending on national institutional contexts. For example, if a country’s education system allows for or incentivises part-time study, using number of students enrolled as an output indicator rather than number of students adjusted for full time equivalency may produce different results.

Index choices when compiling volume estimates

Estimates of the volumes of goods and services can either be compiled through applying a price (or unit cost) index to current price values of production or by constructing a direct volume index. Either way, weights are needed for each output category (for example, Diagnosis-Related Groups categories for healthcare)[2] to reflect the relative importance of different services in the overall aggregate.

An important decision for an index is the period from which the prices used are taken, as it is this period for which the weights correspond. For quarterly measures of non-market output, most countries, including the UK, construct weights using price and quantities of the previous year to determine the volume growth between successive quarters of the current year. They apply a Laspeyres-type index. Contrasting this is a Paasche-type index where weights are based on the unit cost of the current period applied to the quantity of the previous period.

The Laspeyres-type is favoured in practice since the use of previous period weights requires minimal information from the current period, that is, just the new prices to derive price indices or the new quantities in case of volume indices. Normally, because of the relatively stable demand and composition of non-market services, the choice of the index number formula is not a major concern. However, in 2020 the composition of outputs within the healthcare industry changed significantly for many countries.

Firstly, there was a strong increase in treatments associated with COVID-19, such as testing and intensive care of respiratory related illnesses. Additionally, because of lockdowns and other restrictions the number of “non-COVID-19” health treatments, such as dentist appointments or elective surgery, was greatly reduced in comparison with the previous year.

Furthermore, depending on the categorisation system employed in a country, unit costs may have changed substantially where COVID-19 treatment is included in existing treatment categories. Because of these changes in unit costs and the composition of activity, the choice of the reference period in determining weights is likely to have had a larger effect than in previous years.

Example

The issue is best illustrated with a numerical example (Table 1). Assume that in 2019 (denoted as t-1), a hospital treats 90 knee replacements and 5 respiratory diseases, ignoring for simplicity the distinction between quarterly and annual data. Unit costs for the two types of treatment are 10 and 15, respectively.

Given the experiences in various countries, assume that the number of treatments of respiratory diseases increased significantly in 2020 (denoted as t in Table 1) as a consequence of COVID-19 (20 compared to 5 in 2019), whereas the number of an alternative treatment (knee replacements) declined to 50, down from 90. Because of the higher demand in COVID-19 treatments, the unit cost of these also increases between t-1 and t from 15 to 20.

Table 1: Example of Laspeyres and Paasche volume indices in a situation with changes in relative cost and activity

Example data

Procedure	Time period	Cost	Quantity	Total cost	Simple cost share	Quantity growth rate	Total growth (Laspeyres index)	Total growth (Paasche index)
Knee Replacement	t-1	10	90	900	0.92	-	-	-
Knee Replacement	t	10	50	500	0.56	-44.40%	-	-
Respiratory Diseases	t-1	15	5	75	0.08	-	-	-
Respiratory Diseases	t	20	20	400	0.44	300.00%	-	-
Total procedures	t	-	-	-	-	-	-17.90%	-10%

Notes

1. Where t = a given year.
2. - indicates no data.

In this example, the expanding production (from 5 to 20, an increase of 300%) and cost of the more expensive COVID-19 treatments combined with the contracting production (from 50 to 90, a decrease of 44.4%) of the less expensive treatments for knee replacements leads to large difference in the cost shares between the two years.

Such a large compositional change can result in non-trivial differences in aggregate growth, depending on the index methodology chosen. If the growth rates are applied to the categories based on weights calculated using cost from the previous year (a Laspeyres-type index), recorded output would be defined as:

$$\frac{\mathbf{c}_{\mathrm{t}-1} * q_t}{\mathbf{c}_{\mathrm{t}-1} * q_{t-1}},$$

Where c = cost, q = quantity of activity and t = the year, resulting in a calculation of:

[(50 x 10) + (20 x 15)]/ [(90 x 10) + (5 x 15)] – 1 = - 0.179

showing a decline of -17.9%. However, if costs from the current year are used to apportion the growth rates (a Paasche-type index), recorded output would be defined as:

$$\frac{\mathbf{c}_{\mathrm{t}} * q_t}{\mathbf{c}_{\mathrm{t}} * q_{t-1}},$$

Where again c = cost, q = quantity of activity and t = the year, resulting in a calculation of:

[(50 x 10) + (20 x 20)]/ [(90 x 10) + (5 x 20)] – 1 = - 0.1

showing a decline of -10.0%.

Neither result is necessarily correct or incorrect. The Laspeyres-type approach likely understates growth in the case where the unit cost of the faster-growing activity is increasing, as it attaches too much weight to those treatments that drop, and too little weight to those treatments that increase.

The converse holds for the Paasche-type measure that would overstate volume growth. An average of the two measures (a Fisher-type index) could be envisaged in principle but would mean losing the practical advantages offered by the Laspeyres index, which is an important reason why it is applied by so many countries. There is also a question of consistency with index numbers used in other parts of the national accounts. For example, Laspeyres is used to construct most price indices used for deflation purchases.

Overall, while there is no simple solution, and the basic (and extreme) example provided creates a larger difference that is likely observed in aggregate outputs, the experience of the impacts in 2020 and 2021 could serve as an opportunity to test empirically how consequential the choice of an index can be, even for macro-economic aggregates.

Notes for: Methods used to measure non-market output

1. Since volume and nominal estimates are created independently a price index can be created by dividing one by the other. This “implicit price deflator” may be compared with other more conventional price indices to quality assure the volume estimates.

2. DRG (Diagnosis-Related Groups) systems are used to classify treatments into medically meaningful and relatively homogenous groups. This provides a basis for applying differential cost weights to different treatments to produce a volume output measure.

5 . How national statistical institutes (NSIs) measure non-market output

In 2010, the Organisation for Economic Cooperation and Development (OECD) working paper Towards Measuring the Volume Output of Education and Health Services: A Handbook provided an inventory of countries’ practices based on a survey conducted by the OECD and Eurostat. As the coronavirus (COVID-19) pandemic brought new challenges to the measurement of non-market output, Eurostat and the OECD conducted a new inventory based on a “Questionnaire on Price and Volume Measures for Collective Non-market Services, Health Services and Education Services during COVID-19”. While this Eurostat inventory is not available publicly, a general summary is available in Annex 1.

The results of these two surveys have been crucial in understanding the prevalence and nature of different non-market output methodologies. However, because of the intricate nature of compilation and the broad nature of the economy, such surveys can only collect limited information. This leaves further questions on how different methodologies have responded to the consequences of the coronavirus pandemic.

