

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

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Contacts: Mr John Mitchell (john.mitchell@oecd.org), Mr Jorrit Zwijnenburg (Jorrit.zwijnenburg@oecd.org), Ms Rachida Dkhissi (Rachida.dkhissi@oecd.org).

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*International comparisons of the measurement of non-market
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John Mitchell, OECD¹

James Lewis, UK Office of National Statistics

Jorrit Zwijnenburg, OECD

Rachida Dkhissi, OECD

Thomas Prendergast, UK Office of National Statistics

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Abstract

The measurement of non-market output, characterised by providing goods and services without economically significant prices, has always proved challenging for compilers of the National Accounts. Various approaches are available to meet these challenges, often resulting in slight differences in methodology between countries. Government policies, introduced in response to the coronavirus (COVID-19) pandemic exacerbated some of these existing differences, potentially influencing the GDP estimates across countries. This joint paper by the United Kingdom Office for National Statistics (ONS) and the Organisation for Economic Cooperation and Development (OECD) explains the methodological options available to statistical compilers and explores differences in methodologies used by countries to measure non-market output, analysing their implications for international comparisons of GDP growth during the COVID-19 pandemic.

Keywords: Non-market output, COVID, GDP, national account methodology, education.

JEL Classification: H51, H52, C82, E01.

Résumé

La mesure de la production non marchande, qui se caractérise par le fait de fournir des biens et des services sans prix économiquement significatifs, a toujours constitué un défi pour les comptes nationaux. Plusieurs approches existent pour relever ce défi, menant souvent à de légères différences de méthodologie entre pays. Les mesures gouvernementales, introduites en réponse à la pandémie de coronavirus (COVID-19), ont accentué certaines de ces différences, influençant potentiellement les estimations du PIB entre pays. Ce document, conjointement préparé par l'Office National des Statistiques (ONS) du Royaume-Uni et l'Organisation de Coopération et de Développement Économique (OCDE), présente les options méthodologiques à la disposition des statisticiens qui compilent ces chiffres et explore les différences de méthodologies utilisées par les pays pour mesurer la production non marchande, analysant leurs implications sur les comparaisons internationales de la croissance du PIB durant la pandémie de COVID-19.

Mots clés : Production non marchande, COVID, PIB, méthodologie comptes nationaux, éducation.

Classification JEL : H51, H52, C82, E01.

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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 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.

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

1. 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.

2. The COVID-19 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 COVID-19 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.

3. The purpose of this paper is to inform on the range of approaches currently applied by National Statistical Institutes (NSIs) to measure non-market output, and to investigate how different approaches may have contributed to differences in the measured growth of non-market output and GDP over the COVID-19 pandemic through 2020 and 2021. To this end, the paper 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,² 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 excess mortality rates). While this paper 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.

4. The composition of Government Final Consumption Expenditure (GFCE)³ 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 paper 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) and Human health and social work activities (ISIC section Q).⁴

5. Cross-country differences in changes in GFCE or the output of the three industries most commonly captured in GFCE exist because of the following reasons: the pandemic impacted countries with slightly different timing; economic and health policy responses

² For the project, the OECD and the ONS interviewed national account compilers from the respective NSIs in Australia, Canada, Italy, Ireland, France, Germany, Norway, the United Kingdom and the United States.

³ GFCE consists of expenditure incurred by general government on both individual consumption goods and services and collective consumption services (SNA2008 Para. 9.117).

⁴ It should be noted that while these three industries are predominantly non-market in most countries, market activity may also occur within all three industries, with possibly different compilation methodologies being applied for the market component. Overall, measurement methodology of market output (even in predominantly non-market industries) is more consistent across countries and thus warranted less investigation of methodology.

from governments were not always comparable; and as will be discussed in greater detail in this paper, the methodology used to measure these 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.

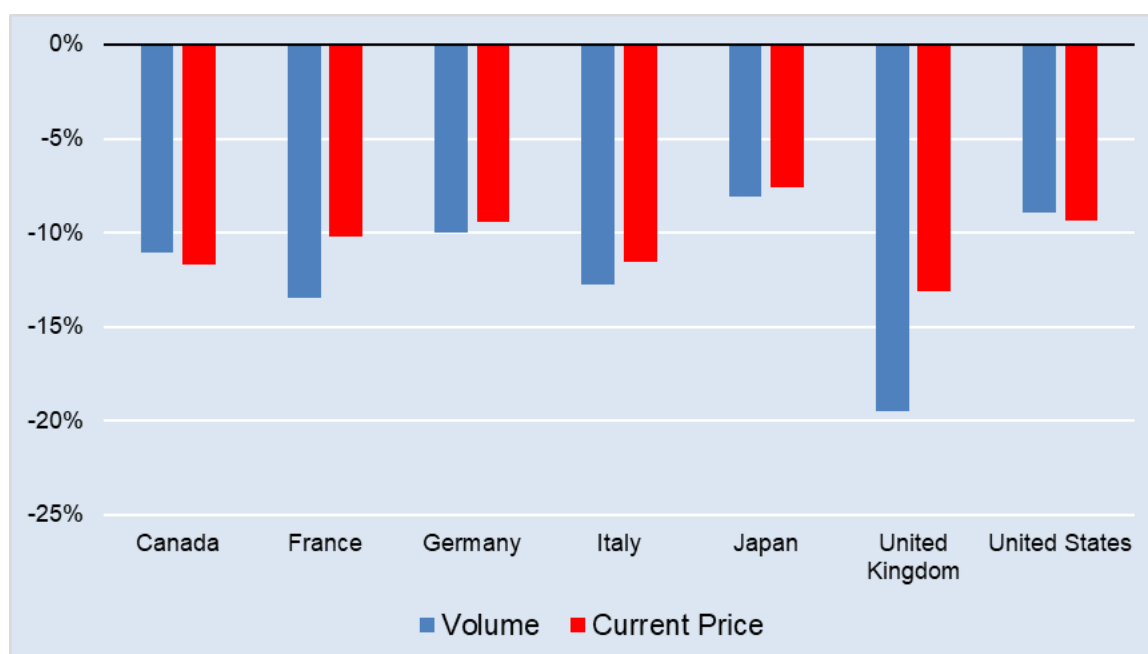
6. The paper is structured as follows. Section 2 provides the rationale for this paper, presenting how different growth rates in non-market output impacted differences in GDP growth rates across countries. Section 3 details the existing recommended methodologies for measuring non-market services. Section 4 outlines which methodologies are currently in use by NSIs before explaining how these different methodologies have been affected by the COVID-19 pandemic in Section 5. Section 6 concludes the paper and provides some basic suggestions on how to move forward.

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

7. 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 pandemic. Although differences in the rate of GDP growth across countries are not unusual, the relative size of the differences observed in the second quarter of 2020 (e.g. 9.5 percentage points between the growth rates of GDP volume estimates in the United Kingdom (UK) and Germany) is highly unusual,⁵ with COVID-19 fully entrenched in all G7 economies at this time. This analysis focuses on the second quarter of 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 2.1 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 pandemic.

