STATISTICS

Special Series on COVID-19

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Estimating the Volume of Government Education Services during COVID-19

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The COVID-19 pandemic affects governments' ability to deliver services. In many cases, while the volume of services has declined, government workers delivering services remain fully employed. This has caused challenges when measuring the real output and value added of the government sector. Furthermore, it has increased the risk of unfair comparisons of economic performance among countries that have adopted different methodologies, especially for measures of government-provided education services. This note gives guidance as to how to adapt the sources and methods used to measure the volume of education services.

I. INTRODUCTION

The measurement of non-market output (such as government services) is a challenge for national accountants. Most transactions that occur in the economy involve a willing buyer and seller who agree on a price when exchanging goods and services. In the case of non-market services produced by government and nonprofit institutions serving households, the goods and services are either supplied free or at prices that are not economically significant. The "non-market" nature of the transaction means that national accountants need to use alternative methods when measuring the value and volume of these services.

In many countries, governments provide education services[1] to their populations and therefore reflect non-market output since governments do not charge a price or charge a not economically significant price. Given the variety of "back to school" delivery models being adopted by governments across the world there may be a need to refine the data sources and methods used to measure the volume of educational services.

The *2008 System of National Accounts* recommends that the value of non-market educational services is estimated based on the "sum-of-costs" approach. This estimates output by adding together all the production costs incurred, comprising intermediate consumption, labor costs, and consumption of fixed capital by the non-

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[1] These may also include an element of free or subsidized before- and after-school childcare.

market producer in the process of delivering the service. This contrasts with market output provided by private education institutions, which is valued using the prices willingly paid by consumers, and which covers not only the production costs but also any net operating surplus earned.

For example, assume that teachers work a set number of hours each week, and that in the first quarter of 2020 the quarterly salary of a teacher is $25,000, the cost of rent for the classroom is $1,000, the cost of student materials and overheads is $500, and consumption of fixed capital (buildings, vehicles) is $500 (Table 1). The national accountant would estimate the value of educational output to be $27,000 ($25,000 + $1,000 + $500 + $500). Assume that in the second quarter of 2020 the quarterly salary increases to $26,000, the cost to rent the classroom increases to $1,100, the cost of materials and overheads increases to $600, and the consumption of fixed capital remains unchanged at $500. The total cost in the second quarter would be $28,200, an increase of 4 percent from the first quarter.

TABLE 1. Sum-of-Costs Approach to Measuring Educational Output in Current Prices

Input	First Quarter	Second Quarter	Change
Wages and salaries	25,000	26,000	
Rent	1,000	1,100	
Materials and overheads	500	600	
Consumption of fixed capital	500	500	
Total (sum of costs)	27,000	28,200	4%

Source: Authors' calculation.

The issue is further complicated when measuring the volume of educational output. Normally, a national accountant deflates the value of output with an appropriate price index in order to arrive at an estimate of the volume of output. In the case of non-market government services there is no such price index since the goods and services are provided free of charge or at prices that are not economically significant. This leaves two options (1) using either deflated input values or direct volume indicators of inputs, or (2) direct volume measurement based on output indicators. The former assumes that the change in the volume of inputs is representative of the change in the volume of output. A drawback of this "inputs equal outputs" method is that it makes it impossible to analyze changes in productivity and will wrongly estimate the change in output if this is different from the change in inputs.[2] However, in most cases, countries only have access to input indicators and therefore these are predominately used when estimating the volume of non-market output. For example, since a large share of the input into the provision of government services comes from labor provided by public servants, many countries use input volume indicators such as indices of hours-worked (or paid) or staffing levels,[3] or alternatively use a wage index to deflate compensation of employees to measure the volume of the labor portion of government services output.[4] Furthermore, for the many countries that do not have estimates of consumption of fixed capital, this labor portion then forms the sole component of nominal and real value added levels and growth.[5]

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[2] Such as when teachers continue to be paid but do not deliver educational services or deliver reduced educational services.

[3] In both cases, the volume index is used to extrapolate nominal values from the reference period to create a volume series in monetary terms.

[4] Note that the term hours paid might be a better term than hours worked. Most countries refer to this as hours-worked but in fact hours-paid is a more appropriate term since it reflects what is done in practice.