To answer these questions, the OECD and the Office for National Statistics (ONS) jointly conducted an information gathering exercise, engaging with the eight national statistical institutes (NSIs) listed previously in Section 1, on:

- their basic methodology and data sources for measuring International Standard Industrial Classification (ISIC) sections O, P and Q, and government final consumption expenditure (GFCE)
- any differences in methodology and data sources between first and final estimates
- any adjustments applied to reflect the impact of the coronavirus pandemic
- implications of the methodology used for interpreting changes in non-market output during the coronavirus pandemic

The information collected from NSIs have shown that sum-of-costs methods are used in both annual and quarterly national accounts to estimate current price output of non-market services. For volume estimates, all four methodologies described in Section 3 are used. Several countries report the use of multiple methods for components of a service category. For example, deflation of inputs may be used to measure the output of public education while deflation of outputs is used to measure the output of private education.

Differences in methodology were not a strong driver of differences in growth for combined ISIC sections O (public administration and defence), P (educational services) and Q (human health and social care services), referred to as industries OPQ, in the pre-coronavirus pandemic period. Year-on-year growth rates in countries that made heavy use of direct output measurements showed slightly higher volatility than in countries predominantly relying on deflation using input prices, but once again, these differences are small and difficult to untangle from wider economic factors.

Trilateral discussions between the OECD, the ONS and NSIs enabled a more detailed study of the practical application of the different methodologies for non-market services across countries. This section explores the themes uncovered from this work for each of the three main industries of the non-market sector.

For simplicity, countries are listed by the predominant methodology used in quarterly and annual compilation. However, each country's level or mix of private or public involvement in the delivery of these services should be taken into consideration when analysing the results. Full results are available in Annex 1.

Public administration and defence (section O)

ISIC section O includes:

- public administration
- defence
- law enforcement
- other collective non-market services, which are overwhelmingly publicly funded and provided

As discussed in Section 3, the collective consumption aspect of most services in ISIC section O prevents the use of direct output volume measures for most services in this industry. Direct input indicators are commonly used for volume measures of section O output, typically focussing on labour inputs. Use of data on hours worked or employee numbers are both common.

Predominant methodology used in quarterly national accounts (QNA) and annual national accounts (ANA) for public administration and defence (section O)

Input price deflation is used in:

Belgium, Canada, Norway (ANA)

Direct input indicators are used in:

Australia, Austria*, Chile*, Colombia*, Czech Republic*, Denmark*, Finland*, France, Germany*, Hungary*, Ireland, Italy, Japan* (ANA), South Korea*, Latvia*, Luxembourg*, Mexico*, Netherlands*, New Zealand*, Norway (QNA), Poland*, Portugal*, Slovak Republic*, Slovenia*, Spain*, Sweden*, South Africa*, United Kingdom, United States.

An asterisk (*) refers to the assumed approach for output of collective non-market services, such as national defence or fire services. Although most of section O consists of these types of services, some aspects are not considered as collectively consumed, such as social security administration.

Output price deflation and direct output indicators are not used as the predominant methodology in any OECD country.

In a minority of countries, indirect estimation is also used for a specific components of ISIC section O, with volume output estimated by deflating output expenditure using input prices. Deflators used include industry-specific deflators derived from national accounting systems and components of producer price indices (PPIs). For instance, the UK uses industry specific deflators based on average weekly earnings extracted from national accounts to deflate output of policing and some other government services.

Although a minority, direct output volume indicators are applied rarely for non-collective non-market services. For instance, the UK measures elements of ISIC section O, including fire protection services, prisons, probation and legal aid services, using the cost-weighted activity approach with output indicators. However, a large majority of the services in ISIC section O in the UK have no suitable activity data available for the direct output methodology, and most of this industry is measured through direct input approaches.

For both direct and indirect inputs approaches, data tend to be available for initial quarterly estimates. However, for many countries, a short period of forecasting is required for producing preliminary outputs whatever the methodology used.

Education (section P)

As an individually consumed service, education output is more easily measured by direct output indicators. This is reflected in countries' practices; the vast majority (81%) use direct output indicators. Furthermore, several countries use input-price deflation (16%) while a smaller number apply deflation of outputs (13%) or input indicators (10%). Several countries report the use of multiple methods for components of a service category. For this reason, percentages as presented in this section may not sum to 100%.

Many countries use output indicators, such as the number of pupils or students enrolled, to measure volume change in education services in annual national accounts (ANA). Cost-weighted activity is commonly used, with different weights applied, to account for differences in costs among schooling types. Alternatively, direct output volume may be captured using pupil or student hours.

Predominant methodology used in quarterly national accounts (QNA) and annual national accounts (ANA) for education (section P)

Input price deflation is used in:

Canada, Japan (ANA), South Korea, Colombia, United States

Output price deflation is not the predominant methodology in any OECD country.

Direct input indicators are used in:

Canada, Ireland, Latvia, Norway (QNA), Spain.

Direct output indicators are used in:

Australia, Austria, Belgium, Chile, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Mexico, Netherlands, New Zealand, Norway (ANA), Poland, Portugal, Slovak Republic, Slovenia, Sweden, South Africa, United Kingdom.

Input cost deflation and direct input indicators, including the number of teachers employed or their hours worked, are also used for education volume estimates. Often this is because the data are available more rapidly than the data for output-based measures. Combinations of approaches are also possible. For instance, Ireland uses both direct output and input indicators whereby changes in student numbers have a large contribution to the change in growth for the industry, but changes in labour inputs are also factored in.

Countries using output indicators for their annual results will typically make quarterly estimates following an annual path based on the most recent benchmark data. In some cases, the quarterly path may depend on quarterly patterns. Enrolment data are often only available annually and output is thus spread across the four quarters using a linear trend or other estimation technique.

Healthcare (section Q)

As with education, healthcare is primarily, although not always, an individually consumed service. However, while in most OECD countries education is provided as a public service, substantial variation can be seen across countries regarding the relative size of healthcare services provided by private and by public entities.

In the US, for instance, most hospitals and many health providers are private entities charging economically significant prices[1]. While this is reflected in their choice of predominant methodology, different methodologies are used for other components of healthcare.

Responses to the various surveys, coupled with information publicly available from NSIs and Eurostat, show that over a third of countries (35%) use input prices to deflate output to generate the volume of healthcare services.

Almost as many countries use direct output indicators (32%), while a smaller group (23%) deflates using output prices. The latter group includes countries (10%) where healthcare is predominately delivered by the private sector, so market prices are more readily available. A further 19% of countries use direct input indicators.

