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Volume measures of education in the Norwegian National Accounts

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1. Background and purpose

Statistics Norway received in 2003 financial assistance from Eurostat in the field of National Accounts: Volume indices for education and health.

The Norwegian price indices for education and health by government and non-profit institutions have traditionally been input price indices. "The handbook on price and volume measures in national accounts" states however that input price indices will not be allowed for general government output except for production of collective services.

The primary purpose of the grant project was to develop an appropriate and efficient methodology for establishing output measures for education and health to satisfy the requirements of ESA95. In accordance with the guidelines in the handbook, the volume indices should as far as possible take the quality of the outputs into account.

The project for volume growth for education services started 1. December 2003 and was finished 1. June 2005. The project received financial support from Eurostat. The work continues, however, by use of own resources on the volume indices for health as part of our main revision of national accounts 2006. The volume indices for education as well as health will be implemented as part of our main revision of the national accounts in 2006. Revised national accounts figures will be published in December 2006.

1.1. Introduction to the Norwegian National Accounts

In the final Norwegian annual national accounts, an integrated set of price and volume measures is compiled within the framework of annual Supply and Use tables (SUT). The definitions inherent in the current price SUT are maintained in the constant price tables. Value added for the different industries are calculated as a balancing item, i.e. by double deflation.

The Norwegian supply and use tables are compiled in current and previous year's prices, with 1200 products. The constant price figures are compiled by deflating current values by price indices at the product level. This method results in integrated Laspeyres volume indices and Paasche price indices, with previous year (year t-1) as base year. Deflation is from the supply side and the balancing of the supply and use tables in constant prices is first carried out at the detailed product level in producer values.

In the Norwegian SUT, separate categories have been introduced for market production, production for own final use and three categories for other non-market production, including central government, local government and NPIs serving households. Each of these categories is broken down by detailed industries.

For each industry in central and local government, the production accounts have traditionally been deflated by input price indices. The calculation has been based on separate deflations of the three components: intermediate consumption (by product), compensation of employees and consumption of fixed capital.

2. Volume indices for education

In the area of education, the output can be defined as the quantity of teaching (i.e. the transfer of knowledge, successfully or not) for a pupil.

For education (NACE 80) we specify four industries: education in local government (mostly primary and secondary education), education in central government (mostly higher education), education in NPISH and market educational activities. Within each industry there is a further classification by type of services, largely corresponding to different levels of education. Different quantity measures for teaching have been evaluated. An investigation has been carried out regarding the allowance for quality change in teaching (see ch. 8: Quality change in teaching). So far, we have not succeeded in adjusting our volume indices for quality change.

An important part of the project was to identify and evaluate data sources, including administrative registers.

3. Data sources for education

Detailed information on education services is available from official statistics and administrative registers.

The source for pupils and pupil hours on primary and lower secondary education is a separate information system administered by Statistics Norway. The information system is called "Grunnskolenes informasjonssystem" (GSI) in Norwegian. Ordinary education for level 1 to 10 (school age 6-15) as well as separate groups for language minorities and specific education are covered by GSI. In addition, GSI collect data on special education schools. Norway does not have pre-primary education as part of the school system.

The number of pupils in GSI refers to 1. October whilst the pupil-hours refer to the school year. The school year usually starts medio august and ends medio june. In the project the number of pupils have been estimated for the calendar year t , weighting together the numbers for 1.October year $t-1$ (weight $7/12$) and 1.October year t (weight $5/12$). Correspondingly, pupil-hours for year t have been estimated by weighting together pupil-hours for school year $t-1$ and school year t .

The quality of the GSI data is considered at several stages. First the schools report their data to GSI. The local government and the county governor are then examining the numbers. At the final stage the Norwegian Directorate for Education and Training analyse the data and check the quality of the reports, especially where there are large changes from previous years. Nevertheless, while calculating the volume indices for 2004 for primary and lower secondary schools, several errors in GSI were discovered. These errors showed cases of obvious misreporting, as well as an unwarranted (?) change of institutional sector, which might have had consequences for our industry classification. As a consequence, some of the volume indices from the first calculations of 2003 had to be revised. So far our experience is that GSI data should be closer examined for such errors when the volume indices are calculated.