[5] Via the sum-of-costs approach, Output equals Compensation of Employees (COE)+ Intermediate Consumption (IC) + Consumption of Fixed Capital (CFC). As Gross Value Added (GVA) = Output – IC, if CFC is not measured then GVA = COE.

In the above example, this means that the volume of education output would remain unchanged between the first and second quarter. It assumes that the national accountant only has access to hours-paid information. But in some cases, national accountants have access to output measures that can be used to estimate the volume of government non-market services. For example, assume that the national accounts compiler has access to the number of students in the classroom. Consider that in the first quarter there were 90 student days wherein education services were provided, and in the second quarter there were 60 student days of education services provided (due to extended breaks and early dismissal). If using the number of student days as an indicator of the volume of education services. then it is estimated that the volume of output decreased by 33 percent (a far different result than if using the input indicator to estimate the volume of services).

II. WHY ADJUSTMENTS MAY NEED TO BE MADE

While the approach to measuring the value and volume of non-market educational services outlined above is widely used and yields credible estimates during normal circumstances, the measurement framework begins to break down in cases where there are dramatic changes in the amount and/or quality of the service being provided and the **corresponding costs of the inputs** (in particular labor) remains static or substantively unchanged.

In most countries throughout the global pandemic, a significant share of the educational workforce (for example, teachers, educational support staff, and educational administrators delivering non-market education services) has been working from home. Most educational facilities have been shutdown since March and reopening plans in many countries are a hybrid of working from home and onsite delivery (for example, online and in-class learning). While changes in the mode and quality of some educational services have been clearly impacted, government employees continue to receive their regular pay in most countries. In cases wherein countries use the sum-of-costs approach to measure the value of educational output and use input volume indicators or deflated input costs, the volume estimates may not reflect the economic reality of the pandemic. For example, the use of deflated input costs or hours paid to measure the volume of educational services during this period means that the volume of educational services would remain unchanged. While computationally correct this does not seem to align with the reality: it would be very difficult to argue that the volume of education services provided during the pandemic has remained unchanged. In this situation, using output-based methods should be preferred.

To illustrate, consider the following example. Assume that all the costs remain the same (teachers continue to receive their full pay), but teachers are only able to deliver 50 percent of the curriculum they would normally deliver if providing in-class instruction, proxied by a drop in the hours of tuition received by students. The reduction in service could be due to a number of factors such as connectivity issues for some students, time lost due to the rearrangement of curricula, reduced interaction among students whereby the students are unable to learn from each other, more difficulty ensuring the engagement of the students and more difficulty in undertaking group work or providing individualized instruction. If hours-paid remained unchanged and are used to measure the volume of services, then there would be no change in the volume of educational output. However, if the share of curriculum delivered is used, then there would be a 50 percent reduction in educational output.

While most countries rely on input measures (such as the hours paid of teachers) to estimate the volume of government services, some countries have access to a richer set of (output) data.[6] For example, in the United

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[6] For the volume of non-market education and health services, European System of Accounts (ESA) 2010 mandates that European countries must use output measures without direct quality adjustment. https://ec.europa.eu/eurostat/documents/10186/10693286/Non-market_output_guidance.pdf

Kingdom, the Office of National Statistics (ONS) uses information on the number of students across eight different educational settings to estimate the volume of educational output. Even with this more-sophisticated approach they were compelled to adjust their methodology to account for the fact that some students did not attend school following the shutdown in March 2020 and others were forced to move online—something that was not captured in their regular data collections.

The fact that countries are using a range of input- or output-based methods to estimate the volume of educational output means that significant measurement inconsistencies can arise during the pandemic. Formerly distinct but anodyne national methods that have suddenly become very material may not be well signposted in statistical release documentation, potentially resulting in unfair peer group comparisons. Consider Figure 1 which compares the drop in Public Administration, Compulsory Social Security, Education and Human Health output (which includes education) reported by the UK ONS in the first and second quarter of 2020 with that of Canada and Germany. The Canadian, German, and UK estimates all use slightly different methodologies. While both Canada and Germany registered declines, these were muted relative to the fall reported by the United Kingdom, even though each country implemented countrywide closures beginning in March 2020. It is therefore critical that when users are analyzing the volume of government output during the pandemic, they carefully consider the data sources and methods used by each country to measure the volume of output to ensure they are able to interpret the results, as well as draw comparisons between countries.