Predominant methodology used in quarterly national accounts (QNA) and annual national accounts (ANA) for human health and social work activities (section Q)

Input price deflation is used in:

Austria, Canada, Chile, Colombia, Czech Republic, Denmark (QNA), Poland, South Korea.

Output price deflation is used in:

Germany, Japan (ANA), Luxembourg, South Africa, United States.

Direct input indicators are used in:

Canada, Ireland, Denmark (QNA), Latvia, Mexico, New Zealand (QNA), Slovak Republic, Spain.

Direct output indicators are used in:

Australia, Belgium, Denmark (ANA), Finland, France, Hungary, Italy, Netherlands, New Zealand (ANA), Norway, Portugal, Slovenia, Sweden, United Kingdom.

In annual national accounts, many OECD countries use direct output indicators to measure most aspects of non-market healthcare output. Specifically, volume change of hospital output, which accounts for a significant portion of non-market healthcare output, is often derived on the basis of Diagnosis-Related Groups (DRGs) or something similar such as the UK's Healthcare Resource Groups (HRGs).

As DRG data are usually only available annually, there is substantial variation in the indicators used to measure hospital output in quarterly national accounts. Initial quarterly estimates usually come from more timely but less detailed direct output indicators, including those based on projections of the annual data. For instance, Australia has access to early but less exhaustive DRG data for use in initial estimates, while the UK employs a mixture of highly aggregated indicators spanning the main components of hospitals, primary care and prescriptions.

Alternatively, countries use input prices to deflate quarterly current price estimates or use input indicators such as employment levels. The use of such data allows preliminary estimates of quarterly national accounts to be created without requiring the level of detail used for annual national accounts, such as the compositional mix or resources used.

GFCE and non-market output

While the aggregate output of ISIC industries OPQ is a major component of GFCE, these categories do not directly match each other. This is because industry-level output may cover both non-market and market output (for example, education services may mainly be provided as non-market output but may also include driving lessons provided by private entities at market prices). Additionally, not all non-market output is captured in industries OPQ. For example, some subsidised cultural services in ISIC section R are also captured in GFCE.

The market structure of all these industries varies substantially between countries. For example, the bulk of healthcare spending in countries with highly centralised public healthcare services such as Norway or the UK would be reflected in GFCE. In contrast, healthcare spending in the heavily market-based US is more likely to be part of private consumption expenditure (PCE). These differences imply that the degree of correspondence between GFCE and industries OPQ will depend on countries' institutional arrangements.

Furthermore, as was the case for the estimates of non-market output, NSIs also use diverse methodologies to calculate volume GFCE figures. Many NSIs construct the portions of volume GFCE coming from industries OPQ with the same measures and data used to calculate the volume output of those industries. This is the case, among others, in Canada, France and the UK. Other countries, such as Australia, deflate current price GFCE estimates to create their GFCE volume figures. As such, divergences may arise between GFCE and industries OPQ, despite them reflecting conceptually similar output[2].

Notes for: How national statistical institutes (NSIs) measure non-market output

1. It should be noted that ownership of the economic unit is less important than the prices charged for determining whether a unit is in the market sector. Many hospitals are likely owned by non-profit institutions or theoretically even by the general government. However, units charging economically significant prices are considered market producers.

2. While divergences may occur at the aggregate level on a quarterly basis, at a detailed level, products are balanced during the standard compilation of Supply-Use Tables, which also benchmarks annual estimates.

6 . How the coronavirus (COVID-19) pandemic affected measures of non-market output

The events of 2020 brought unique challenges to the measurement of non-market output. Standard methods that were considered adequate for measuring non-market output before the coronavirus (COVID-19) pandemic required investigation to reflect shifts in the delivery of non-market services, such as the introduction of new treatments in healthcare or the switch to remote education.

As a result, some national statistical institutes (NSIs) implemented methodological changes, temporary adjustments, or incorporated additional information, such as data reflecting lower school attendance, to augment existing compilation methods. The extent to which NSIs adapted their methods and implemented adjustments varies substantially by country and industry.

This section discusses methodological changes implemented by NSIs for International Standard Industrial Classification (ISIC) industries OPQ - combined ISIC sections O (public administration and defence), P (educational services) and Q (human health and social care services) - before comparing published outputs and assessing the coronavirus pandemic's impact. It then contrasts the output of the aggregated non-market sector (industries OPQ combined) across a wider set of countries before discussing some general considerations related to compilation practices during 2020.

Public administration and defence (section O) output measurement during the COVID-19 pandemic

As mentioned in Section 5, there is greater similarity between countries in the methods used to measure the output of section O than those used for sections P and Q, as almost all countries use direct input indicators to compile their volume estimates for this section. The coronavirus pandemic did nonetheless raise measurement challenges for the output of section O. This included accounting for the different policy responses countries applied, which ranged from substantial layoffs of local government employees in the US to furloughing public employees in France, while Australia reported that government employees were able to continue their work despite the restrictions.

The degree to which any reduction in output would translate into the volume estimates is largely dependent on the method used. Direct input indicators, such as the number of employees, or volume estimates derived from input prices, would not show any reduction in output when public sector workers remained employed, even if the amount of work they were able to do was severely limited.

Some countries, such as Canada and France, felt that this did not properly reflect economic reality, so they collected additional data on the reduction in actual hours worked to make adjustments to public administration output. For these countries, this led to a noticeable reduction in section O output. In Canada, for instance, volume output for public administration (the North American Industrial Classification System category most similar to ISIC section O) declined by 4.9% in Quarter 2 (Apr to June) 2020.

However, it appears that most countries made no specific additional adjustment to section O output. This was either because any reduction in production was not deemed material or the indicator in use already properly reflected the evolution. For instance, hours worked is used as direct input indicator in several countries, which would already automatically pick up the reduction caused by employees shifting to a reduced workload. In most countries, the disruption observed was only minimal, with some countries even showing small increases during Quarter 2 2020, for example, Australia (0.7%), Norway (1.1%) and the UK (0.7%).

These examples show that (with a few notable exceptions) in most countries' output the measurement of section O was not significantly impacted by the coronavirus pandemic, and that, by contrast with education and healthcare services, it was not a significant source for international differences in non-market output.

Education (section P) output measurement during the COVID-19 pandemic

Almost all Organisation for Economic Co-operation and Development (OECD) countries – and all countries interviewed for this paper – saw substantial disruption to normal education practices, with remote learning implemented for pupils during part of the coronavirus pandemic or facing temporary interruptions. While the education industry is larger than just primary and secondary schooling, this was the area of focus for most NSIs as it makes up the largest component of the overall industry.

