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MEASUREMENT OF NON MARKET SERVICE: OUTPUT AND OUTCOMES

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(preliminary draft)

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Table of contents (*)

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1. Introduction

The long way that led to the idea of introducing direct output methods in national accounts for measuring non market services of government has become quite broadly accepted, since its explicitly mentioning in SNA93.
The attention has now been drawn on the best practices to implement the calculation by introducing the quality issue that, nevertheless, represents a relevant part of the volume change of the output.
As far as quality measures are concerned education, stratified by level, is one of the areas in which relevant advancements could be reached. A wide variety of measures that are related to outcomes have become available. Nevertheless there is still a debate on their use for the quality correction.
Our proposal is concerned with the application of different quality corrections outcome based for education, for the period 2000-2007, according to the availability of the indicators. Italy is using a quality correction since the ESA95 first implementation. The idea is now to compare the actual method with more complex quality measures to give an evaluation of the impact of alternative hypothesis.
Given the relative high weight of education in the non market output it would be of interest to compare the effect of several measures in the calculation of relevant aggregates such as Government final consumption expenditure and GDP in volume te rms. It should be done separately for scholastic education and university education because of the different framework of providing the two services.

2. Education: some figures

The Lisbon strategy put a stress on the development of an information society, with the goal[1], to become by 2010 "the most competitive and dynamic knowledge-based economy in the world". To this aim the availability of detailed data on education is a pre-requisite “conditio sine qua non”. A good result have been reached by the TF on COFOG, that made possible for the majority of European countries to reach a satisfactory level of analysis of the data sources, in order to produce statistics on public expenditure at the second COFOG level.
This means that, at least, at current prices a comparability among countries has been obtained. When referring to the EU15 group of countries, it can be observed that for the last seven years, on average, Government final consumption expenditure represents 20 per cent of GDP, having a maximum for Sweden, more than 27 per cent in the most recent years, and a minimum for Ireland, at around 15 per cent in the same period[2].

The following tables show some results for the EU15, referred to the ratio of education with respect to government final consumption expenditure and to the total expenditure.

[1] This strategy was set up by the Lisbon European Council in March 2000 and, for the time being given the actual economic contest, it would be rather difficult to reach the goal.
[2] D. Collesi, D. Guerrucci, D. Versace, S. Zannoni, *The use of class size and the Italian method*, OECD Workshop on measuring Education and Health Volume, 6-7 June 2007, Paris. The table has been updated according to the data availability from the Eurostat GFS database.

Table 2.1 - Government Final consumption expenditure: % of Education Expenditure

	2000	2001	2002	2003	2004	2005	2006
Belgium	25.75	25.91	25.60	25.38	24.74	24.96	25.14
Denmark	23.34	23.11	23.18	23.04	23.43	23.37	23.07
Germany	18.26	18.34	18.54	18.44	18.73	18.50	18.20
Ireland	16.65	16.17	16.41	17.27	17.30	17.40	17.40
Greece	18.56	18.40	18.39	20.80	20.61	21.60	21.98
Spain	22.85	22.83	22.78	22.47	21.93	21.39	21.47
France	22.33	22.00	21.99	21.73	20.67	20.59	-
Italy	22.47	21.99	21.69	21.69	20.16	20.33	19.64
Luxembourg	24.25	24.04	24.01	23.86	23.72	23.26	23.90
Netherlands	17.97	18.43	18.27	18.30	18.85	18.85	17.77
Austria	27.81	28.14	28.22	28.24	27.43	27.39	27.38
Portugal	30.04	29.86	30.28	29.78	29.39	28.87	28.46
Finland	21.42	21.57	20.89	20.66	20.44	20.26	19.99
Sweden	23.00	23.59	23.86	23.76	23.92	24.17	24.28
United Kingdom	17.24	17.59	17.69	17.49	17.26	17.50	17.35

Source: Eurostat GFS database

Examining in detail the composition of the Final consumption expenditure (P3) it can be noted that education is 22 per cent on average, reaching its maximum for Portugal, 30 per cent of the total, and the minimum for Ireland and UK, that spend 17 per cent of P3 on education.

Table 2.2 - Education: expenditure as a percentage of Total Government expenditure

	2000	2001	2002	2003	2004	2005	2006
Belgium	11.60	11.85	11.94	11.77	11.85	11.48	12.07
Denmark	14.90	14.97	15.08	14.96	14.97	15.08	14.97
Germany	9.31	8.86	8.96	8.88	9.04	8.97	8.91
Ireland	12.81	12.88	12.53	12.83	12.70	12.63	12.21
Greece	6.11	6.06	6.49	7.12	6.80	6.94	5.51
Spain	11.19	11.14	11.23	11.35	11.33	11.15	11.24
France	12.23	12.25	12.16	11.92	11.58	11.40	-
Italy	10.04	9.77	9.94	10.08	9.61	9.74	9.04
Luxembourg	11.50	12.00	11.49	11.60	11.89	11.76	11.72
Netherlands	10.60	10.66	10.90	11.03	11.36	11.40	11.13
Austria	11.38	11.55	11.61	11.79	11.05	11.81	11.94
Portugal	15.61	15.59	16.41	16.16	15.90	15.95	15.29
Finland	12.07	12.42	12.19	12.34	12.11	12.01	11.97
Sweden	12.16	12.90	12.90	12.77	12.80	12.80	12.98
United Kingdom	12.72	13.01	13.65	13.71	13.66	13.94	13.85

Source: Eurostat GFS database

On average European countries devote more than 11 per cent of their total government expenditure[3] to education, with a maximum of 16 per cent for Portugal and a minimum of 6 per cent for Greece. If we go in more details, the update is related to last available disseminated in June 2008, the Italian situation is shown in the two following tables, related to Government output and Value added to GDP.

[3] Total government expenditure is defined as of EU Regulation 1500/2000.