⁵ All data used throughout the paper were extracted from their respective data bases on 4th February 2022.

Figure 2.1. Change in GDP, (quarter-on-quarter), Quarter 2 2020, G7 economies, current price and volume estimates

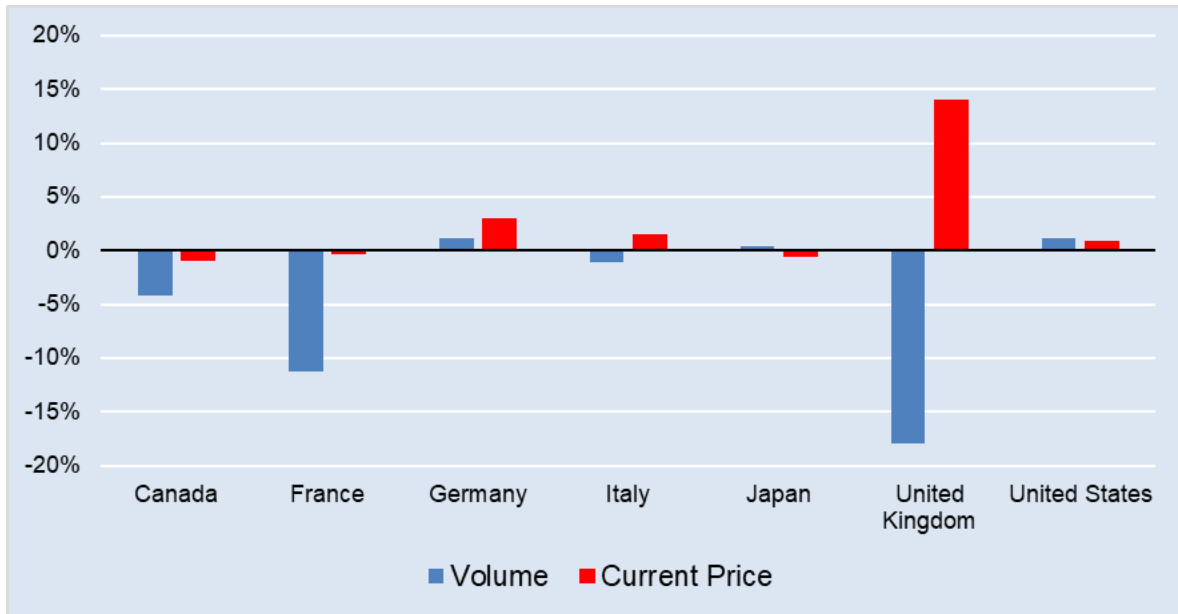


Source: OECD Quarterly National Accounts database.

8. Looking at the expenditure components of GDP, Dey-Chowdhury et al. (2021) identify that 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 §2.40).⁶ Across G7 economies, the UK observed the largest increase in current price GFCE in the second quarter of 2020, while recording the largest decrease in volume terms (see Figure 2.2). In the other G7 economies – where GDP changes were more modest – movements in current price and volume GFCE have been more closely matched.

⁶ This may include goods and services purchased at market price on behalf of households, who then receive them free or below economically significant prices.

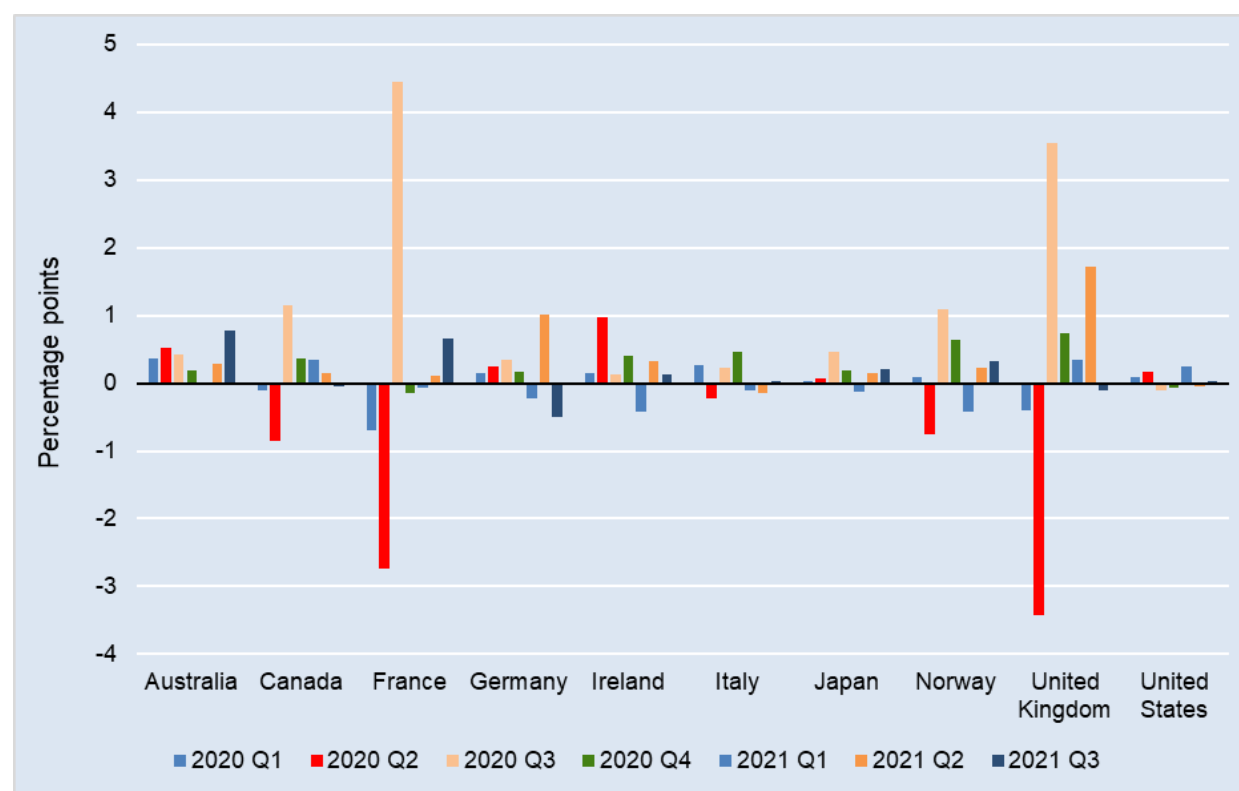
Figure 2.2. Change in GFCE, (quarter-on-quarter), Quarter 2 2020, G7 economies, current price and volume estimates



Source: OECD Quarterly National Accounts database.

9. The fall in volume GFCE in the UK, and to a lesser extent in France, in the second quarter of 2020 negatively affected real GDP growth. Figure 2.3 shows that the negative contribution for France and the UK in the second quarter of 2020 is offset in the third and fourth quarter, although quarterly growth remains more variable than in other countries.

Figure 2.3. Contribution (% points) of GFCE to real GDP growth (quarter-on-quarter), Quarter 1 2020 - Quarter 3 2021, selected OECD economies, seasonally adjusted



Source: Calculations based on OECD Quarterly National Accounts database.