FIGURE 1. Public Administration, Compulsory Social Security, Education and Human Health (ISIC Rev.4), Quarterly Chained Volumes, Seasonally Adjusted (2016:Q1 = 100)
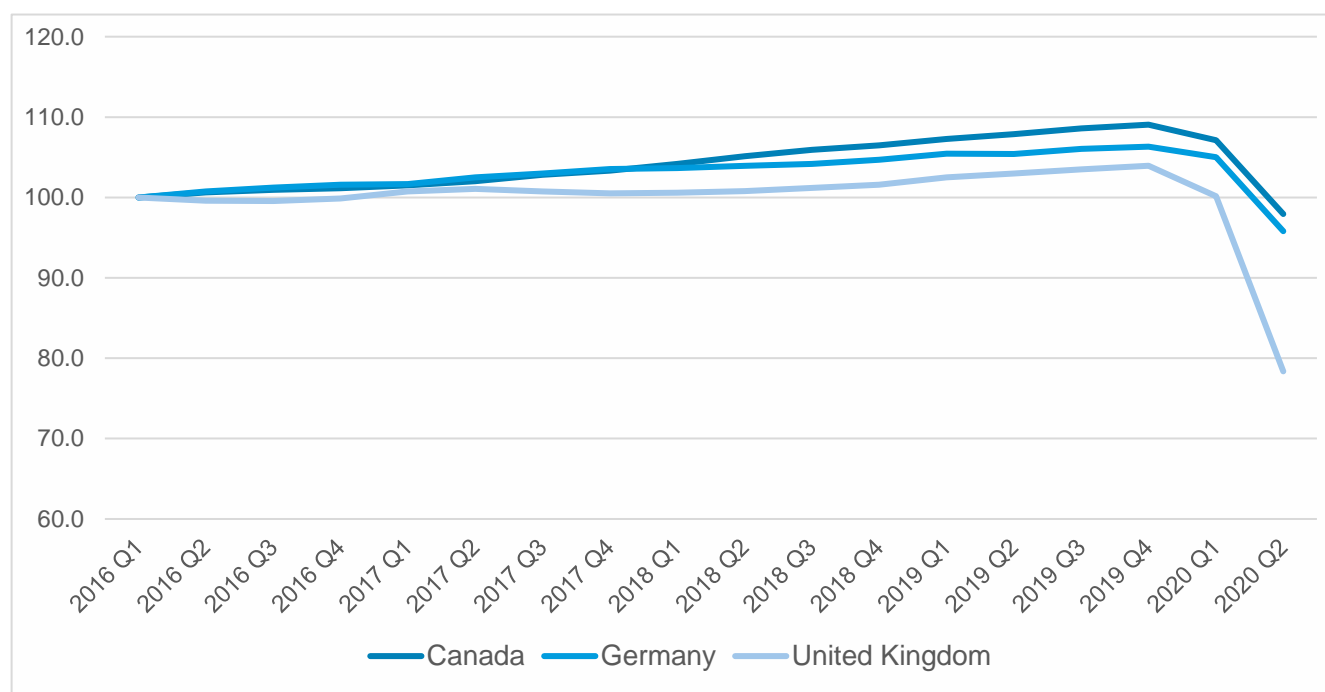

Source: Organisation for Economic Co-operation and Development.

III. ADVICE TO COMPILERS

In the case wherein countries are using input measures to estimate the volume of education services, consideration should be given to making exceptional adjustments to the data sources to reflect the volume of activity rather than the level of compensation. This would involve collecting supplemental information regarding

the actual hours worked as well as some indication of the quality/quantity of the education services being delivered. However, adoption of exceptional adjustments may prove challenging if the source data, such as actual hours worked, are not available or if the statistical agency is not operating at full capacity due to COVID-19 measures, such as reduced staff in the office.[7] For example, the general lockdown may have resulted in school boards reducing the number of classes or required credits. Most countries (as indicated by the UNESCO school closure tracking data) have either fully or partially closed their schools at some point during the pandemic.