GSI does not contain information on costs related to education. The source for expenditure figures is the KOSTRA system (Municipality- State -Reporting), a national information system that provides information on municipality and county activities. The KOSTRA system provides detailed information on all economic transactions in the municipality by detailed type of function (and type of expenditure).

Data on higher education i.e. upper secondary education, education at colleges and universities, adult and other education are in the Database for statistics on higher education (DBH). The DBH includes both the number of students and costs. The yearly figures of number of students have been estimated as the average (50/50) of registered students in spring and autumn. The quality of DBH database is considered as good.

Local government education includes primary schools, lower secondary schools and upper secondary schools, adult primary and lower secondary education, special schools and music and cultural schools.

Central government education includes mainly colleges and universities, but also some few primary, secondary and special schools.

4. Primary and lower secondary education

This section shows the weighted Laspeyres volume indices for primary and lower secondary education. Primary and lower secondary education is given in ordinary schools and special schools.

4.1. Local government primary and lower secondary education services

The number of pupil hours is used as a volume indicator, which is weighted by the adjusted gross operating expenditure from previous year. In special schools the costs per pupil are considerably higher than in ordinary schools. Special schools are schools for pupils who either do not or are unable to benefit satisfactorily from ordinary tuition, and are provided special education due to a decision by municipal or county authorities. As the cost per pupil in special schools are so much higher than for ordinary schools, we find that the cost weighted volume index is slightly higher than the average growth in pupil hours.

Table 1. Local government primary schools and lower secondary schools.

	Pupil hours 1000h ¹⁾	Pupil hours 1000h ¹⁾	Volume index Previous year equals 100	Volume index Previous year equals 100	Adjusted gross operating expenditure ²⁾ 1000 NOK	Costs per pupil hour NOK
Year	2003	2004	2003	2004	2003	2003
Ordinary schools	581 489	590 177	102,2	101,5	38 131 045	65,57
Special schools	1 025	1 254	120,4	122,3	620 780	605,38
Total	582 514	591 431	102,2	101,5	38 751 825	66,53
Weighted index			102,5	101,8		

Notes to table 1: Pupil hours from GSI. 2) Adjusted gross operating expenditure from KOSTRA.

4.2 Central government primary and lower secondary education services

So far the total costs for central government primary and lower secondary schools are estimated by assuming that costs per pupil hour are the same as in local government schools. In the further development of our calculations, we hope that the cost for governmental schools will be available.

Table 2. Central government primary schools and lower secondary schools.

	Pupil hours 1000h ¹⁾	Pupil hours 1000h ¹⁾	Volume index Previous year equals 100	Volume index Previous year equals 100	Costs per pupil hour NOK ²⁾	Estimated total cost 1000 NOK
	2003	2004	2003	2004	2003	2003
Ordinary schools	207	217	98,7	104,8	65,57	13 574
Special schools	157	154	95,1	98,1	605,38	95 189
Total	364	371	97,1	101,9	298,60	108 764
Weighted index			95,5	98,9		

Notes to table 2: 1) Pupil hours from GSI. 2) The costs per pupil hour have been put equal to corresponding figures on local government primary education services.

4.3. Private primary and lower secondary education services

All private schools in primary and lower secondary education are regarded as non-profit institutions serving households in the Norwegian National Accounts. Due to data problems, the cost weights have to be based on data for the local government schools.

Table 3. Private non-profit primary schools and lower secondary schools.