Some countries reacted to these disruptions by making specific adjustments to education output measures; this was done by collecting information on the impact of remote learning or changing the fundamental method in use. For instance, Norway continued using a direct input indicator (number of people employed in education), but they introduced adjustments for a short period of time to reflect the transition period to remote learning, lower capacity in primary schools and the cancellation of exams. Germany applied specific adjustments to output to reflect the complete shutdown of pre-primary education in Quarter 2 2020, the magnitude of which varied between sub-national units depending on local circumstances.

Some countries applied more aggregated adjustments to cover the reduction in output provided to pupils who had switched to remote learning. Both Italy and the UK used survey data to investigate the reduction in the amount of learning materials delivered to students learning from home.

An additional adjustment was made by France and the UK to discount the quantity of education output because of a larger proportion of the education service being provided through parental input, which is outside the production boundary of the national accounts[1]. France also made an adjustment reflecting a higher-than-normal rate of attrition observed in students attending school via remote learning relative to the level observed in a normal year.

These adjustments appear to have had a substantial effect on education output. The methodological changes in Norway and the UK resulted in declines in education output in Quarter 2 of 5.8% and 38.8%, respectively. Similarly, although France does not produce separate growth rates for section P, the overall fall in output of industries OPQ for France in Quarter 2 2020 was second only to the UK among G7 nations, with the education adjustments likely being an important driver for this.

The countries applying these adjustments acknowledged that they were implemented because it was perceived that the move to a remote learning environment led to a lower level of education services. However, this view was not shared across all NSIs, with the majority of NSIs in Europe not applying such a correction, as Eurostat guidance suggested:

“Services delivered remotely count as non-market output just as those delivered ‘physically’. There is no implicit change in the volume of the service delivered”.

This was followed up with an additional clarification, specific for education:

“Where the services have shifted towards remote teaching and more homework, with all pupils engaged somehow, it seems reasonable to assume that output is more or less unchanged compared with a normal situation”.

Several countries (Australia, Canada, Germany and Ireland), when interviewed, confirmed that this guidance was consistent with their own views.

Some of the countries that did not apply specific adjustments still recorded decreases, because of actual decreases observed in the direct input or output indicator used. For example, Canada, which uses the direct input indicator of hours worked, supplemented this indicator with information on hours worked from their Disaster and Catastrophic Events (DCE) survey. This was not a remote learning adjustment; Statistics Canada advised that “output in [the education] service industry and in public administration will be unaffected by the closures except insofar as the employees report reduced actual hours worked”.

The DCE survey was used to update hours worked estimates following the widespread layoffs of school support staff when school buildings closed and students switched to remote learning early in the coronavirus pandemic. Overall, this yielded a 10.8% decline in the output of education services in Quarter 2 2020.

Australia, which was also subject to school closures and remote learning in Quarter 2 2020, similarly chose not to apply a remote learning adjustment. Because of the use of the relatively stable pupil numbers’ series as a direct output indicator of education services, Australia observed a 0.2% growth in education output volume in Quarter 2 2020.

The output of ISIC section P is broader than the education share in government final consumption expenditure (GFCE). It includes private schooling and wider education services usually funded by household consumption. For instance, driving schools faced extended closures and despite accounting for only a small proportion of education, as noted by Norway, the complete reduction in activity had a significant effect on total education output. Dynamics such as these may contribute to greater divergences between GFCE measures and industries OPQ measures, emphasising the varying effects of COVID-19 on these two measures.

In conclusion, differences between countries in output growth for ISIC section P over 2020 were heavily influenced by whether adjustments have been applied to account for any perceived changes in education provision. Importantly, adjustments of this sort have not been applied by all NSIs, and where they have, they have not been applied consistently, leading to a wide range of results.

Based on the available data and discussions with NSIs it appears that the largest falls in education output were in those countries that applied adjustments to reflect a perceived reduction in production because of remote learning. In countries where no adjustments were applied or no additional data incorporated, direct output methods (which are often based around student enrolment) typically show little change in response to the coronavirus pandemic. In contrast, direct input indicators, based on teacher numbers, hours worked or wages, may have shown some reduction, but not to the extent observed for those countries where additional adjustments were undertaken.

Overall, output divergences from the use of diverse methodologies were magnified both directly – as a result of some methodologies responding more than others to the sizeable disruptions, and indirectly – as some NSIs applied additional adjustments increasing the divergence among them.

Healthcare (section Q) output measurement during the COVID-19 pandemic

The coronavirus pandemic had a profound impact on healthcare services, with widespread cancellations of non-urgent appointments and procedures, resources redeployed to care for COVID-19 patients, large-scale additional expenditure on personal protective equipment (PPE), and the creation of new services such as COVID-19 testing and contact-tracing.

As outlined in Section 5, whereas several countries rely on direct input or output indicators for their annual estimates, most countries use projections, input price deflation methods or more aggregated indicators to generate quarterly estimates for healthcare. Those quarterly techniques often failed to automatically incorporate the rapid changes in healthcare activity in early 2020.

Many NSIs responded by using more timely activity data replacing their conventional data sources. This allowed the increased use of new COVID-19 related treatments at the expense of non-urgent healthcare services to be properly reflected in output. Norway, for instance, gained access to monthly DRG figures from hospitals, enabling timely accounting for changes in the case mix of hospital care. The US, where the primary method for compiling healthcare services involves deflation using output prices, incorporated timely new sources such as credit card and lab data to reflect the impact of COVID-19.

Additionally, while some countries are able to incorporate case mix effects on a quarterly basis through the DRG system, this was further complicated by the likely higher expenses for COVID-19 treatments and the disruption of DRG recording mechanisms, where staff were redeployed from their regular specialties to help with emergency care. Many countries, including Australia, France and Norway, assigned COVID-19 treatments to existing DRG categories reflecting severe respiratory disease. This allowed the existing categories to reflect the higher level of COVID-19 cases in hospital, but at the same time may result in those categories receiving a higher cost weight in the future once the higher costs have fed through into base period weights. In some countries, such as Italy, adjustments were applied to existing DRG categories to reflect the higher cost of COVID-19 treatments.

However, some of the resources deployed to support these services came from outside the healthcare industry (for example, the military) and so without changes to the accounting systems to assign these resources to the proper activity, the costs of these services may not always be fully captured in ISIC section Q.