10. The pandemic's effects on non-market services were similar in most OECD⁷ 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 2.2 and 2.3 may involve differences in the measurement of non-market output and may not only reflect the impact of the pandemic.

11. It should be noted that most countries expect higher revisions of national accounts data than average for the period covering the 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. 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.

⁷ 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, United Kingdom and United States.

3. Methods used to measure non-market output

12. 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),⁸ 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.

13. 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?

14. 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?

15. While this paper 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 pandemic on the delivery of non-market services.

16. 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 (ESA)* and the Eurostat *Handbook on prices and volume measures in the national accounts (2016)*, as well as existing commentary such as 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.

⁸ Schreyer, P. (2010), “Towards measuring the volume output of education and health services: A handbook”, *OECD Statistics Working Papers*, No. 2, p. 27.

3.1. Current price estimates

17. The 2008 SNA defines market output in current price terms as “*the value of goods and services sold at economically significant prices*” (see 2008 SNA §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 intermediate consumption; compensation of employees; consumption of fixed capital; and other taxes (less subsidies) on production (see 2008 SNA §6.130).⁹ Following this guidance, there is little variation between countries in the methodology used for current price estimates of non-market output.

3.2. Volume estimates

18. 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.

19. 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

20. 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.

3.2.1. Deflation using output prices

21. 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.

⁹ 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.”

22. 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.

3.2.2. Deflation using input prices

23. 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).

24. 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.

3.2.3. Direct output indicators

25. 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.¹⁰ The indicators used explicitly relate to the output, such as student numbers or medical appointments. The 2008 SNA (§15.122) states that the use of direct output indicators is the recommended approach for non-market services where the appropriate data are available.

26. 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 over the pandemic, where many

¹⁰ 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 indexes to quality assure the volume estimates as well as price index.

services, such as elective surgery, were restricted, and new services, such as COVID-19 testing, were created.

3.2.4. *Direct input indicators*

27. 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.

28. 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 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.¹¹

29. 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.

3.3. Considerations in the choice of non-market output methodology

30. 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).

31. 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.

32. In practice, 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 COVID-19 pandemic).

¹¹ 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 pandemic employers with furloughed workers were usually the recipient of various similar 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 in the UK and the temporary wage subsidy scheme in Ireland.

3.4. Comparability of non-market output measures

33. 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.¹² Methodological choices may also generate different results depending on national institutional contexts – for instance, 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.

¹² 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.

Box 3.1. 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 (e.g. DRG categories for healthcare)¹³ 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 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. Thus, 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, i.e. 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 for respiratory illnesses. Additionally, because of lockdowns and healthcare capacity 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.

The issue is best illustrated with a numerical example. Assume that in 2019 (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, let’s assume that the number of treatments of respiratory diseases increased significantly in 2020 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.

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 90 to 50 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.

¹³ 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.

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 calculated as:

$$[(50 \times 10) + (20 \times 15)] / [(90 \times 10) + (5 \times 15)] - 1 = -0.179$$

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 calculated as:

$$[(50 \times 10) + (20 \times 20)] / [(90 \times 10) + (5 \times 20)] - 1 = -0.1$$

showing a decline of -10.0%

Example numbers		
Knee replacement	t-1	t
Cost	10	10
Quantity	90	50
Total cost	900	500
Simple Cost Share	0.92	0.56
Respiratory diseases	t-1	t
Cost	15	20
Quantity	5	20
Total cost	75	400
Simple Cost Share	0.08	0.44
Growth Rates		
Quantity		t
Knee replacement		-44.4%
COVID-19 treatments		300.0%
Total aggregate growth		t
Previous period cost share (Laspeyres)		-17.9%
$t-1c \cdot t_q / t-1c \cdot t-1q$		
Current period cost share (Paasche)		-10.0%
$t_c \cdot t_q / t_c \cdot t-1q$		

Note: Where c is the cost, Q is the quantity of activity and t is the year.

Neither result is necessarily correct nor 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 in the same situation. 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 – 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, the Laspeyres method 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 than that likely observed in aggregate outputs; the experience of 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.

4. How National Statistical Institutes (NSIs) measure non-market output

34. In 2010, the 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 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”.¹⁴

35. 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, leaving further questions on how different methodologies have responded to the consequences of the COVID-19 pandemic. To answer these questions, the OECD and the UK ONS jointly conducted an information gathering exercise, engaging with the eight NSIs listed previously in Section 1, on the following topics:

- their basic methodology and data sources for measuring 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 COVID-19 pandemic
- implications of the methodology used for interpreting changes in non-market output during the pandemic.

36. 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.

37. Differences in methodology were not a strong driver of differences in growth for combined ISIC sections O, P and Q (hereafter referred to as industries OPQ) in the pre-pandemic period.¹⁵ 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.

38. Trilateral discussions between the OECD, 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. Tables 4.1-3 summarise the methods

¹⁴ While this Eurostat inventory is not available publicly, a general summary is available in Annex A.

¹⁵ Industries OPQ is the aggregate of ISIC sections O (Public administration and defence), P (Educational services) and Q (Human health and social care services).

used to measure these industries across OECD countries.¹⁶ Full results are available in Annex A.

4.1. Public administration and defence (Section O)

39. ISIC section O includes public administration, defence, law enforcement and 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.

Table 4.1. Public administration and defence (Section O)

	Input-based measures	Output-based measures
Indirect methods	Input price deflation Belgium, Canada, Norway (ANA)	Output price deflation
Direct methods	Direct input indicators 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	Direct output indicators

Note: 1. Applies to both quarterly national accounts (QNA) and annual national accounts (ANA) unless specified. For simplicity, countries are placed in the quadrant that reflects their predominant methodology used in quarterly and annual compilation.

2. * 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.

Source: Eurostat-OECD surveys (2020, 2010).

40. 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.

41. Although a minority, direct output volume indicators are applied occasionally in the compilation of section O. For instance, the UK measures 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.

¹⁶ Data are based on a Eurostat-OECD “Questionnaire on Price and Volume Measures for Collective Non-market Services, Health Services and Education Services during COVID-19”, which was self-reported by countries in 2020. For simplicity, countries are placed in the quadrant that reflects their predominant methodology used in quarterly and annual compilation. For many, but not all countries, this predominant methodology concerns that used to measure non-market output; 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.

42. 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.

4.2. Education (Section P)

43. 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%.

44. 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. 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.

Table 4.2. Education (Section P)

	Input-based measures	Output-based measures
Indirect methods	Input price deflation Canada, Japan (ANA), South Korea, Colombia, United States	Output price deflation
Direct methods	Direct input indicators Canada, Ireland, Latvia, Norway (QNA), Spain	Direct output indicators 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

Note: Applies to both quarterly national accounts (QNA) and annual national accounts (ANA) unless specified. For simplicity, countries are placed in the quadrant that reflects their predominant methodology used in quarterly and annual compilation.

Source: Eurostat-OECD surveys (2020, 2010).

45. 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.

46. 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.