FIGURE 2. Global Monitoring of School Closures Caused by COVID-19 – UNESCO [8]
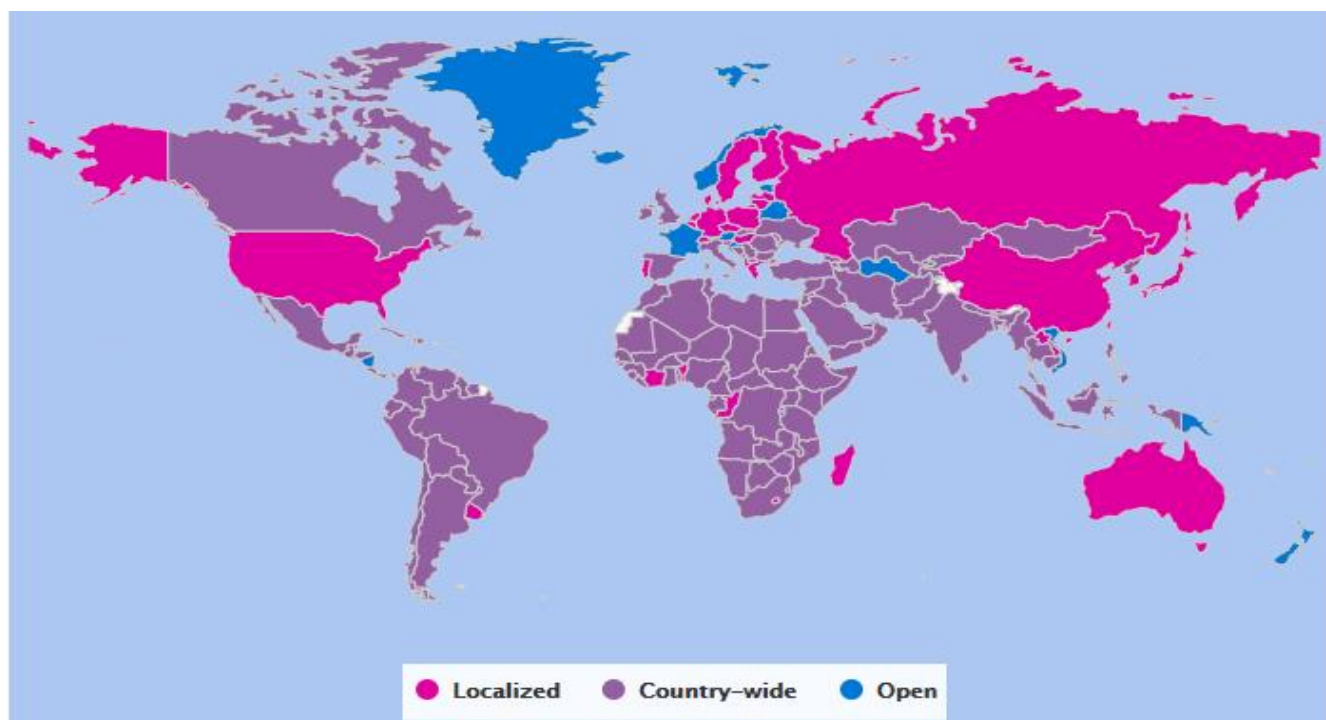
Source: Global Monitoring of School Closures – UNESCO, United Nations Educational, Scientific and Cultural Organization.

Given the widescale closure of schools, countries that rely on input measures for government education provision such as hours-paid should consider collecting additional data capturing the number and degree to which students are attending school and/or receiving their education online. Information regarding pupil hours, number of classes, and scope of the curriculum could also be used to adjust the hours paid information to reflect the hours of educational services provided. Stratifying by the broad levels of education (for example, primary, secondary, higher education) is recommended to better reflect the heterogeneity of education services within each level of education as a reduction in teaching hours may have a different impact depending on the student's capacity for independent work. Potential sources of these extra data include education ministries/authorities, online service providers, and existing or bespoke student/teacher surveys.

For example, assume that under normal circumstances a compiler has access to the following information to estimate the volume of educational output (Table 2).

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[7] Actual hours worked data may be available from education ministries.