Table 2.3 - General Government: Output at current prices as a % of GDP

Education	Cofog Groups	2000	2001	2002	2003	2004	2005	2006	2007
Pre-primary and primary	09.1	1.7	1.7	1.6	1.7	1.6	1.6	1.6	1.7
Secondary	09.2	1.9	1.9	2.0	2.0	1.9	1.9	1.9	2.0
Post-secondary non-tertiary	09.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tertiary	09.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Other education services	09.5…09.8	0.3	0.2	0.3	0.2	0.3	0.2	0.2	0.2
Total		**4.3**	**4.4**	**4.4**	**4.5**	**4.2**	**4.3**	**4.2**	**4.3**

Sources: Italian national Accounts

Table 2.4 - General Government: Value Added at current prices as a % of GDP

Education	Cofog Groups	2000	2001	2002	2003	2004	2005	2006	2007
Pre-primary and primary	09.1	1.6	1.6	1.6	1.7	1.5	1.6	1.5	1.6
Secondary	09.2	1.8	1.8	1.9	1.9	1.7	1.8	1.8	1.9
Post-secondary non-tertiary	09.3	0.1	0.1	0.1	0.1	-	0.1	-	-
Tertiary	09.4	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3
Other education services	09.5…09.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total		**3.8**	**3.8**	**3.9**	**4.0**	**3.6**	**3.8**	**3.8**	**3.9**

Sources: Italian national Accounts

3. A definition of Education

Given the relevance of Education, a shared definition is necessary and the 2007 OECD manual[4] will help in this sense. *Par 2.1 Terminology and concepts in education services* provides an exhaustive overview of the various classifications having impact on Education services.

Whatever definition is used it outlines that the provision of education services is connected both to output, as a result of the activity of producing the service itself (as teaching, training and learning), and to outcome as a change in status and welfare. This change could be related to both the individual receiving education and to the society as a whole that should, in theory, receive a benefit from more trained and skilled people.

Referring to the ISCED[5], the ad hoc classification of Education, the definition is: "organised and sustained communication designed to bring about learning". The other classifications, currently used[6], allow a more precise use of the Education concept inside the National accounts framework.

This work aims to provide a contribution to the debate on the indicators to be used in the evaluation of education in volume terms. This will be done in a very pragmatic way by presenting some selected alternative scenarios that result from the application of quality corrections, outcome based. Additional analyses are available in the appendix.

The SNA and ESA95 guidelines on this topic are under construction, as work in progress and, in the European area, there is a concern on the implementation of the output indicators and on the feasibility of the quality corrections. Also being aware of the difficulty in reaching a consensus in this field - being Education rather complex to measure because of the whole bundle of economic and social characteristics it has - we still think that a crude output indicator[7], without quality adjustments, doesn't provide a full picture of the Education production. Probably a renewed

[4] OECD Handbook '*Measuring Education and Health Volume Output*', Statistical Directorate, National Accounts and Financial Statistics Division, 2007.

[5] ISCED is the International Standard Classification of Education, used by Oecd, Unesco and Eurostat in the production of statistical indicators on education for international comparison.

[6] For additional detail see: D. Collesi, N. Di Veroli, F. Tartamella, *Using Statistics to compile an Education Satellite Account for Italy*, 3rd International symposium on economic theory, policy and applications, 4-7 August 2008, Athens, Greece.

[7] For more details, refer to the document presented at the 2nd of July 2008 Meeting of the Directors of the European NA.

statistical and operative definition of Education output is needed at this point, as for European countries the measurement through a raw output indicator, being it the number of pupils or the teaching hours, is strictly connected to the decreasing trend of birth rate directly or indirectly. The use of such a "simple and compulsory" measure would result in a decrease in the Government production and final consumption expenditure, in volume terms, that doesn't provide in the least a realistic picture of the underlying real dimension/trend.

4. Measuring Education volume output: currently method and new proposals

The public production of educational services is divided into the followings activity areas:

- School system
- Vocational training
- University education
- Subsidiary services to education

The index used for estimate the output at the prices of the previous year is the Laspeyres volume index, in which the weights are the unitary costs of the single types of service produced, incurred in the previous year by the service provider, and the quantities are represented by the quantity indicators calculated on the basis of the number of students. The index used for the synthesis represents a summary of the indices relative to each type of service. The corrections for the quality changes are included in the calculation of the indices concerning scholastic education and university education.
Referring to the previous table on Education output by COFOG 2nd level, it is evident the relevance of scholastic education (levels 9.1-9.2), as also the fact that it drives the global index.

4.1. School system

Public school system is organized through the provision of education operated by state[8] schools and other public schools at the local level.
Scholastic education is supplied mainly in state schools, and is divided into four levels: pre-primary education, primary education, lower secondary and upper secondary education.
In the volume index the quantities are represented by the number of pupils in state schools and non-state schools.
The index is calculated at the most detailed level of analysis. The number of students of state and non-state schools is broken down into the four levels of education and, in upper secondary education, by type of institute: classical lyceum, scientific lyceum, teacher-training institutes and schools, vocational institutes, technical institutes, art institutes, art lyceums. Detailed breakdown of the basic data is essential in order to ensure homogeneity among the elementary indices and the costs assigned to them.
The corrective factor for quality changes is based on the number of pupils per class. The quality correction is done according to the education level[9].

In this section some quality indicators alternative to the class-size currently in use will be proposed for capturing the quality dimension of the scholastic education output indicator.
The indicators selected concern the phenomenon called scholastic dispersion intended as the whole of factors that can modify the regular length of a course or that cause the advance exit from the scholastic system.

[8] The state schools are local units of the Ministry of Education and the other public schools are local units of the local authorities (Municipalities, Provinces and Regions).
[9] More details: D. Collesi, M. Anzalone, M. Marotta, D. Versace, S. Zannoni, *Improving the measurement of Government output in Italy*, 29th General Conference of The International Association for Research in Income and Wealth, 20-26 August 2006, Joensuu, Finland.

Dispersion could be considered, in this case, an anomaly of the educational system. It can be determined by two causes: first, the performances of a single student who drops out the studies before regular ending or, on the other hand, by the scholastic system that is not able to satisfy the needs of the scholastic population with a proper educational offer.
Other external causes related to the social, economic and cultural differences should be considered theoretically speaking but in this specific exercise are not examined.
Being a phenomenon that derives from a large number of causes both related to the scholastic system and to the economic and social context where a student lives, the dispersion can hardly be measured by a single indicator but a set of indicators is needed to catch the students' ability, and the ability of the scholastic system to support him, to complete the studies.
The quality adjustments proposed in this experimental study refer to: failures, students repeating a year and drops-out. In addition, two indicators related to the skills are calculated: the graduation rate and the average mark, both are used for Upper-secondary education.