	Pupil hours 1000h ¹⁾	Pupil hours 1000h ¹⁾	Volume index Previous year equals 100	Volume index Previous year equals 100	Costs per pupil hour NOK ²⁾	Estimated total cost 1000 NOK
	2003	2004	2003	2004	2003	2003
Ordinary schools	12 025	12 917	107,4	107,4	65,57	788 530
Special schools	46	48	87,9	105,8	605,38	27 703
Total	12 071	12 966	107,3	107,4		816 234
Weighted index			106,5	107,4		

Notes to table 3: 1) Pupil hours from GSI. 2) The costs per pupil hour have been put equal to corresponding figures on local government primary education services.

5. Upper secondary education

Secondary education is mainly performed by local government, and in some degree by private non-profit institutions serving households.

5.1. Local government upper secondary education services

Local government secondary education is divided into 15 fields of study, of which three general and business studies and 12 vocational studies. The volume indices on the three aggregates in table 4 are estimated according to Laspeyres formula.

Pupil hours are not available for this type of education. Our volume measure is based on a calculation of full year equivalent number of students. The calculation of full year equivalents is a conversion of the number of pupils in proportion to the share of the course they are attending.

The source for full year equivalents and costs is KOSTRA. Full year equivalents are estimated for the calendar year by the same method as pupil hours described in chapter 3.

Table 4. Local government upper secondary education

Fields of study	Full year equivalents		Costs	Volume index	Volume index
	2003	2004	2003	2003 (2002 = 100)	2004 (2003 = 100)
General areas of study	79 519,04	79 864,31	3 447 050	92,7	100,8
General and business studies	68 367,51	67 642,02	2 827 106	90,9	98,9
Music, dance and drama	4 732,57	5 080,01	328 361	100,1	107,3
Sports and physical education	6 418,96	7 142,48	291 583	102,6	111,3
Vocational studies	72 140,14	74 487,46	4 699 414	105,1	103,3
Building and construction trades	6 120,77	6 545,88	400 604	112,0	106,9
Electrical trades	9 025,20	8 957,91	616 151	101,2	99,3
Arts, craft and design	11 836,65	12 188,86	700 411	96,1	103,0
Health and social studies	15 076,28	14 560,49	798 359	99,6	96,6
Hotel and foodprocessing trades	6 347,02	6 563,91	435 301	104,3	103,4
Chemical and processing trades	853,31	801,99	48 880	110,4	94,0
Media and communication trades	3 298,64	4 143,86	211 176	162,1	125,6
Engineering and mechanical trades	10 055,62	10 755,01	724 519	106,9	107,0
Agriculture, fishing and forestry	3 035,00	2 965,84	361 594	99,3	97,7
Retail and service trades	3 852,75	4 357,93	228 983	132,6	113,1
Building and construction trades	2 095,60	2 147,48	130 601	105,1	102,5
Woodworking trades	543,30	498,30	42 835	91,2	91,7
Total	151 659,19	154 351,98	8 146 464	99,8	102,2

Source: KOSTRA

5.2. Central government upper secondary education services

There are only four upper secondary schools in Norway where the central government has the operational liability. Those are mainly Lappish schools in the north of Norway. The volume measure is based on the number of pupils.

Table 5. Central government upper secondary education

			Volume index	Volume index
Year	2003	2004	2003 (2002=100)	2004 (2003=100)
Pupils	308	288	100,7	93,5

Source: KOSTRA

5.3. Private upper secondary education services

The calculations are based on the number of pupils in upper secondary education in private schools. All these schools are classified as non-profit institutions serving households in the National Accounts.

Table 6. Upper secondary schools, non-profit institutions

			Volume index	Volume index
Year	2003	2004	2003 (2002=100)	2004 (2003=100)
Pupils	8 620	8 700	98,4	100,9

Source: KOSTRA

6. Higher education

The yearly number of students has been estimated as the average (50/50) of the spring and autumn figures.

6.1. Central government higher education

Higher education is primarily performed by central government. The calculations for colleges ("high schools") are based on the number of students and costs by institution. The universities have in addition been stratified by groups of faculties having different unit costs (i.e. costs per student).