As with education, it is important to understand the difference between what is covered in healthcare output and what will feed into GFCE, because in many countries some healthcare services are provided by the market. Therefore, household consumption expenditure on healthcare services will also be affected by changes in the output of ISIC section Q. Indeed, early in the coronavirus pandemic, privately funded elective treatment, including cosmetic surgery, was widely cancelled and many regular primary care services, such as dentistry and ophthalmology, experienced significant disruption. This may be an important explanation why industries OPQ sometimes showed larger drops than reflected in GFCE.

Healthcare may also be an important component in the explanation of the differences between current price and volume estimates observed in non-market output. For example, the large-scale purchases of PPE or setting up of testing sites, undertaken by public entities in many OECD countries, made substantial contributions to current price increases in healthcare output and GFCE[2], but may not have directly influenced the output indicators based on activity data used in volume estimates. Therefore, several countries may have recorded large drops in the output of healthcare services in volume terms, while at the same time recording an increase in current price estimates.

In summary, although a wide range of methodologies are used by NSIs to measure healthcare on a regular basis, the methodologies, along with additional data sources that NSIs have developed, appear to have picked up the fall in healthcare output resulting from the coronavirus pandemic. There appears to be a consistent theme across countries that the decline observed in non-COVID-19 related healthcare services was larger than the increase in COVID-19 related output in Quarter 2 2020.

However, a variety of adjustments and additional data sources have also been incorporated by NSIs in response to capturing new types of healthcare output that have arisen in the coronavirus pandemic. Some adjust for new services, such as COVID-19 testing, and some source new data that enable the high cost of treating COVID-19 patients to be accounted for immediately, rather than waiting until the annual benchmarks are compiled.

While these adjustments have no doubt contributed to a more accurate representation of the production actually taking place during the coronavirus pandemic, disentangling the often-opposing effects of changes in regular indicators and the application of additional adjustments presents substantial challenges.

Comparing declines in healthcare and education with the impact of the COVID-19 pandemic

Despite the lack of consistency in methodologies and adjustments, there seems to be a relationship across countries between the change in healthcare and education output as reported by countries and the degree to which they have been impacted by the coronavirus pandemic (proxied in our analysis by relative excess mortality rates).

Among the five countries that were interviewed as part of this project and for which individual industry section output data was available for healthcare (albeit with some differences in classification systems), Australia, Norway and the UK use direct output indicators, while Canada deflates output using input prices and the US predominately uses output prices.

Despite the different methodologies, a main driver of the decline in output of healthcare services in volume terms appears to be the severity of the coronavirus pandemic and the scale of the resulting disruption to healthcare services.

Generally, where excess mortality is higher, indicating a more severe disruption to the healthcare system (including, importantly, elective and non-emergency healthcare), healthcare output shows a sharper decline (see Figure 4)[3]. All countries show a substantial fall in healthcare, with the UK recording the largest fall at 21.7%, followed by the US (14.9%) and then Canada (13.0%).

Even Norway, with only a 0.6% relative excess mortality rate during Quarter 2 2020, displayed a 7.6% fall in healthcare output in volume terms reflecting reductions in some healthcare services taken as a precautionary response.

Figure 4: For countries that publish output at the individual-industry level, change in healthcare output appeared closely related to excess mortality but there was more variation in education

Relative excess mortality versus healthcare and education output, Quarter 2 (Apr to June) 2020: selected countries

Notes:

1. Selection of countries based on those for which individual industries data was available.

2. The excess mortality rate is a measure of relative excess mortality detailing the percentage difference between the number of deaths in a given portion of the year and the five-year average number of deaths during that same portion of the year. Relative excess mortality rates have been calculated in the chart as: (Total number of deaths in a specific quarter) divided by (Five-year average number of deaths in that quarter) minus 1.

3. For the United States, healthcare and education output is for the market sector only, all other countries include both market and non-market sectors, as the United States does not publish combined market and non-market industry estimates on a quarterly basis.

4. Data extracted on 4 February 2022.

Download the data

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Figure 4 shows a similar pattern for education, with those countries that experienced a more severe impact of the coronavirus pandemic recording a larger fall in education services. In most cases, the falls in healthcare output are more severe than for education.

The exception is the UK, with much greater falls in education because of the adjustments implemented to reflect both the lower relative amount of education services provided to remote learners and the larger contribution from parents in providing these services (which is considered to be outside the production boundary). Norway and the United States also made adjustments to reflect reductions in the quantity of education output because of the transition to remote learning. However, Figure 4 suggests that these adjustments were of a more subdued nature.

Overall, for the limited number of countries that publish quarterly industry estimates of industries P and Q, there is a positive correlation between the drop in healthcare and education output and the severity of the coronavirus pandemic. However, this cannot explain all of the differences between countries, and it is clear that the output declines are also affected by differences in methodology and additional adjustments put in place.

Aggregate industries OPQ output during the COVID-19 pandemic

Since disaggregated industry data are not available for all countries on a quarterly basis, additional comparisons can only be done at the aggregated level. When the output of industries OPQ is compared with the severity of the coronavirus pandemic for a larger range of countries (see Figure 5), the relationship established in Figure 4 is not as obvious.

To a certain extent this may be expected because the more aggregated numbers and additional countries reflect a variety of industry composition, differing methodological approaches, varying strictness of lockdown policies and other variables that affect the output of industry OPQ and excess mortality.

Overall, the correlation between declining output of industry OPQ and higher excess mortality appears relatively weak, even when methodological approaches and adjustments are taken into consideration. For example, based on submissions to the 2020 Eurostat/OECD survey, both Poland and Slovakia reported generally identical quarterly methodology for non-market output (see Annex 1 for detail).

However, despite Poland recording the relatively higher impact of COVID-19 with an excess mortality rate of 4.2%, it recorded positive growth in industries OPQ, while Slovakia, which recorded a negative relative excess mortality rate, signifying fewer deaths than the five-year average, reported a decline in industries OPQ of 4.5% for Quarter 2 2020.

There are many possible reasons for this, including the composition of industries OPQ in each country or the level of COVID-19-related restrictions. Alternatively, it may be that adjustments or additional data have been applied by Poland or Slovakia that may not have been reflected in the 2020 survey.

Figure 5: Some countries experience little or no fall in industries OPQ output despite high excess mortality

Relative excess mortality versus aggregate industries OPQ output, Quarter 2 (Apr to June) 2020: selected countries

Notes:

1. The United States does not publish combined market and non-market industry estimates on a quarterly basis. Therefore, industries OPQ output for the United States is made up of market contribution for industry P and Q and total general government output, covering all industries.