The new approach: sources and available data

Data on students come from two school surveys: the School Census[10] and the Survey on scrutiny and final examination results[11] both carried out by the Ministry of Education.
The first survey takes place at the beginning of the scholastic year and refers to all the students attending both state and non-state schools by level of education.
From the scholastic year 2006/2007 the second survey has been unified to the first one and takes place at the same time at the beginning of the scholastic year.
It's extremely important to underline that the datasets utilised are not completed. Actually mainly for the initial years of the time series there are several problems of undercovering. These problems will be solved only when "Students' Register" (Anagrafe degli studenti) [12] will come into force.
Furthermore datasets used have, in some cases, problems of inconsistency among the variables. In these cases, new calculations of the variables involved have been needed.
Figures proposed here have to be read cautiously bearing in mind all these limits of the datasets. The indicators are calculated only for the state school.

The new approach: methodology

One of the main factors influencing the risk of an exit in advance from the scholastic system is the discontinuity in the educational course due to scholastic failures.
The indicators we are proposing are:

1. Students repeating a year Rate**;**
2. Failures Rate, calculated as the ratio between the number of students not admitted to the next year and the number of examined students**;**
3. Drops-out Rate, as the ratio between the number of students interrupting their course before the end of the scholastic year and the number of enrolled students;

With reference to the third indicator, it is important to remark that the drops-out are referred to the students who interrupt the studies without giving any justification or the students reaching a high number of unexcused absences.
Other kinds of drops-out, such as students leaving the class because of the transfer to another school or health reasons, are not involved in the study of scholastic dispersion.
The three quality indicators are constructed for Lower-secondary education and Upper-secondary education with the same breakdown degree utilised for the output volume indicator.

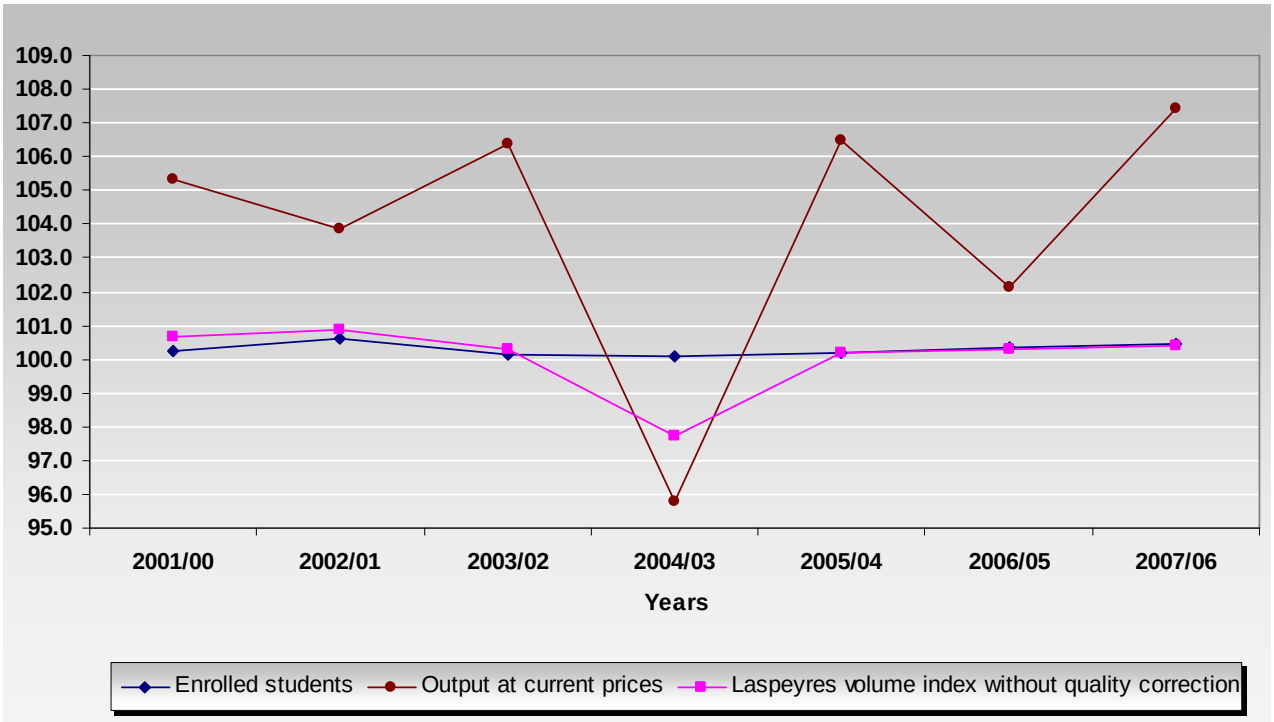
[10] Surveys (IUR_00055, IUR_00054, IUR_00052) inserted in the National statistics programme 2007-2009 and previous editions.
[11] Rilevazione sugli Scrutini ed Esami di Stato conclusive del I e II ciclo, 2007 and previous editions.
[12] "Anagrafe degli studenti" is an integrated dataset based on information about students coming from all the institutions involved in the educational system.

Available data don’t allow a complete evaluation of the dispersion for the Primary education, that is, nevertheless, very limited. Only the first indicator, the students repeating a year rate, has been calculated.
Failures, drops-outs and students repeating a year are here considered as a failure of the educational system.
Assuming the working hypothesis that failures, drops-outs and students repeating a year represent a malfunction of the educational system, the change between two years of the quality indicators, taken with the reverse sign, can be used as quality correction of the volume indicator based on enrolled students.
In this case, the quality correction takes the following values:

1. 100, when no quality correction is demanded. This case occurs when there is no change in the quality indicator;
2. >100, when the change between two years of the quality indicator is negative. This case is associated with an improvement in the quality of the educational system;
3. <100, when the change between two years of the quality indicator has a plus sign, that corresponds to a worsening in the quality of the educational system (because of more drops-out etc.).