[8] https://en.unesco.org/covid19/educationresponse

TABLE 2. Hypothetical Example – Measurement of Educational Services

Date	Number of Jobs	Compensation of Employees	Other Inputs	Value of Educational Input	"Other Input" Prices	Volume of Other Inputs	Hours Paid Index	Volume of Educational Output
Q1-2019	100	25,000,000	5,000,000	30,000,000	100	100	100	100.0
Q2-2019	100	25,000,000	5,000,000	30,000,000	100	100	100	100.0
Q3-2019	100	25,000,000	6,000,000	31,000,000	105	114	100	102.4
Q4-2019	100	25,000,000	6,000,000	31,000,000	105	114	100	102.4
Q1-2020	100	25,000,000	6,500,000	31,500,000	110	118	100	103.0
Q2-2020	100	25,000,000	6,500,000	31,500,000	110	118	100	103.0

Source: Authors' calculations.

Using only the data provided in Table 2, the compiler would estimate the volume of education output by weighting together the flat hours paid index (the largest weight) and the volume of other inputs index. This estimation technique causes the volume of educational output to slightly increase in the first quarter of 2020 (from 102.4 in the fourth quarter of 2019 to 103.0 in the first quarter of 2020) and remain unchanged in the second quarter of 2020.[9] This seems counterintuitive given the degree of the shutdown—the estimate does not align with the economic reality.

Assume that the compiler can collect additional information from local school boards and education ministries that indicates that during the second quarter of 2020 students will be in class four days per week and will receive each Wednesday off so that schools can be properly cleaned. In this case the compiler would want to adjust the hours paid information downward by 20 percent to account for the fact that education is only being delivered four out of five days (even though teachers are being compensated for the entire five days). Note that this also assumes that the teachers are not trying to "squeeze" five days of educational services into four days, nor are they required to work on Wednesdays. Table 3 illustrates the impact showing that the volume of educational output falls to 86.4 in the second quarter of 2020 from 103.0 in the first quarter, a 16 percent decline.[10]

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[9] Using weights from Q1- 2019, the implied reference quarter, the calculation for Q1- 2020 is 0.833 * 100 + 0.167 * 118.1 = 103.0.

[10] Using weights from Q1- 2019, the implied reference quarter, the calculation for Q2-2020 is 0.833 * 80 + 0.167 * 118.1 = 86.4.

TABLE 3. Hypothetical Example: Adjusted Measurement of Educational Services

Date	Number of Jobs	Compensation of Employees	Other Inputs	Value of Educational Input	"Other Input" Prices	Volume of Other Inputs	Adjusted Hours Paid Index	Volume of Educational Output
Q1-2019	100	25,000,000	5,000,000	30,000,000	100	100	100	100.0
Q2-2019	100	25,000,000	5,000,000	30,000,000	100	100	100	100.0
Q3-2019	100	25,000,000	6,000,000	31,000,000	105	114	100	102.4
Q4-2019	100	25,000,000	6,000,000	31,000,000	105	114	100	102.4
Q1-2020	100	25,000,000	6,500,000	31,500,000	110	118	100	103.0
Q2-2020	100	25,000,000	6,500,000	31,500,000	110	118	80	86.4

Source: Authors' calculations.

Some might argue that the adjustment to the input deflator will distort the average compensation (computed as the compensation of employees/the number of jobs). In some cases, even though the service to the individual may have declined, the teachers may still be working their full hours since they are required to put in extra effort to ensure they deliver the curriculum as effectively as possible. In this case the compiler should use the original series to estimate average compensation. If in fact, the teacher is now working only four out of five days (but being paid for five days of work) the large jump in average compensation is reflective of reality. The government policy to limit school to four days per week, reduce the workload of teachers, and continue to fully remunerate the teachers is equivalent to a 20 percent increase in pay, which is properly reflected in the average compensation estimates.

Lastly, some additional considerations merit discussion:

    i.   Quantities versus volumes

The discussion above describes ways in which countries may estimate education output volumes, but it is important to note the difference between volumes and quantities. A volume estimate comprises changes in both quantity and quality, with the latter normally reflected in the market price. In the absence of market prices, as is the case for non-market education services, quality cannot be directly observed, so some proxies for output volumes, such as pupil numbers or pupil-hours, may be regarded as pure quantity indicators, or alternatively as volume indicators that implicitly assume constant levels of quality. While they are considered to be better indicators of service delivery than deflated inputs, this limitation should be borne in mind.