4.3. Healthcare (Section Q)

47. 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 United States, for instance, most hospitals and many health providers are private entities charging economically significant prices.¹⁷ While this is reflected in their choice of predominant methodology, different methodologies are used for other components of healthcare.

48. 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 uses direct input indicators.

Table 4.3. Healthcare (Section Q)

	Input-based measures	Output-based measures
Indirect methods	Input price deflation Austria, Canada, Chile, Colombia, Czech Republic, Denmark (QNA), Poland, South Korea	Output price deflation Germany, Japan (ANA), Luxembourg, South Africa, United States
Direct methods	Direct input indicators Canada, Ireland, Denmark (QNA), Latvia, Mexico, New Zealand (QNA), Slovak Republic, Spain	Direct output indicators Australia, Belgium, Denmark (ANA), Finland, France, Hungary, Italy, Netherlands, New Zealand (ANA), Norway, Portugal, Slovenia, Sweden, United Kingdom

Note: Applies to both quarterly national accounts (QNA) and annual national accounts (ANA) unless specified. For simplicity, countries are placed in the quadrant that reflects their predominant methodology used in quarterly and annual compilation.

Source: Eurostat-OECD surveys (2020, 2010).

49. 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).

50. 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

¹⁷ It should be noted that ownership of the economic unit is less important for determining whether a unit is in the market sector than the prices charged. 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.

without requiring the level of detail used for annual national accounts such as the compositional mix or resources used.

4.4. GFCE and non-market output

51. 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 (e.g. 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 instance, some subsidised cultural services in ISIC section R are also captured in GFCE.

52. 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 United States 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.

53. 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, amongst 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.¹⁸

¹⁸ While divergences may occur at the aggregate level on a quarterly basis, at a detail level, products are balanced during the standard compilation of Supply-Use Tables, which also benchmarks annual estimates.

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

54. 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 prior to the 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 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 ISIC industries OPQ, before comparing published outputs and assessing the 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.

5.1. Public administration and defence (Section O) output measurement during the COVID-19 pandemic

55. As mentioned in Section 4, 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 COVID-19 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 United States to furloughing public employees in France, while Australia reported that government employees were able to continue their work despite the restrictions.

56. 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 declined by 4.9% in the second quarter of 2020.¹⁹

57. 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 the second quarter of 2020 (e.g. Australia (0.7%), Norway (1.1%) and the United Kingdom (0.7%)).

¹⁹ Canada uses the North American Industrial Classification System, whereby Public administration is similar to section O of ISIC.

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

5.2. Education (Section P) output measurement during the COVID-19 pandemic

59. Almost all 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 pandemic or facing temporary interruptions.²⁰

60. 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 the second quarter of 2020, the magnitude of which varied between sub-national units depending on local circumstances.

61. 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.²¹ 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.

62. 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 the second quarter of 2020 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 the second quarter of 2020 was second only to the UK among G7 nations, with the education adjustments likely being an important driver for this.

63. The countries which applied these adjustments acknowledged that they were implemented as it was perceived that the move to a remote learning environment led to a

²⁰ Although 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.

²¹ The 2008 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 SNA2008 para. 29.157).

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”.²² Several countries (Australia, Canada, Germany and Ireland), when interviewed, confirmed that this guidance was consistent with their own views.

64. 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”.²³ 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 pandemic. Overall, this yielded a 10.8% decline in the output of education services in the second quarter of 2020.

65. Australia, which was also subject to school closures and remote learning in the second quarter of 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 the second quarter of 2020.

66. 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 OPQ measures, emphasising the varying effects of COVID-19 on these two measures.

67. 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 pandemic. In contrast, direct input indicators, based on teacher numbers, hours worked or wages, may have shown some reduction, but not to the extent

²² See Eurostat “Guidance on non-market output in the context of the COVID-19 crisis”, https://ec.europa.eu/eurostat/documents/10186/10693286/Non-market_output_guidance.pdf.

²³ For more information on Statistics Canada recording of COVID-19 in the national accounts, see: <https://www150.statcan.gc.ca/n1/pub/13-605-x/2020001/article/00001-eng.htm>.

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 amongst them.

5.3. Healthcare (Section Q) output measurement during the COVID-19 pandemic

68. The COVID-19 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.

69. As outlined in Section 4, 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.

70. 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 United States, 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.

71. 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.

72. However, some of the resources deployed to support these services came from outside the healthcare industry (e.g. the military) and thus 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.

73. 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 COVID-19 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.

74. Finally, healthcare may 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, likely made substantial contributions to current price increases in healthcare output and GFCE,²⁴ but may not have directly influence 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.

75. 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 pandemic. There appears to be a consistent theme across countries that the decline observed in non-COVID related healthcare services was larger than the increase in COVID related output for periods of the pandemic. 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 during the 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 pandemic, disentangling the often opposing effects of changes in regular indicators and the application of additional adjustments presents substantial challenges.

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

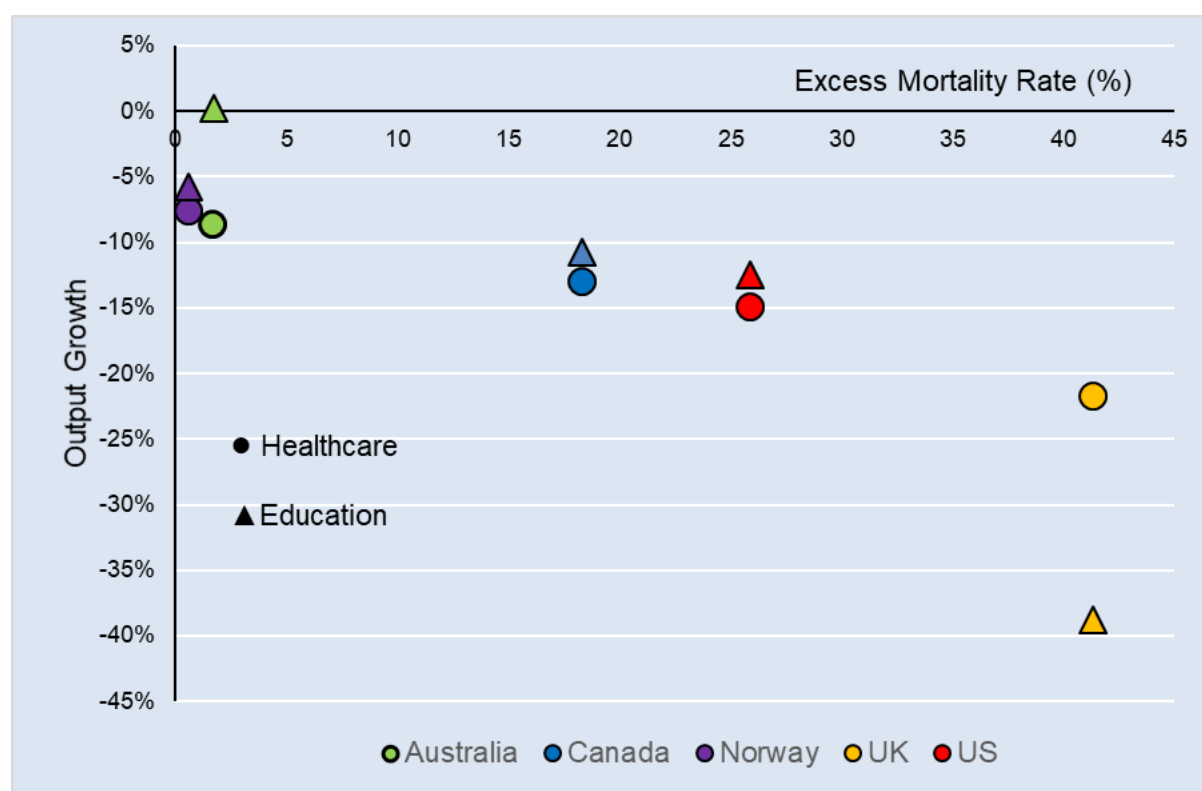
76. Despite the lack of consistency in methodologies and adjustments, there seems to be a relationship across countries between the change in healthcare and education output as reported by countries and the degree to which they have been impacted by the pandemic, proxied in our analysis by excess mortality 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 United States 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 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 5.1).²⁵