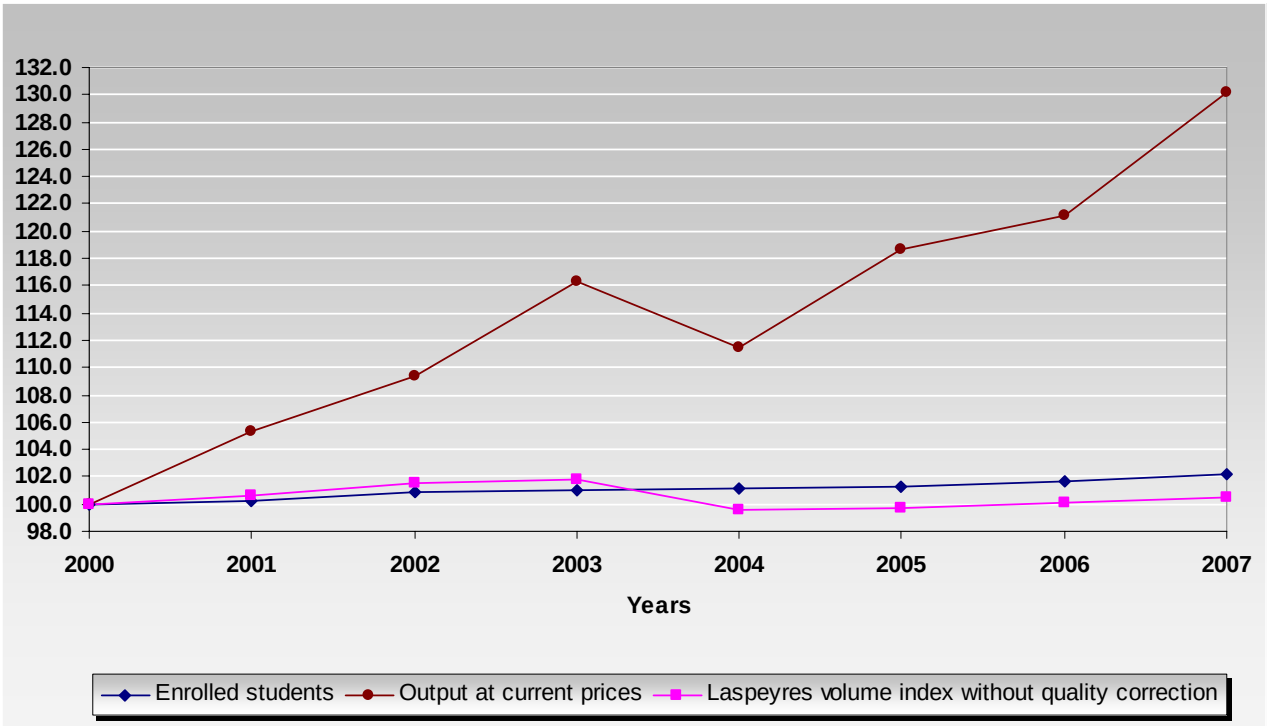
For the Upper-secondary education two additional indicators, having an opposite sign from the previous ones, can be calculated: the graduation rate and the average mark. These two indicators are summarized in a unique indicator under the hypothesis that an increasing number of school leavers with a high graduation mark is a signal of an improvement of the educational service and vice-versa. Data availability on skills allows calculating this type of quality adjustment for the last two years of the time series.
The Figure 4.1.1 shows the trend of three indicators: the change of the output at current price, the change of the output at constant prices (the Laspeyres volume index trend) and the trend of the basic quantity index represented by the number of enrolled students. All the indices are calculated on the previous year.
The comparison between the three lines shows the effect of weighting by the previous year costs.
The high decrease of the output at current prices registered in 2004, combined with the smooth trend of the enrolled students, is completely reflected in the Laspeyres volume index. This is the result of the school contract renewal that took place in 2003.

Figure 4.1.1. Scholastic Education: output growth at current price, output real growth and quantity index (previous year = 100)



The reading of the trends of the output at current and constant prices and of the quantity index can be made easier taking the year 2000 as the reference year.

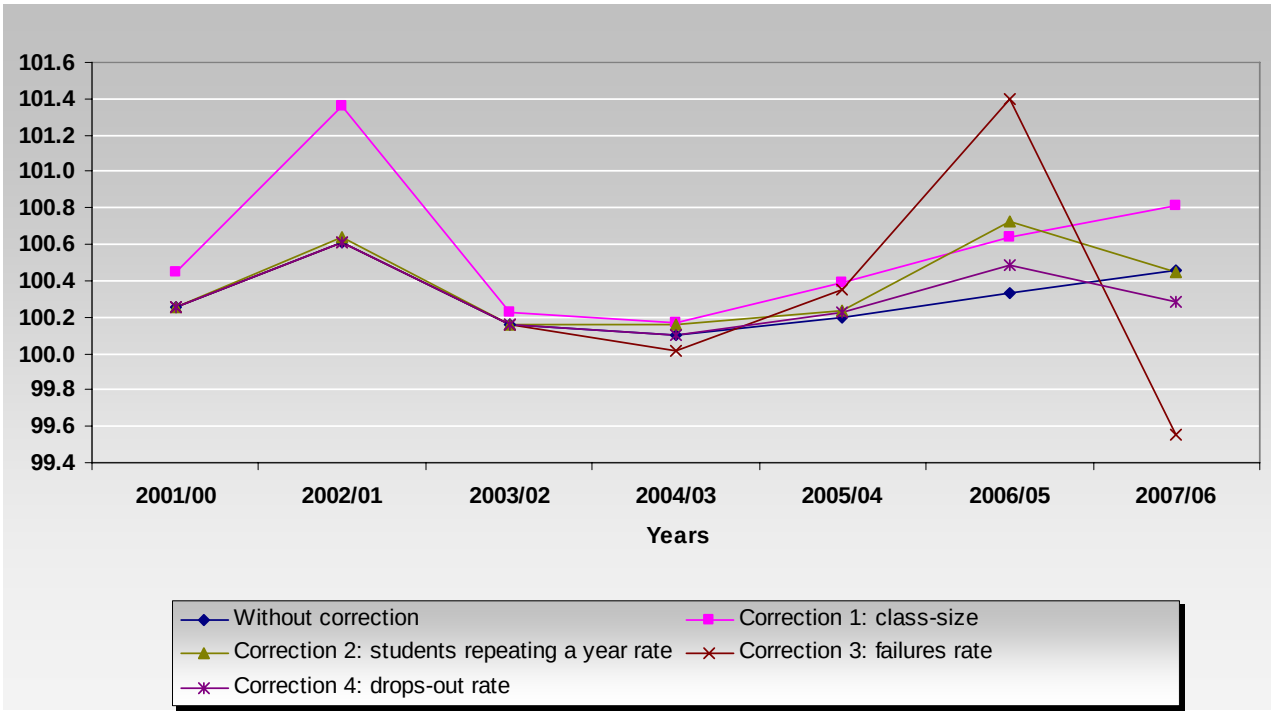
Figure 4.1.2. Scholastic Education: output growth at current price, output real growth and quantity index (2000 = 100)