The volume indices in table 7 have been calculated by Laspeyres formula by cost weighting the volume indices of the institutions.

The next step in our project on volume measures is to investigate the use of credits instead of number of students in calculating the volume index for higher education. The Norwegian credit system is in accordance with the European Credit Transfer System of higher education.

Main results are shown in table 7.

Table 7. Volume index for higher education. Central government		
Type of institution	Volume index 2003 (2002=100)	Volume index 2004 (2003=100)
General high schools	104,0	103,8
Art and aesthetic high schools	100,6	102,2
Scientific high schools	105,3	101,2
Universities	101,3	99,6
Total	102,8	101,6

The calculations by university and faculty are found in table 8.

Table 8. Volume index for education at the universities

University	Faculty	Volume index 2003 (2002 = 100)	Volume index 2004 (2003=100)
Oslo		101,6	98,9
	Mathematics and natural science	100,4	102,0
	Medicine	107,8	102,0
	Odontology	105,7	98,6
	Other	98,5	95,0
Bergen		102,1	99,1
	Mathematics and natural science	104,0	101,4
	Medicine	99,1	101,1
	Odontology	100,3	99,9
	Other	102,4	96,1
Trondheim		102,1	102,0
	Natural science and technology	96,4	105,2
	Medicine	109,9	103,8
	Architecture and art	100,4	99,8
	Andre	102,1	100,6
Tromsø		96,9	97,0
	Mathematics and natural science	84,9	94,0
	Medicine	98,5	95,6
	Fishery	101,9	93,0
	Other	100,7	103,8
Total		101,3	99,6

6.2. Private higher education services

The calculations are based on the number of students.

	Students 2003	Students 2004	Volume index 2003 (2002=100)	Volume index 2004 (2003= 100)
	23 583	23 628	97,5	100,2

Source: Database for higher education

7. Comparison between input and output methods

Table 10 gives a survey of the two methods of calculating volume indices for the years 2003 and 2004. In the old (input) method the production of educational services in current prices is deflated by the input price index. In the new (output) method the calculated volume indices described in preceding chapters are used to calculate an implicit price index.

Table 10. Comparison between input price index and implicit price index. Previous year=100

	Volume index 2003	Input price index 2003	New volume index 2003	Implicit price index 2003	Volume index 2004	Input price index 2004	New volume index 2004	Implicit price index 2004
Central government education services								
Primary education	0,909	1,053	0,955	1,002	1,073	1,018	0,989	1,105
Upper secondary education	0,939	1,052	1,007	0,981	0,914	1,019	0,935	0,997
Higher education	1,079	1,053	1,028	1,106	1,011	1,019	1,016	1,014
Adult education	0,708	1,052	0,926	0,805	0,820	1,017	0,670	1,245
Total	1,036	1,050	1,023	1,063	1,025	1,019	1,008	1,037
Local government education services								
Primary education	1,014	1,053	1,025	1,041	1,012	1,018	1,018	1,012
Upper secondary education	1,039	1,053	0,995	1,099	0,995	1,018	1,021	0,992
Adult education	1,043	1,053	1,012	1,085	1,021	1,018	1,020	1,019
Total	1,024	1,049	1,017	1,056	1,006	1,018	1,019	1,005
Private education services, market producers								
Higher education	0,978	1,057	0,975	1,060	0,962	1,055	1,002	1,013
Driving schools	0,996	1,028	0,996	1,028	1,337	1,047	1,337	1,047
Adult education	1,101	1,057	1,062	1,096	0,861	1,055	1,030	0,882
Total	1,022	1,048	1,011	1,060	1,042	1,052	1,140	0,961
Private non-profit institutions serving households								
Primary education	0,934	1,043	1,065	0,915	1,075	1,033	1,074	1,034
Upper secondary education	1,110	1,043	0,984	1,177	1,046	1,033	1,009	1,070
Adult education	1,051	1,059	1,062	1,048	1,027	1,031	1,030	1,028
Total	1,017	1,045	1,030	1,033	1,057	1,033	1,041	1,048

An overall consideration of the year 2003 shows that the output method tend to give lower volume growth indices than the old input method. This is the case for three of the four industries in NACE education. The exception is within the non-profit institutions serving households, where we have seen a marked growth in the number of pupils in later years. This industry is rather small, however, compared to production in general government.