²⁴ 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 report](#), which suggest that in financial year 2020-21, over £12 billion had been spent on purchases of PPE in the UK.

²⁵ 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 indexes exist, the components and weights applied to them could be considered quite subjective. For instance, even the use of a simple infection rates 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 (i.e. quality of health care 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

All countries show a substantial fall in healthcare, with the UK recording the largest fall at 21.7%, followed by the United States (14.9%) and then Canada (13.0%). Even Norway, with only a 0.6% excess mortality rate during the second quarter of 2020, displayed a 7.6% fall in healthcare output in volume terms reflecting reductions in some healthcare services taken as a precautionary response.

Figure 5.1. Excess mortality versus healthcare and education output, Quarter 2 2020: selected countries



Note: 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.

Sources: Output data: ABS, Statistics Canada, Statistics Norway, BEA, and ONS. Selection of countries based on those for which individual industries data was available.

Excess mortality: calculations based on OECD COVID-19 Health Indicators. 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: $(\text{Total number of deaths in a specific quarter}) / (\text{Five-year average number of deaths in that quarter}) - 1$.

entirely in one direction. More information on the data related to excess mortality is available from the OECD working paper "Excess mortality: Measuring the direct and indirect impact of COVID-19" (Morgan et al., 2020).

77. Figure 5.1 shows a similar pattern for education, with those countries that experienced a more severe impact of the COVID-19 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). As mentioned, Norway and the United States also made adjustments to reflect reductions in the quantity of education output during the transition to remote learning. However, Figure 5.1 suggests that these adjustments were of a more subdued nature.

78. 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 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.

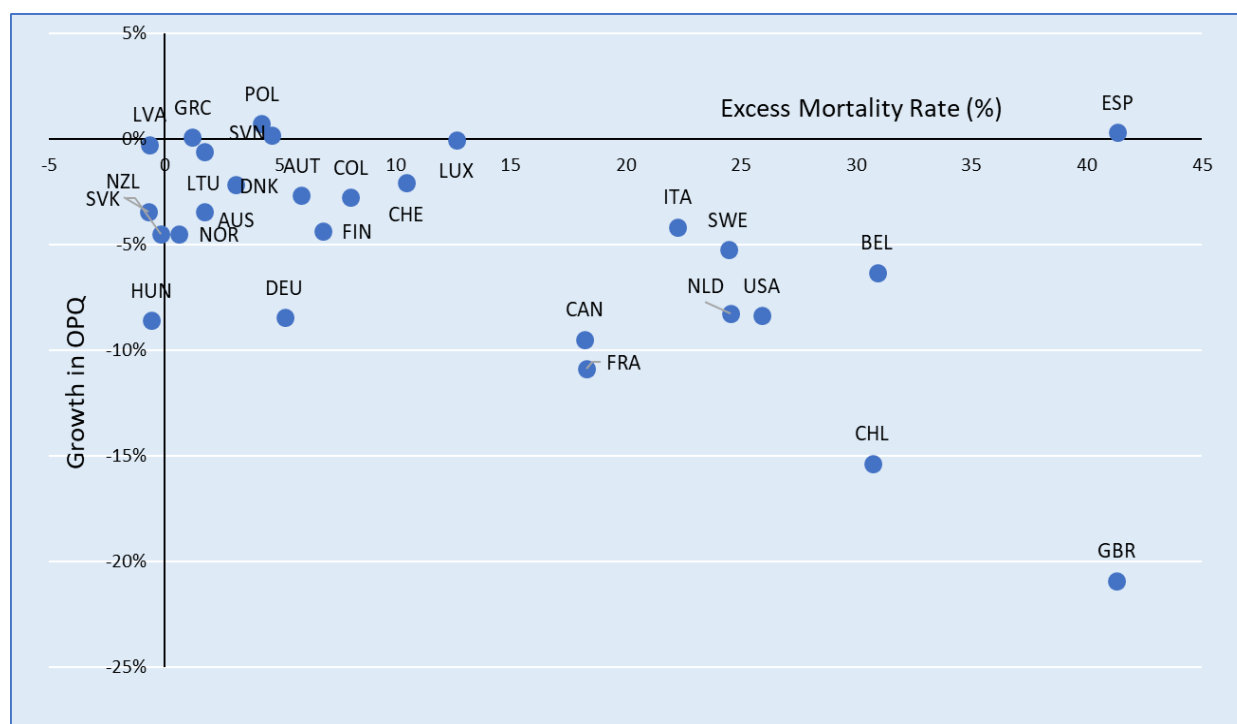
5.5. Aggregate industries OPQ output during the COVID-19 pandemic

79. 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 pandemic for a larger range of countries (see Figure 5.2), the relationship established in Figure 5.1 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.

80. Overall, the correlation between declining output of industry OPQ and higher excess mortality rates appears relatively weak, even when methodological approaches and adjustments are taken into consideration.²⁶

²⁶ 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 A 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 excess mortality rate, signifying less deaths than the five year average, reported a decline in industries OPQ of 4.5% for the second quarter of 2020. As mentioned, 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 5.2. Excess mortality versus aggregate industries OPQ output, Quarter 2 2020: selected countries



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

Source: OECD Quarterly National Accounts database and calculations based on OECD COVID-19 Health Indicators.

81. 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 5.2. Since almost all countries are using a similar method for section O, the differences are predominately in approaches to measuring education and healthcare.