The next step is to demonstrate how the different quality adjustments have effect on the enrolled students' quantity index. At first the corrections will be shown for the whole scholastic education, then separately for Lower-secondary education and Upper-secondary education, that is for the

levels of education for which the calculations of all the three quality indicators have been possible. The indices shown in the Figures 4.1.3, 4.1.4 and 4.1.5 are calculated on the previous year.

Figure 4.1.3. Scholastic Education Quantity Indices (previous year = 100)



It should be noted that the starting point for the application of the corrections is not the same because of the different data availability. Additionally, the correction based on the graduation rate and the average mark is not included because only two years are available. This correction will be involved in the analysis later in this paper since a synthetic index will be developed.

Figure 4.1.4. Lower Secondary Education Quantity Indices (previous year = 100)

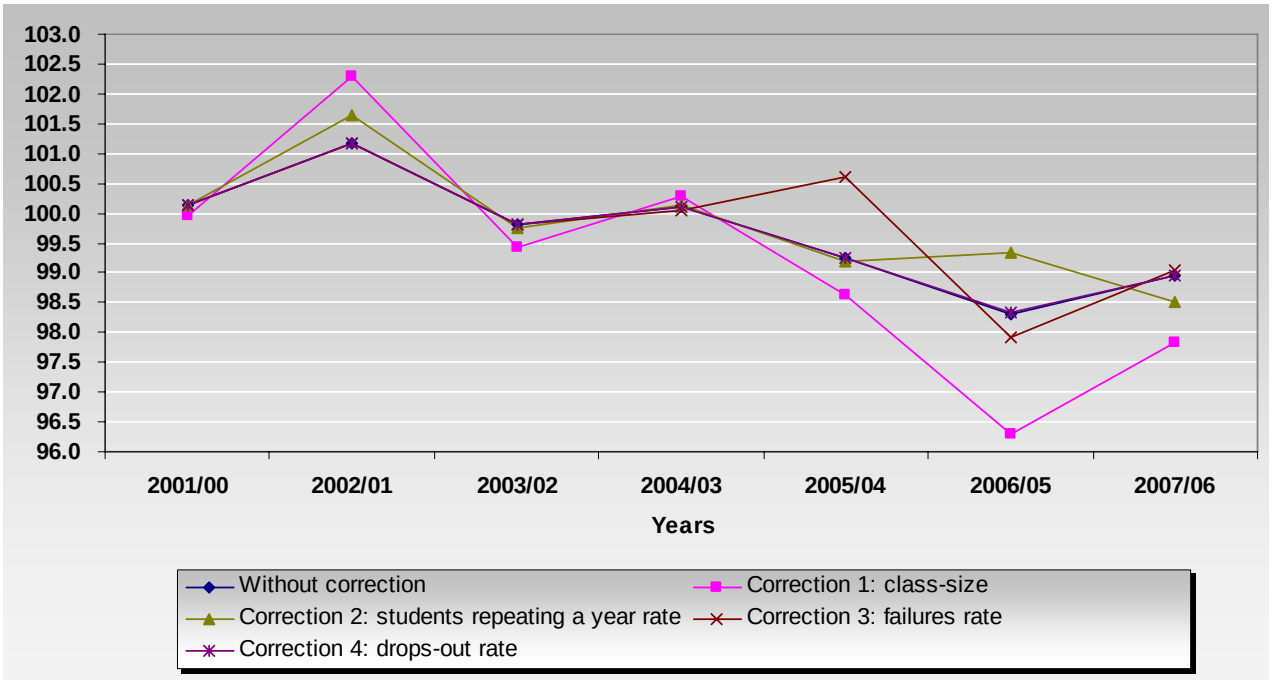
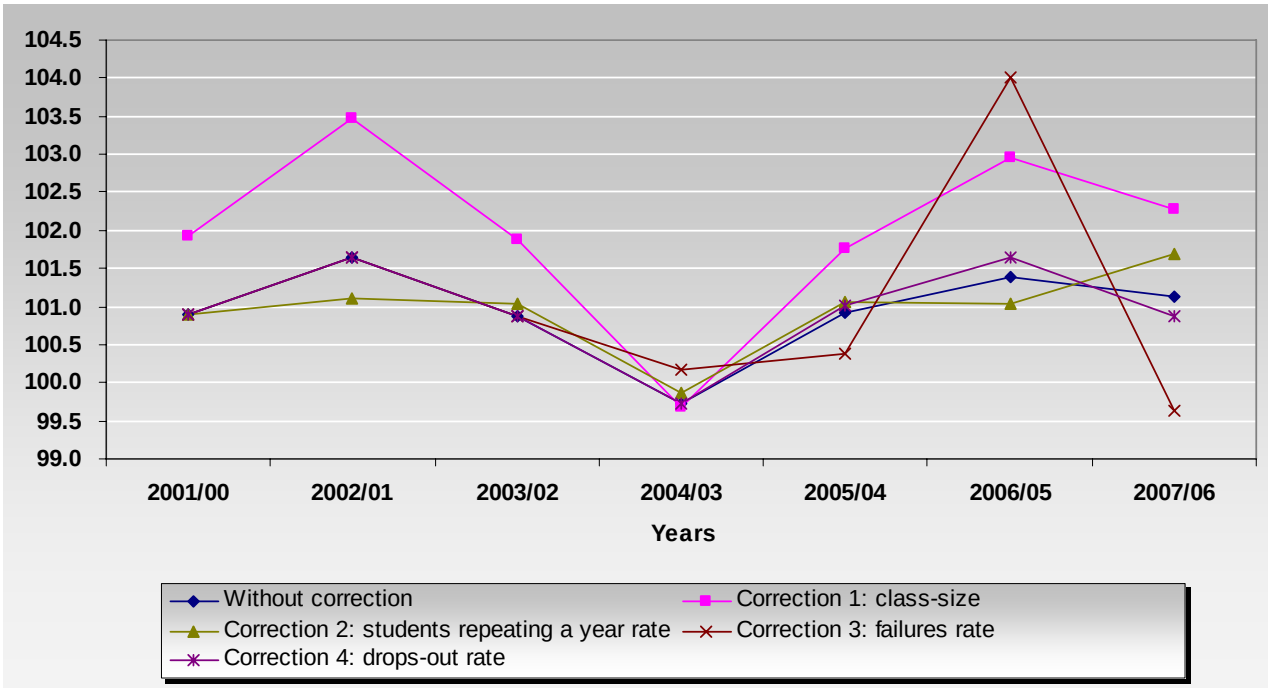
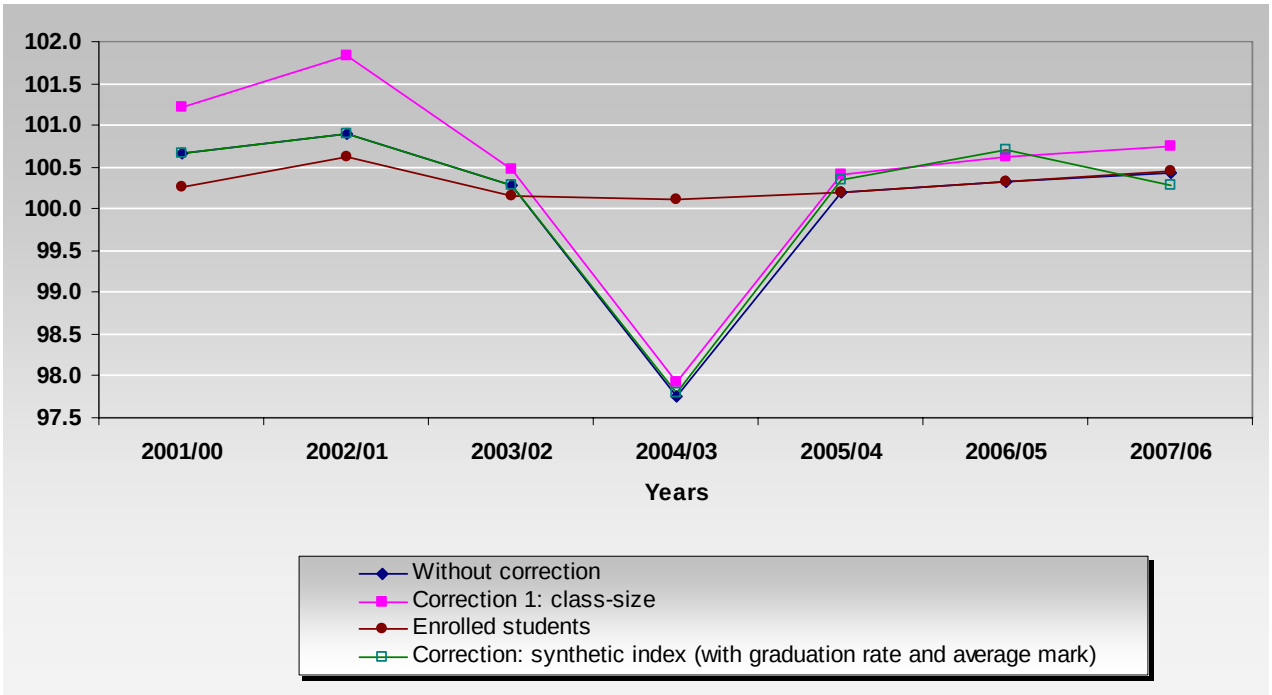


Figure 4.1.5. Upper Secondary Education Quantity Indices (previous year = 100)



The introduction of quality correction needs a unique indicator obtained as a synthesis of the indicators explained above.
The synthetic index can be calculated with and without the indicator on graduation and average mark of school leavers. Since these indicators have an opposite sign in comparison to the previous indicators it is necessary at first to uniform the signs among the indicators.
Secondly, to make the different indicators comparable and allow their synthesis an operation of normalization is needed. In this way a series of three normalised indicators (failures rate, students repeating a year rate, drops-out rate) plus two normalized indicators concerning skills for the Upper secondary education (graduation rate, average mark) is obtained. The different indicators can be summarized with the simplest assumption by an arithmetic mean assuming that they have the same weight.
The change of the mean can be utilized as correction for the quality changes: positive change means quality improvements.
In the Figure 4.1.6, the new quality adjusted Laspeyres volume index is compared with the classical one based on class-size.

Figure 4.1.6. Comparison among Laspeyres volume indices (previous year = 100)



With reference to the last four years, an increasing trend in the volume can be observed both for the index based on the enrolled students (without any correction) and for the quality adjusted index based on the class-size. The quality adjusted index based on a synthesis of the indicators illustrated above has the same trend except for the last year where the lowest increase has been registered. The line representing these adjusted volume Laspeyres index is placed under that one representing the volume index adjusted for the class-size.
The reason can be found in the increasing failures and drops-out rates occurred in the Upper-secondary Schools associated with a decrease in the average graduation mark[13].