2. Data extracted on 4 February 2022.

Download the data

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As there is no pair of identical countries in terms of the composition of their economies and of industries OPQ, their experience or timing of COVID-19 or their methodology, it is not possible to correct for all possible factors that might affect a country's position on the graph. However, when reviewing the countries that show larger deviations, there are some common traits between countries with similar positions in Figure 5. Since almost all countries are using a similar method for section O, the differences are predominately in approaches to measuring education and healthcare.

Spain was one of the few countries to record increases in the output of industries OPQ despite its high level of excess deaths. Importantly, among the countries listed on the graph, Spain and Ireland, for which excess mortality cannot be calculated but recorded a relatively small (negative 3.1%) decline in industries OPQ growth, are the only countries that use the direct input indicator "number of employees" to estimate the quarterly output of both healthcare and education.

This choice is important because in most countries, the level of full-time employment barely changed as employees either switched to remote working or were maintained as employees with the help of government support. Their reliance on this type of indicator, along with the fact neither Spain nor Ireland made any additional adjustments to healthcare or education output to reflect changes in these industries, may explain why output of industries OPQ remained relatively stable.

In contrast, France and the UK recorded greater falls in the output of non-market services while experiencing higher relative excess mortality rates. These countries use direct output indicators for healthcare, which may have been able to better capture the impact on non-COVID-19 healthcare. At the same time, both France and the UK made specific adjustments to reflect the switch to remote learning.

Italy also uses direct output methods and made some additional adjustments to reflect the lower number of pupils reached by remote learning and to account for the higher costs of COVID-19 patients. However, Italy showed a relatively small decline in output of industries OPQ when compared with the substantial COVID-19 impact experienced, based on excess mortality. The decline in Italy is reflected in both Quarter 1 (Jan to Mar) 2020 and Quarter 2 (Apr to June) 2020 because of its earlier imposition of COVID-19-related restrictions compared with other European countries.

Figures 6 and 7 show time series of industries OPQ output for OECD countries for which data were available, divided into those using direct output methods to measure both healthcare and education services, and those using alternative methods for at least one of these industries. Countries using direct output methods to measure both sections P and Q exhibited changes in industries OPQ ranging from positive 1.1% to negative 24% between Quarter 4 (Oct to Dec) 2019 and Quarter 2 2020, followed by rebounds beginning in Quarter 3 (July to Sept) 2020.

For the countries using alternative methods, the change observed between Quarter 4 2019 and Quarter 2 2020 was less marked, ranging from an increase of 1.5% to a decrease of 11.3% with all but three countries in the positive 1.5% to negative 5% range. This likely reflects the response of output indicators to the quantity of services provided, especially in healthcare, while methodologies driven by input-factors may not have changed much over the coronavirus pandemic. However, the wide variation among countries that do not use direct output for healthcare and education irrespective of any adjustment is clear.

Figure 6: Almost all OECD countries using direct output measures for healthcare and education experience a fall in industries OPQ output in Quarter 2 2020

Volume change in output for industries OPQ, countries using direct output methods for both sections P and Q, Quarter 4 (Oct to Dec) 2019 to Quarter 3 (July to Sept) 2021, indexed to Quarter 4 2019 (=100)

Notes:

1. Data extracted on 4 February 2022.

Download the data

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Figure 7: Several OECD countries using indirect or input-based approaches for healthcare and education experience limited falls in industries OPQ output in Quarter 2 2020

Volume change in output for industries OPQ, countries not using direct output methods for both sections P and Q, Quarter 4 (Oct to Dec) 2019 to Quarter 3 (July to Sept) 2021, indexed to Quarter 4 2019 (=100)

Notes:

1. Data extracted on 4 February 2022.

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Correlation between GFCE and industries OPQ during the COVID-19 pandemic

In some of the countries studied, the effect of the COVID-19 pandemic on GFCE has been similar to that on industries OPQ but in other countries there are notable differences. Figure 8 shows the change in these indicators for the countries that were interviewed.

In Canada, France, Norway and the UK, volume GFCE and industries OPQ output have tracked each other quite closely, all demonstrating correlation coefficients of more than 0.9 over 2020. These countries all have particularly high degrees of non-market healthcare and education output and use the same data sources to calculate both GFCE and industries OPQ output. A weaker, but still present relationship is visible in Italy, which exhibits similar characteristics.

Far greater disparities are seen in Australia, Germany, Ireland and the US, all of which exhibit equivalent correlation coefficients of less than 0.2 over 2020. Furthermore, in Australia and the US the relationship between industries OPQ output and GFCE is negatively correlated. This can be partially explained by differences in market structures – hospitals in the US are privately run, whereas healthcare in Australia has a large, but not universal, private insurance component.

Differences in Australia were also affected by activity within the childcare industry switching from household to government expenditure because of policy changes during the coronavirus pandemic. However, methodological differences are also important; Australia calculates GFCE by deflating current price spending whereas its volume estimates for industries OPQ output primarily come from direct input and output indicators. Ireland calculates GFCE volume estimates based on a slightly different mixture of input volume indicators and deflated output than for its industries OPQ output measures.

Figure 8: Several countries with a large proportion of non-market provision in healthcare and education show a similar trend in government final consumption expenditure and industries OPQ output

Volume change in industries OPQ output and government final consumption expenditure (GFCE) for selected countries, Quarter 4 (Oct to Dec) 2019 to Quarter 3 (July to Sept) 2021, indexed to Quarter 4 2019 (=100)

Notes:

1. Data extracted on 4 February 2022.

Download the data

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As a result, as illustrated in Figure 8, while France and the UK showed large falls in output and GFCE, several countries, including Australia, Germany, Ireland and the US, showed an increase in GFCE in Quarter 2 2020 in contrast to the movement seen in these countries for industries OPQ. This reinforces the need to look at both industries OPQ output as well as GFCE when considering the contribution of non-market output to gross domestic product (GDP) estimates on a quarterly basis.

An interesting measurement consideration regarding the correlation between GFCE and section O raised by some countries relates to the impact of COVID-19 on cultural institutions or infrastructure run by governments and municipalities, such as libraries, museums and toll roads. Norway provided additional monetary resources to these institutions to cover for their reduced income over this period in relation to reduced use of their services. In this case, the input indicators used by Norway to measure these institutions' output on an industry basis – the number of people employed – would not have captured this reduction, while GFCE may have even increased because of the additional government expenditure on subsidies.

Similarly, if a direct output indicator had been used to compile output of section O in volume terms, this would have led to a decline, in line with the reduced number of books borrowed, tickets sold, or cars on the toll road. This is not a conceptual flaw, but rather a practical consideration when using different sources and methodologies to derive what is conceptually the same output.