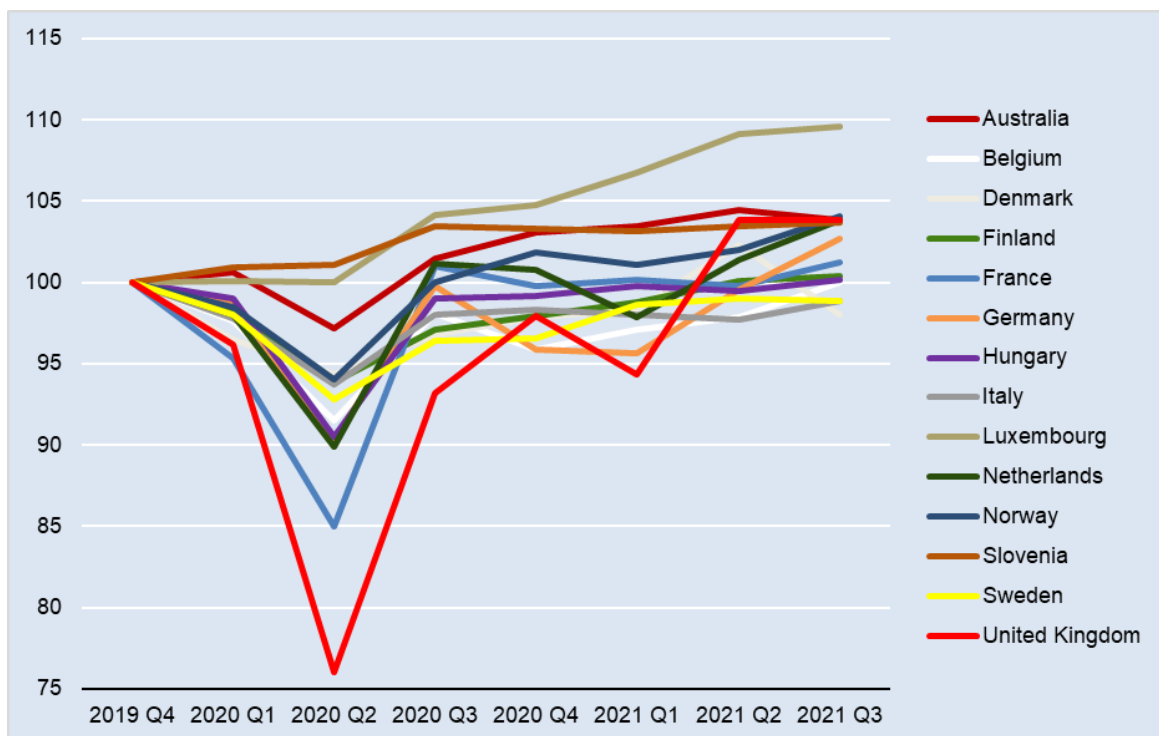
82. Spain was one of the few countries to record increases in the output of industries OPQ, despite its high level of excess deaths. Importantly, among the countries listed on the graph, Spain and Ireland (for which excess mortality cannot be calculated, but recorded a relatively small (-3.1%) decline 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.

83. In contrast, France and the UK recorded greater falls in the output of non-market services while experiencing higher 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.²⁷

84. Figures 5.3 and 5.4 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 +1.1% to -24.0% between the fourth quarter of 2019 and the second quarter of 2020, followed by rebounds beginning in the third quarter. For the countries using alternative methods, the change observed between the fourth quarter of 2019 and the second quarter of 2020 was less marked, ranging from an increase of 1.5% to a decrease of 11.3% with all but three countries in the +1.5% to -5.0% 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 pandemic. However, the wide variation among countries that do not use direct output for healthcare and education irrespective of any adjustment is clear.

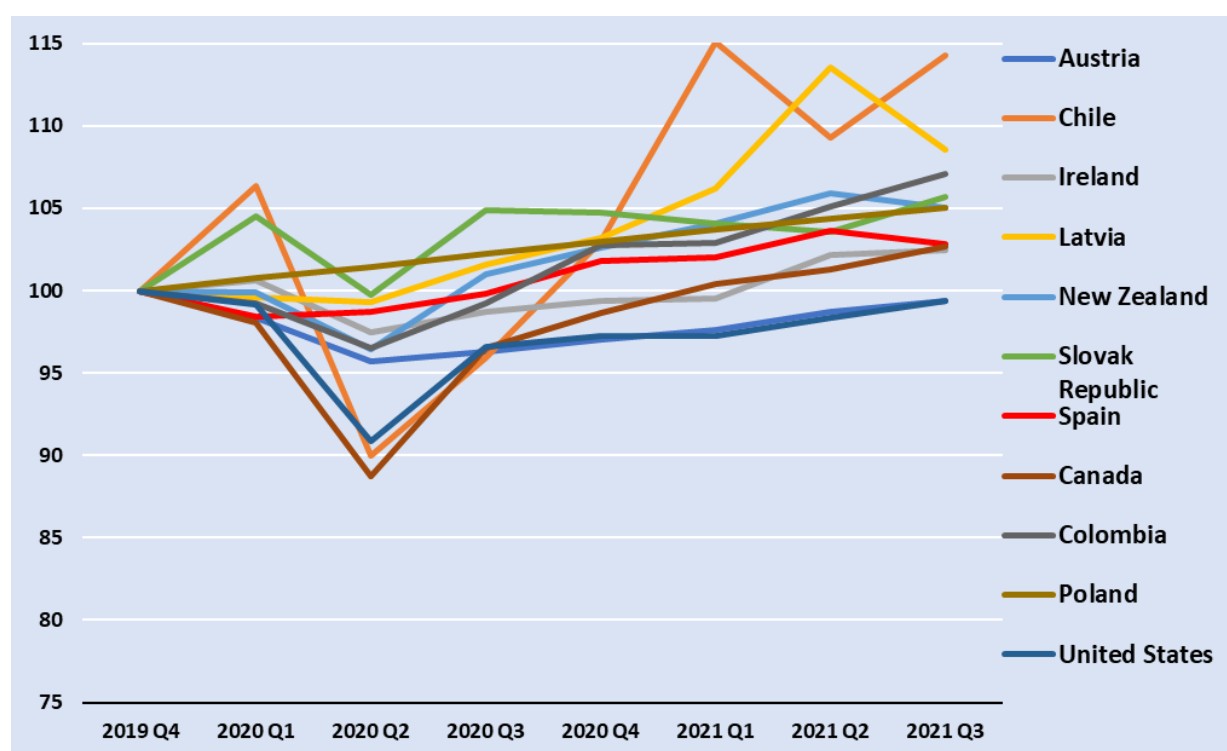
Figure 5.3. Volume change in output for industries OPQ, countries using direct output methods for both sections P and Q, Quarter 4 2019 – Quarter 3 2021, indexed to Quarter 4 2019 (=100)



Source: OECD Quarterly National Accounts database and Eurostat-OECD survey (2020).

²⁷ The decline in Italy is reflected in both the first quarter and second quarter of 2020 because of its earlier imposition of COVID-related restrictions compared with other European countries.

Figure 5.4. Volume change in output for industries OPQ, countries not using direct output methods for both sections P and Q, Quarter 4 2019 – Quarter 3 2021, indexed to Quarter 4 2019 (=100)



Source: OECD Quarterly National Accounts database and Eurostat-OECD survey (2020).