An overview of the effects that the different quality adjustments have on the scholastic education output at the previous year prices is obtained calculating the chained series of the output.
Since the indicators used are not calculated for all time series because of the different data availability, it has been assumed that for the missing years the quality corrections has no impact.
Of course, in these cases, the Laspeyres adjusted volume index and the simple Laspeyres volume index have the same value as it happens for the chained series of the different quality adjusted outputs at the previous year prices that overlap.
The following table presents the years for which the quality adjustments can be applied:

Quality adjustment	2001	2002	2003	2004	2005	2006	2007
Class-size	x	x	x	x	x	x	x
Students repeating a year rate		x	x	x	x	x	x
Failures rate				x	x	x	x
Drops-out rate					x	x	x

[13] The decrease of the average graduation mark takes place in the same period of an increase of the graduation rate.

Figure 4.1.7. Scholastic Education Chained Volume indices (2000 = 100)

As shown in the Figure 4.1.7 the chained volume indices have the same trend being linked to the enrolled students and to the previous year output at current prices. The differences among the lines are due to the corrections applied for the quality changes. The quality factors based on the class-size causes the highest output volume changes.

4.2. University education

The production of services supplied by universities is split in two CPA classes[14]: Research and Development, for the part related to research, and Education, for the part concerning didactic services. Research and development services are deflated using an input method, while the education component is deflated with the output method.

In the Italian university system an obligation of attendance for all the courses does not exist, there is no standard number of courses to be attended during the academic year and there are no constraints to pass from one year to the next.

This situation makes impossible to carry out statistical and/or administrative surveys that give an estimation of the teaching hours received by each enrolled student; similarly to the case of scholastic education, it is not possible to apply Eurostat's recommendation.

This is the reason why the number of enrolled students[15] per faculty and/or group of homogenous faculties is the quantity indicator used (see Annex 2), hereafter called as faculty.

The most relevant changes due to the reform are:

- The introduction of two levels of university degree: the degree course lasting three years, and the specialised degree course.
- The possibility of enrolment in a year other than the first one considering the number of credits acquired through professional experience.

[14] The division of university production is based on a research carried out by Istat about time length that university professors involve in didactics and research.

[15] The total number of enrolled students was used because starting from the academic year 2000/2001 the new didactic system came into force, and as a consequence the data concerning students in the courses are not homogenous for the period examined, provided that they are related to two different kind of university organisation. In the Italian case it was impossible to use the OECD classification of the university system because the areas do not take into account the faculties, but directly classify the several study courses.

- The possibility for students who enrolled under the old system to pass to the courses set up with the new system having a different legal duration.
- The simultaneous presence of degree courses according to the old system and the new one.

The method currently used

Given the updated and more exhaustive data-set, established with the benchmark revision[16], it has been possible to calculate per capita average cost for 18 faculties. This allows capturing the specific nature of each faculty. The model used for estimating the unitary cost per student is defined by using a methodology based on the standard cost per student[17]. The method for per capita cost calculation would benefit in future, from accountability according to cost centres that is going to be implemented by several universities. For the description of the data used see Annex 1.
The quality adjustment currently in use is based on two indicators[18]:

- The ratio between the enrolled "regular students" in the course and the total number of enrolled students
- The reduction of the distance between the actual number of years for graduation and the theoretical length.

Regular students (students who did not exceed the legal length of their degree) were calculated considering the year of first registration in the Italian university. This is not valid for students enrolled in specialised degree courses, introduced with the new didactic system. The indicator is at maximum equal to 1 if all enrolled students are attending their proper year of attendance. Those faculties for which the indicator is close to 1 are the most efficient.
The actual time for graduation is calculated for graduates from each degree, considering the year of first registration and then grouping by faculty the various actual times of graduation. The theoretical time was calculated considering the legal length of each degree attended by graduates, and then again grouping them by faculty. The correlation between theoretical time and actual time is 1 if all students graduate within the legal duration of the course. In this case, too, if the index is close to 1 the university education process has an effective result.
Considering that the two indicators have the same direction, they both tend to 1, the simplest aggregation to measure the efficiency and/or effectiveness of the educational procedures has been preferred, supposing that both indicators have the same weight.

The new approach

This paragraph proposes an analysis on university education based on different output and quality adjustment measures. Considering the previous work in this field[19], the same methodology is used for the unit cost[20]. The aim at this stage is to use different output indicators and to compare the results.

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[16] Before the benchmark revision, the stratification of faculties regarded 7 groups of faculties, see: Misura e Valutazione dei servizi pubblici, Il Mulino, Bologna 1995, edited by G. Certomà, V. Lo Moro, R. Malizia; in particular see paragraph 2.4 L'Istruzione universitaria. , Istat calculated the average unitary cost per student starting from the unitary costs per faculty of the University "La Sapienza" of Rome.

[17] This methodology has been developed by the "Observatory for the Evaluation of the University System", Ministry of Education, Universities and Research. Please see "Il riparto della quota di equilibrio del fondo per il finanziamento ordinario delle università. Proposte per il triennio 1998 – 2000", DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998. Calcolo degli indici di costo standard per studente, statistical annex to DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998.

[18] More details can be found in: D. Collesi, M. Anzalone, M. Marotta, D. Versace, S. Zannoni, *Improving the measurement of Government output in Italy*, 29th General Conference of The International Association for Research in Income and Wealth, 20-26 August 2006, Joensuu, Finland.

[19] Ibidem.

[20] See Annex 1.

In the exercise 12 scenarios (SC) from the combination of three different quantity indicators are constructed: *enrolled students, enrolled "regular students"*, *graduates* per faculty and/or group of homogenous faculties and four different quality adjustment indicators. Additionally, three scenarios based on the quantity indicators without any quality adjustments have been considered.
For each quantity indicator, five different Laspeyres volume indices[21] can be calculated as follows:

1. without quality adjustments (later called "crude indicator");
2. with quality adjustment: annual change of the synthetic indicator, calculated per faculty (later called "average of the indicators 3 and 4"), deriving from:
   - The ratio between the enrolled "regular students" and the total number of enrolled students,
   - The reduction of the distance between the actual number of years for graduation and the theoretical length;
3. with quality adjustment: variation of reduction of the distance between the actual number of years for graduation and the theoretical length (later called "distance reduction");
4. with quality adjustment: variation of the ratio between the enrolled "regular students" and the total number of enrolled students (later called "ratio regular students");
5. with quality adjustment: variation of the average graduation mark (later called "average graduation mark").