ii.   Quality adjustment based on education outcomes

There is considerable debate on explicit quality adjustments for public services. For education, some countries have developed outcome-based adjustments using student attainment data, which are applied to estimates of output—whether they be based on input or output-type methods. For example, one might adjust pupil numbers by an index of exam scores to produce an estimate of "qualified" pupils. Such measures, in principle, may form good indicators of the effectiveness of new remote or hybrid delivery modalities versus normal in-person tuition.[11] However, to date, these adjustments have not been universally accepted in the national accounts community and indeed are expressly excluded from the central framework of the European System of Accounts.[12] This is due to the lack of consensus as yet on the most suitable approaches, which is in part driven by notable differences in the structures of national education systems and attainment measures that hamper comparability. [13] Even if a core methodology were agreed on, attainment indicators are largely only available annually and with lags, which does not make them suitable to measure the impacts of economic shocks in the short term.

iii.   Increased production of household services

In many countries, there has been a shift in the burden of education and care from non-market schools to parents and guardians, especially on working mothers increasing the gender gap. It will be the case that some of the decline in the volume of non-market education services provided by teachers is "made-up" by parents who provide home schooling services to their children, who will also be covering for any now-absent non-market daycare. While it may be analytically useful to try and estimate the scale of these types of additional activity, they are no longer part of government production, and instead reflect the production of household services for own use, which fall outside the national accounts production boundary as presently defined.

iv.   Offsetting education expenditures

Beyond what may be largely flat government expenditures on education labor, other costs of provision will have risen in many countries, particularly on new expenditures on information and communications technology hardware and software to facilitate remote connectivity, school subscriptions to different Internet platforms to support education, further staff training and new hires to support teachers, and also on facility adaptations to support returns to in-person learning. In addition, some households will have been able to afford private tutors to offset the drop in government education provision. Where such inputs are sourced from formal domestic producers, there will be some increase in market output—though likely very small in comparison to the drop in non-market education output measured using output indicators. Access to technology and the household availability of resources for distance learning can enhance inequality and increase the gap between students with different income levels and between students in high- and low-income countries and may make cross-country comparisons more difficult.

v.   Impact on private sector education provision

Private education institutions have also seen similar major changes in delivery modalities, which to some observers may logically imply that similar ad hoc adjustments are required to measure changes in the volume of output accurately. In principle, the contribution to the economy of market education services—as for any market production—is measured through the value-added producers generate by selling to willing consumers at

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[11] Though they would also need to discount for the estimated impact on attainment resulting from household contributions to service delivery.

[12] See ESA 2010, para. 10.30.

[13] In particular, some countries use relative attainment to assign grades to cohorts, for example, the top 10 percent get an A grade, while others use absolute criteria, which hampers comparisons. In the former, grades alone cannot be used to estimate quality change, while in the latter, there can be issues with grade inflation, with higher and higher proportions of students getting C grade or above over time.

economically significant prices, either in nominal terms or in real terms via suitable deflation. However, two aspects are notable: first, in many countries, some private education institutions may be classified within the nonprofit institutions serving households (NPISH) sector, so by definition their output would classified as non-market, and would be subject to the same measurement advice provided above for government non-market education services; secondly, the relative size of private education may mean changes in output are far less material than those estimated for the government sector, and hence would not warrant equal focus. While in most countries private education may be small, in others it can be very large and so may also contribute to issues around cross-country comparability. Furthermore, it may be considered analytically useful to examine alternate measures of market education using direct volume indicators of output such as pupil hours.

IV. LOOKING BEYOND EDUCATION

This note focuses on potential adjustments to measuring the volume of non-market educational services. While countries should consider making adjustments to their methodology to estimate educational services during the pandemic, they should also look at other government services that may also have seen evidence of increasing disconnects between input and output volumes. The volume of government services related to recreation, culture, and general administration may also have been impacted in a similar way during the pandemic. Countries should consider whether similar adjustments to the one noted for education above is also applicable to these other types of services directly provided to individuals.

In all cases, if countries alter their data sources during the pandemic to better estimate non-market output, they should inform users. For a good example of how this could be done see the methodological note released by the Office of National Statistics (ONS) in the United Kingdom explaining how they updated their methodology to estimate government education output during the pandemic. Furthermore, countries should clearly communicate how they estimate the volume of government services. If, for example, an entire school year has been canceled, a direct volume-based methodology would significantly bring down GDP growth; the communications challenge would be compounded if peers were not adopting the same methodology.