The pattern is more mixed for 2004. Our calculations show that the output method gives higher volume growth in local government and for the market producers. There is a rather marked decline in the volume growth in central government education in primary education and for adult education. It has to be pointed out that the calculation of production for 2004 still is preliminary.

In the case of Driving schools, the headings of table 10 are a bit misleading. In Norway, this is a market activity. In the National accounts, the current price figures are deflated using the CPI (there are no taxes or subsidies on this product). This is the reason why the entries are the same for the new and old method (neither of which is using input prices). The rapid volume growth for 2004 is probably related to new requirements to be met in order to acquire a driving licence.

For other market activities in education, we have so far applied deflation by CPI price indexes. There is, however, a general data problem with these services. Apart from driving schools, we are not able to give separate price indexes for the other products. Also, for adult education, there are important deliveries for intermediate consumption. We think that direct volume indicators can be useful also for market services, when alternative suitable price indices are difficult to find. The changes that result from the new method are rather great, and we should have a closer look at the estimates for the market services before the final figures are decided.

The data quality for Adult education is a challenge for the National Accounts. For private producers, we have not found data that allows separate volume indicators for market producers and non-profit institutions serving households. The volume growth that is indicated in table 10 has been calculated for the two types of private producers together. The table is set up assuming that the volume growth was the same for both types of producers. The consequence is that we have a rather large drop in the (implicit) price index for market producers. So the picture is quite the opposite from the one assuming CPI price indexes. In that case we would have a considerable price increase, and a large drop in volume. As production in current prices is dominated by market producers, even data with a better split of the two sectors should give a volume growth for the market producers that is close to the average shown in the table. So, our conclusion is that the previous method was perhaps misleading in this case. For adult education in central government, just a few producers have been active in this period, and central government has taken steps to transfer the activities to local government.

8. Quality change in teaching

Quality of output is a very important issue for education. Quality adjustment is unlikely to be straightforward in practise, given the general lack of data on quality of teaching. In Norway a reform of the education system is currently being introduced. It is necessary to construct reliable measures of school performance. Such indicators ought to reflect the real performance of schools and not factors more or less beyond the schools control. There are many other factors than the school itself, such as pupil composition and resource use like e.g. teacher intensity that may explain differences in marks across schools. Do resources at schools have an impact on the performance of pupils? Bad pupils may have a strong impact on school performance from one year to the next. The question is whether it is possible to quantify how schools differ in their contribution to pupils learning. School performance is related to school resources, teacher turnover and other input factors that may explain performance.

Statistics Norway in cooperation with Ragnar Frisch Centre for Economic Research and Norwegian School of Economics and Business has carried out an analysis to provide background information on how to construct informative performance indicators (Torbjorn Hægeland, Lars J. Kirkebøen, Oddbjørn Raaum, and Kjell G. Salvanes (2004)). These indicators are based on pupils mark achievements for schools at the

Norwegian lower secondary education level ("Ungdomsskolen", grade 8 to 10). The performance measures are based on weighted attainment marks by subject, individual characteristics and family background as well as by school characteristics. The analysis and results are quite detailed and difficult to implement in our project on volume indicators for national accounts.

As a first step the methods in our project are based on non-quality-adjusted indicators.

9. Conclusions

So far we are pleased with the new methods, which we think should be acceptable also in the context of Eurostat directives. The next step will be to try to introduce quality correction in the calculations of the volume indicators. Some education services (mainly private) are based on number of pupils/students only. We will further investigate how we can use key figures (e.g. cost per unit) from government to estimate the cost weights for private producers.

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