Notes for: How the coronavirus (COVID-19) pandemic affected measures of non-market output

1. The 2008 System of National Accounts (SNA) production boundary (that is, the economic activity that contributes to a country's gross domestic product) excludes unpaid household services. This includes activities such as cleaning, cooking and the supervision of children which would be counted if undertaken in exchange for payment from a third party but are excluded if done for an individual's own benefit. Therefore, if the additional activity by parents is considered an extension of this "unpaid household services", it should not be included as production. However, some countries may take the view that the parent involvement was exceeding what is normally expected from parents, and as such, could be considered that the parents were "volunteering" their services to assist in the school in the production of education services. In this case, the activity would fall back within the SNA production boundary (see 2008 SNA section 29.157).

2. As an example, details of the size and cost of the roll out of PPE within the UK is outlined in the UK Department of Health and Social Care annual report, which suggest that in financial year ending 2021, over £12 billion had been spent on purchases of PPE in the UK.

3. Many different indicators could have been used as a metric to represent the severity of the impact of COVID-19 on a country. While many indices exist, the components and weights applied to them could be considered quite subjective. For instance, even the use of a simple infection rate as a metric is heavily dependent on testing rates, which varied widely across countries in the initial stages of the pandemic. While excess mortality is also impacted by other factors (such as quality of healthcare or the general health and demographics of the population) it was deemed a more neutral and objective indicator than cases per million. That said, excess mortality may still be influenced by the overall level of health service provision and so the relationship between these two factors may not flow entirely in one direction. More information on the data related to excess mortality is available from the OECD.

7 . Conclusions

Because of the need to value output without the availability of explicit prices, non-market output poses a unique challenge in national accounts measurement. While all countries derive current price estimates through a sum-of-costs approach, a variety of methods are applied to derive volume estimates.

The coronavirus (COVID-19) pandemic resulted in large-scale disruption to the delivery of non-market services, particularly in Quarter 2 (Apr to June) 2020. This led to significant changes and increasing differences in measures of non-market output and government final consumption expenditure (GFCE) across Organisation for Economic Co-operation and Development (OECD) countries.

Based on current estimates, it appears some differences may relate to the severity of the COVID-19 pandemic or to the fact that the range of services included in non-market output and GFCE measures differ between countries. However, both existing methodological differences, and those resulting from changes made in response to the pandemic, have also contributed.

The effect of methodological choices on the three main industries that predominantly make up non-market output and GFCE differs for each industry:

- For public administration and defence, input-based methods predominate and the effect of COVID-19 on output appears to have been minor across the countries studied, with limited changes to methods and new adjustments

- For education, although methodological differences exist between countries, most use direct output indicators; as such, variances in output outside those expected as a result of the pandemic, appear to be driven mainly by the varied adjustments that national statistical institutes (NSIs) applied to account for any perceived COVID-19-related reduction resulting from remote learning

- For healthcare, a wider range of regular methodologies are applied across countries with some adopting new data and adjustments to respond to pandemic effects; despite these differences, falls in healthcare output appear to generally align with the severity of the pandemic in a country

Methodological differences, including those applied temporarily, are clearly important in understanding differences between countries' non-market output, especially between those countries that reported similar impacts from COVID-19. In almost every OECD country that primarily used direct output indicators for healthcare and education, the output of these industries fell during the first wave of the pandemic, although the scale of the fall varied depending on factors such as the application of additional methodological adjustments.

On the other hand, countries that used deflated output or direct input indicators as their basic method for non-market output often showed a smaller fall in their non-market output over the pandemic. It is important to note that in some countries GFCE and section Q output are compiled using the same data while in others, the results are based on different sets of data.

Despite these differences, looking at countries where the industry-level data are available shows that there is a clear relationship between the scale of the impact of the pandemic measured through excess mortality and the size of the fall in education and the healthcare output. This indicates some degree of comparability remains across countries, despite the differences in methodology.

This also importantly provides some reassurance that broader comparisons of gross domestic product (GDP) growth between countries are not obscured by these methodological differences. Nevertheless, the potential consequences of different non-market output methodologies should be borne in mind when looking at the quarter-on-quarter changes in GDP observed at the peak of the COVID-19 pandemic, or where there were relatively small differences in GDP growth between countries.

These methodological differences are likely to continue to affect international comparisons of non-market output, with the pandemic having lasting effects on non-market services. For instance, the productivity of healthcare is likely to be negatively affected because of the additional resources required for infection control measures, such as personal protective equipment and the isolation of COVID-19-postive patients in healthcare settings.

Direct output-based measures may decrease as a result of such changes, while input-based measures would be likely to show an increase. Likewise, input-based measures will respond to increases in inputs providing greater contingent capacity for potential future waves of infections, whereas direct output-based measures may not.

To assist international comparisons of GDP over the pandemic period and subsequent economic recovery, or any economically volatile period, it is important that NSIs publish detailed metadata explaining both their regular methods for non-market output and any adjustments or additional data sources incorporated to account for crisis-induced changes. The following are few examples of material released by NSIs over the course of 2020 which provided an important source of reference to users:

- Australia: Economic measurement during COVID-19: Selected issues in the Economic Accounts
- Canada: Recording COVID-19 measures in the national accounts
- France: Detailed methodological notes on Quarter 2 2020 (in French only)
- The UK: Coronavirus and the impact on measures of UK government education output: March 2020 to February 2021
- The US: Gross Domestic Product, Second Quarter of 2020, Technical note

With countries often using different methodologies, interpretation, transparency and analytical potential would also be aided by NSIs publishing industry-level data on a quarterly basis. This is so that the effects of methodologies, which are often industry specific, can be better understood.

Ideally, countries should continue to move to closer alignment for their standard compilation methodologies. Convergence on the use of direct output indicators for individually consumed services, as recommended by the System of National Accounts (SNA), would provide a similar starting point across countries for healthcare and education services – although whether this is possible will depend on mechanisms for delivering education and healthcare in each country as well as on data availability.

Additionally, the international statistical community should continue to discuss and refine some of the concepts around the production of non-market services, to ensure greater consistency between countries. The impact on the quantity of education being produced when students are learning remotely compared with learning in a physical classroom is a clear example where international agreement would likely benefit cross-country comparability.

This research has clearly demonstrated that there is a need for further international discussion on these issues, both conceptual and methodological, even if it requires a level of compromise. Macro-economic indicators like GFCE and GDP need to reflect the actual economy to remain correlated to other macro-economic outcomes like unemployment and prices, but the ability to confidently compare across countries is equally fundamental.