5.6. Correlation between GFCE and Industries OPQ during the COVID-19 pandemic

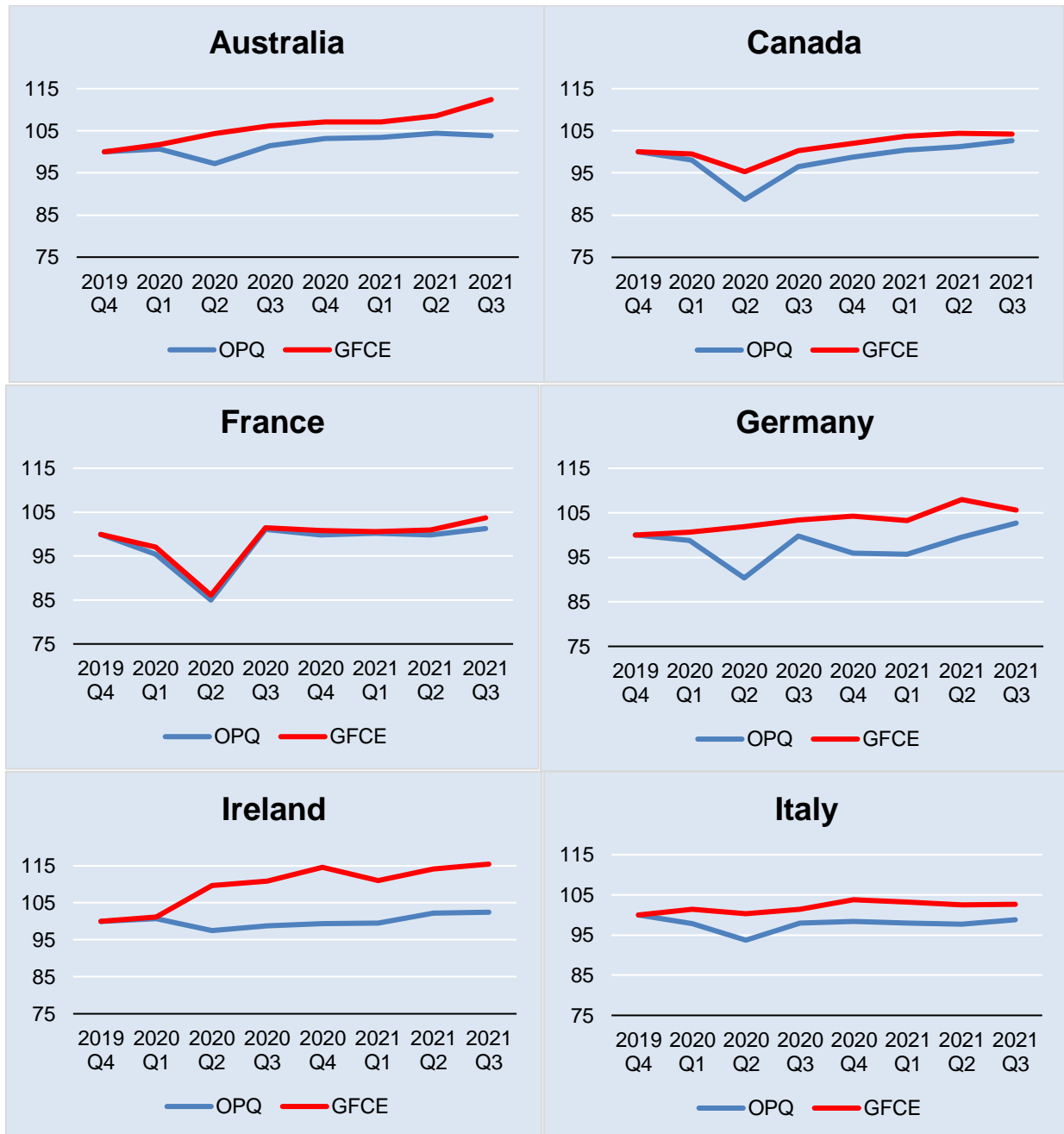
85. In some of the countries studied, the effect of the COVID-19 pandemic on GFCE has been similar to that on industries OPQ but in other countries there are notable differences. Figure 5.5 shows the change in these indicators for the countries that were interviewed. In Canada, France, Norway and the UK, volume GFCE and industries OPQ output have tracked each other quite closely, all demonstrating correlation coefficients of more than 0.9 over 2020. Notably, 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.

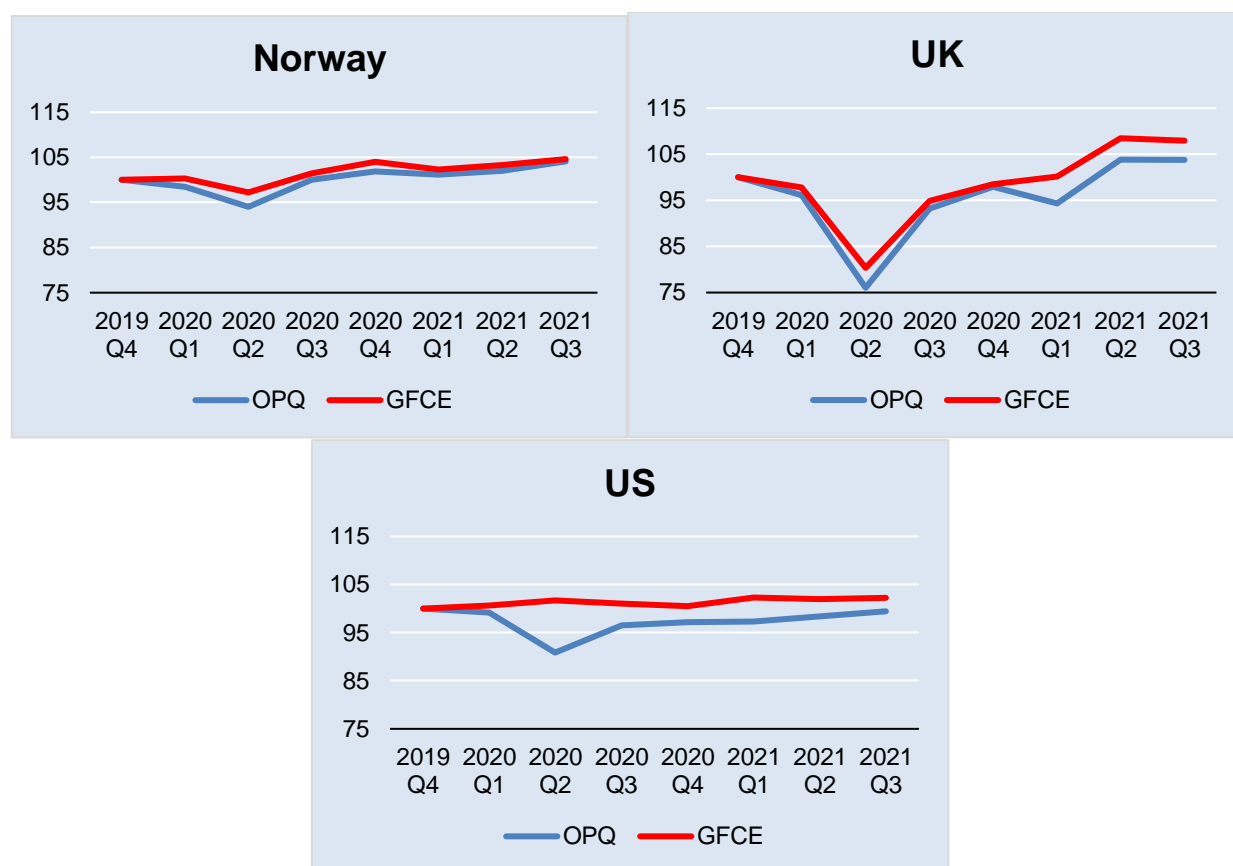
86. Far greater disparities are seen in Australia, Germany, Ireland and the United States, all of which exhibit equivalent correlation coefficients of less than 0.2 over 2020. Furthermore, in Australia and the United States the relationship between industries OPQ output and GFCE is negatively correlated. This can be partially explained by differences in market structures – hospitals in the United States are privately run, whereas healthcare in Australia has a large, but not universal, private insurance component.²⁸ However, methodological differences are also important - Australia calculates GFCE by deflating current price spending whereas its volume estimates for industries OPQ output primarily