8 . Annex: Predominant methods by country

These are the predominant methods used to measure the compilation of output for the three International Standard Industrial Classification (ISIC) industries most commonly captured in government final consumption expenditure (GFCE): Public administration, defence and social security services (ISIC section O); Education (ISIC section P); and Human health and social work activities (ISIC section Q), by country.

Australia

Public administration

Quarterly: Direct input indicators (hours worked)
Annual: Direct input indicators (hours worked)

Education

Quarterly: Projection based on annual direct output indicators
Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Direct output indicators (Diagnosis-Related Groups (DRG) index at lower detail)
Annual: Direct output indicators (DRG index)

Austria

Public administration

Quarterly: Input-based methods
Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators
Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Input price deflation Annual: Input price deflation

Belgium

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Canada

Public administration

Quarterly: Direct input indicators (Compensation of Employees (CoE), measured in hours worked) and input price deflation Annual: Direct input indicators (CoE, measured in hours worked) and input price deflation

Education

Quarterly: Direct input indicators (CoE, measured in hours worked) and input price deflation Annual: Direct input indicators (CoE, measured in hours worked) and input price deflation

Healthcare

Quarterly: Direct input indicators (CoE, measured in hours worked) and input price deflation Annual: Direct input indicators (CoE, measured in hours worked) and input price deflation

Chile

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Input price deflation (public), output price deflation (private) Annual: Input price deflation (public), output price deflation (private)

Colombia

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Input price deflation (public), direct output indicators (private; number of pupils enrolled) Annual: Input price deflation (public), direct output indicators (private; number of pupils enrolled)

Healthcare

Quarterly: Input price deflation Annual: Input price deflation

Czechia (Czech Republic)

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Input price deflation Annual: Input price deflation

Denmark

Public administration

Quarterly: Input-based methods
Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students, student hours for primary)

Healthcare

Quarterly: Direct input indicators and input price deflation Annual: Direct output indicators

Finland

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators
Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

France

Public administration

Quarterly: Direct input indicators Annual: Direct input indicators

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Germany

Public administration

Quarterly: Direct input indicators Annual: Direct input indicators

Education

Quarterly: Direct output indicators Annual: Direct output indicators

Healthcare

Quarterly: Output price indicator Annual: Output price indicator

Hungary

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Ireland

Public administration

Quarterly: Direct input indicators (number employed) Annual: Direct input indicators (number employed)

Education

Quarterly: Direct output and direct input indicators (number of students and teachers) Annual: Direct output and direct input indicators (number of students and teachers)

Healthcare

Quarterly: Direct input indicators Annual: Direct input indicators (number employed in healthcare)

Italy

Public administration

Quarterly: Direct input indicators Annual: Direct input indicators

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Japan

Public administration

Quarterly: Direct input indicators (employee compensation) Annual: Direct input indicators (employee compensation)

Education

Quarterly: Input price deflation Annual: Input price deflation

Healthcare

Quarterly: Output price deflation Annual: Output price deflation

Latvia

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Input-based methods Annual: Input-based methods

Healthcare

Quarterly: Input-based methods Annual: Input-based methods

Luxembourg

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: [Market] Annual: [Market]

Mexico

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Direct output indicators (public; number of students), output price deflation (private) Annual: Direct output indicators (public; number of students), output price deflation (private)

Healthcare

Quarterly: Direct input indicators (public), output price deflation (private) Annual: Direct input indicators (public), output price deflation (private)

The Netherlands

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: [Market] Annual: Direct output indicators (volume index based on International Classification of Diseases (ICDs) by age and discharge numbers)

New Zealand

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Input indicators (public), output price deflation (private) Annual: Direct output indicators (public; composite index of DRG, patient discharge and bed night data), output price deflation (private)

Norway

Public administration

Quarterly: Direct input indicators (number employed) Annual: Input price deflation

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Poland

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Input price deflation Annual: Input price deflation

Portugal

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Slovakia

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Input price deflation Annual: Input price deflation

Slovenia

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

Spain

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Direct input indicators (number employed in education) Annual: Direct input indicators (number employed in education)

Healthcare

Quarterly: Direct input indicators (number employed in healthcare) Annual: Direct input indicators (number employed in healthcare)

Sweden

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (student hours)

Healthcare

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (DRG index)

South Africa

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Output price deflation Annual: Output price deflation

South Korea

Public administration

Quarterly: Input-based methods Annual: Input-based methods

Education

Quarterly: Input price deflation (public), output price deflation (private) Annual: Input price deflation (public), output price deflation (private)

Healthcare

Quarterly: Input price deflation (public), output price deflation (private) Annual: Input price deflation (public), output price deflation (private)

United Kingdom

Public administration

Quarterly: Input price deflation and projection of annual output indicators Annual: Input price deflation and direct output indicators

Education

Quarterly: Projection based on annual direct output indicators Annual: Direct output indicators (number of students)

Healthcare

Quarterly: Direct output indicators Annual: Direct output indicators (HRG index)

United States

Public administration

Quarterly: Direct input indicators (employment) Annual: Output price deflation

Education

Quarterly: Output price deflation Annual: Output price deflation

Healthcare

Quarterly: Output price deflation Annual: Output price deflation

Notes for: Annex: Predominant methods used to measure main ISIC industries

1. “Input-based methods” can consist of direct input indicators, input price deflation, or combinations of the two. Collective services are very often measured through direct input indicators, such as hours worked or number employed.

2. Iceland, Israel, and Lithuania are not incorporated into the list because of replies to the survey having absent or very limited information.

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10 . Related links

International comparisons of the measurement of non-market output during the COVID-19 pandemic (OECD website)
Article | Released 21 February 2022
OECD website edition of this article.

OECD database
Database | Updated regularly
Data on a range of topics, including national accounts and mortality.

UK Annual National Accounts, the Blue Book: 2021
Compendium | Released 29 October 2021
National accounts statistics including national and sector accounts, industrial analyses and environmental accounts.

International comparisons of GDP during the coronavirus (COVID-19) pandemic
Article | Released 1 February 2021
An economic review article analysing international comparisons of GDP during the coronavirus (COVID-19) pandemic.

Measuring the economic output of COVID-19 testing, tracing and vaccinations: April 2020 to June 2021
Methodology | Released 30 September 2021
An overview of our approach to measuring coronavirus (COVID-19) testing, tracing and vaccination services in government output.

Coronavirus and the impact on measures of UK government education output : March 2020 to February 2021
Article | Released 31 March 2021
A summary of our approach to measuring changes in education output in the UK National Accounts during the coronavirus (COVID-19) pandemic teaching from March 2020.