²⁸ Differences in Australia were also affected by activity within the childcare industry switching from household to government expenditure because of policy changes during the pandemic.

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 5.5. Volume change in industries OPQ output and GFCE for selected countries, Quarter 4 2019 – Quarter 3 2021, indexed to Quarter 4 2019 (=100).





Source: OECD Quarterly National Accounts database.

87. As a result, as illustrated in Figure 5.5, while France and the UK showed large falls in output and GFCE, several countries, including Australia, Germany, Ireland and the United States, showed an increase in GFCE in the second quarter of 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.

88. 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 – 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.

6. Conclusions

89. 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.

90. The coronavirus (COVID-19) pandemic resulted in large-scale disruption to the delivery of non-market services, particularly in the second quarter of 2020. This led to significant changes and increasing differences in measures of non-market output and GFCE across 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 contributed.

91. 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, differences in output because of the pandemic appear to be driven mainly by the varied adjustments that NSIs applied to account for any perceived COVID-19-related reduction resulting from remote learning.
- For healthcare, a wider range of regular methodologies is 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.

92. 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.

93. 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 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.

94. 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-positive 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.

95. 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 the second quarter of 2020 (in French only)*
- The United Kingdom: [Coronavirus and the impact on measures of UK government education output: March 2020 to February 2021](#)
- The United States: [Gross Domestic Product, Second Quarter of 2020, Technical note.](#)

96. 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.

97. 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 in order 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.

98. 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 in order to remain correlated to other macro-economic outcomes like unemployment and prices, but the ability to confidently compare across countries is equally fundamental.

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Annex A.

Predominant methods used to measure; 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.

Country	Public Administration		Education		Healthcare	
	Quarterly	Annual	Quarterly	Annual	Quarterly	Annual
Australia	Direct input indicators (hours worked)	Direct input indicators (hours worked)	Projection based on annual direct output indicators	Direct output indicators (number of students)	Direct output indicators (DRG index at lower detail)	Direct output indicators (DRG index)
Austria	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Input price deflation	Input price deflation
Belgium	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
Canada	Direct input indicators (CoE, measured by hours worked) and input price deflation	Direct input indicators (CoE, measured by hours worked) and input price deflation	Direct input indicators (CoE, measured by hours worked) and input price deflation	Direct input indicators (CoE, measured by hours worked) and input price deflation	Direct input indicators (CoE, measured by hours worked) and input price deflation	Direct input indicators (CoE, measured by hours worked) and input price deflation
Chile	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	Input price deflation (public), output price deflation (private)	Input price deflation (public), output price deflation (private)
Colombia	Input-based methods	Input-based methods	Input price deflation (public), direct output indicators (private; number of pupils enrolled)	Input price deflation (public), direct output indicators (private; number of pupils enrolled)	Input price deflation	Input price deflation
Czech Republic	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Input price deflation	Input price deflation
Denmark	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students, student hours for primary)	Direct input indicators and input price deflation	Direct output indicators
Finland	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
France	Direct input indicators	Direct input indicators	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
Germany	Direct input indicators	Direct input indicators	Direct output indicator	Direct output indicators	Output price indicators	Output price indicator
Hungary	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
Ireland	Direct input indicators (number employed)	Direct input indicators (number employed)	Direct output and direct input indicators (number of students and teachers)	Direct output and direct input indicators (number of students and teachers)	Direct input indicators	Direct input indicators (number employed in healthcare)

Country	Public Administration		Education		Healthcare	
	Quarterly	Annual	Quarterly	Annual	Quarterly	Annual
Italy	Direct input indicators	Direct input indicators	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
Japan	Direct input indicators (employee compensation)	Direct input indicators (employee compensation)	Input price deflation	Input price deflation	Output price deflation	Output price deflation
Latvia	Input-based methods	Input-based methods	Input-based methods	Input-based methods	Input-based methods	Input-based methods
Luxembourg	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	[Market]	[Market]
Mexico	Input-based methods	Input-based methods	Direct output indicators (public; number of students), output price deflation (private)	Direct output indicators (public; number of students), output price deflation (private)	Direct input indicators (public), output price deflation (private)	Direct input indicators (public), output price deflation (private)
Netherlands	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	[Market]	Direct output indicators (volume index based on ICDs by age and discharge numbers)
New Zealand	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	Input indicators (public), output price deflation (private)	Direct output indicators – Composite index of DRG, patient discharge and bed night data (public), deflation of outputs (private)
Norway	Direct input indicators (number employed)	Input price deflation	Direct input indicators (number employed in education)	Direct output indicators (student hours)	Direct output indicators	Direct output indicators (DRG index)
Poland	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	Input price deflation	Input price deflation
Portugal	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
Slovakia	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Input price deflation	Input price deflation
Slovenia	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Projection based on annual direct output indicators	Direct output indicators (DRG index)

Country	Public Administration		Education		Healthcare	
	Quarterly	Annual	Quarterly	Annual	Quarterly	Annual
Spain	Input-based methods	Input-based methods	Direct input indicators (number employed in education)	Direct input indicators (number employed in education)	Direct input indicators (number employed in healthcare)	Direct input indicators (number employed in healthcare)
Sweden	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (student hours)	Projection based on annual direct output indicators	Direct output indicators (DRG index)
South Africa	Input-based methods	Input-based methods	Projection based on annual direct output indicators	Direct output indicators (number of students)	Output price deflation	Output price deflation
South Korea	Input-based methods	Input-based methods	Input price deflation (public), output price deflation (private)	Input price deflation (public), output price deflation (private)	Input price deflation (public), output price deflation (private)	Input price deflation (public), output price deflation (private)
United Kingdom	Input price deflation and projection of annual output indicators	Input price deflation and direct output indicators	Projection based on annual direct output indicators	Direct output indicators (number of students)	Direct output indicators	Direct output indicators (HRG index)
United States	Direct input indicators (employment)	Output price deflation	Output price deflation	Output price deflation	Output price deflation	Output price deflation

Note: “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. Iceland, Israel, and Lithuania are not incorporated into the table because of replies to survey request having absent or very limited information.