The Table 4.2.1 is useful to represent and easily interpret the 15 scenarios presented later in the paper.

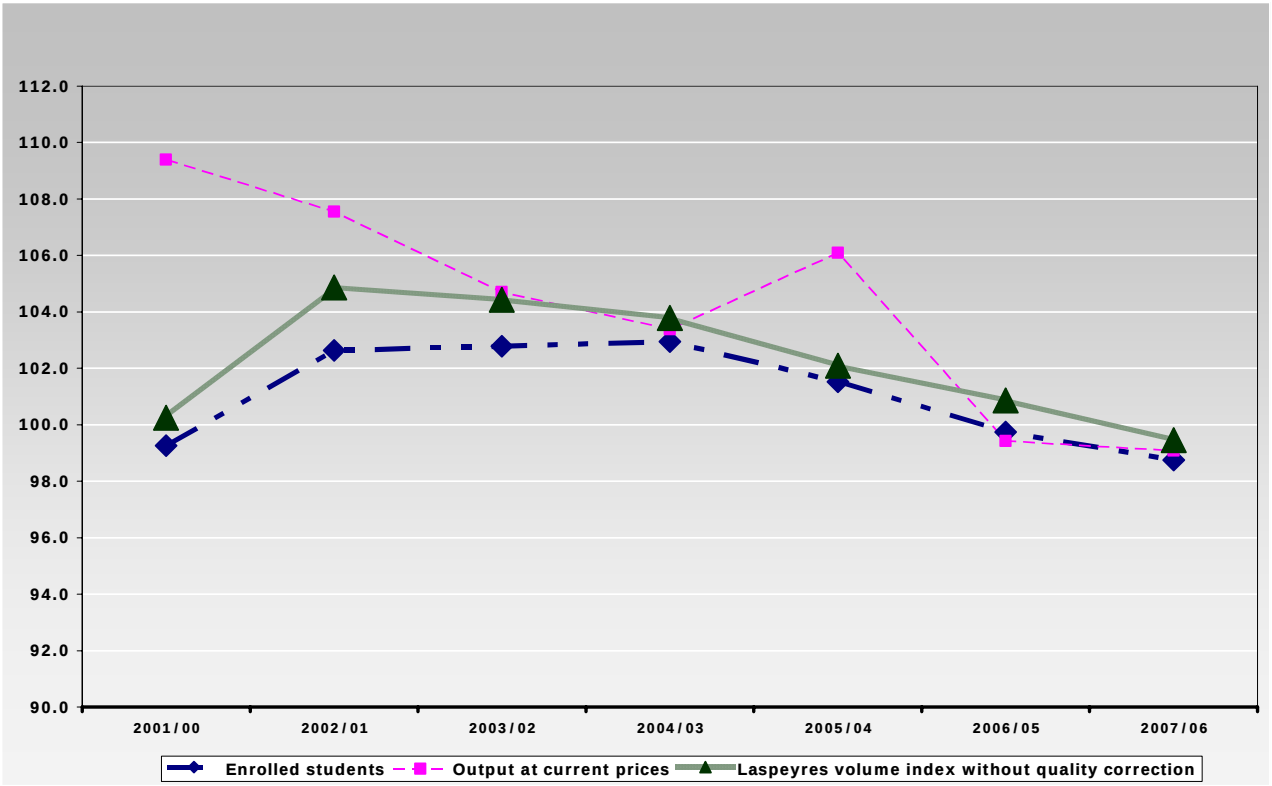
Table 4.2.1 - Cross among quantity and quality indicators

Quality Indicators	Quantity Indicators		
	Enrolled Students (1)	Enrolled "Regular Students" (2)	Graduates (3)
1. Crude indicator	SC 1	SC 6	SC 11
2. Average of the indicators 3. and 4.	SC 2	SC 7	SC 12
3. Distance reduction	SC 3	SC 8	SC 13
4. Ratio regular students	SC 4	SC 9	SC 14
5. Average graduation mark	SC 5	SC 10	SC 15

The scenario 2 (SC 2) is the method currently used in Italian National Accounts (NA) since the 2005 benchmark revision.
The results obtained considering the scenarios from 1 to 5 are described here in synthesis. The results achieved through all the other scenarios are reported in the Annex 3.
Taking into account the Table 4.2.1 (column 1 where the quantity indicator is represented by the enrolled students) and considering the Figures 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.5 the main results obtained are shown here. In particular, the attention focuses on scenario 2. In our opinion, it is the most effective method with explicit adjustments for quality because it gives a qualitative synthesis of the Italian university system and it is not greatly affected by the university reform occurred in the academic year 2000/2001.
Figures 4.2.1 and 4.2.2 show the outputs obtained when no quality adjustments are made (crude indicator). In 2005 (see Figure 4.2.1) the output at current price shows a peak due to the contract renewal[22] for the university sector.

[21] PYP: previous year price.

Figure 4.2.1 - University education: output growth at current price, output real growth and quantity indices (previous year = 100)



The line of PYP Laspeyres volume index during the period examined is collocated between the output at current prices and the variation of enrolled students except for 2004/03 and 2006/05. In 2004 an increase in the number of students (reaching 2.9 per cent) has been observed; this is probably due to the effect of the university reform which, among others, also gives the possibility to enrol in a year other than the first one, considering the number of credits acquired through professional experience. In the rest of the period the output volume remains more or less constant. From 2006, the effects of the university reform were finished: consequently the decreasing in the number of the enrolled students combined with the higher output at current prices registered in the previous year cause an increase in the Laspeyres volume index and its placement over the other two lines in the graph.

[22] The amount related to the arrears is also included in the data.

Figure 4.2.2 - University education: output growth at current price, output real growth and quantity indices (2000 = 100)

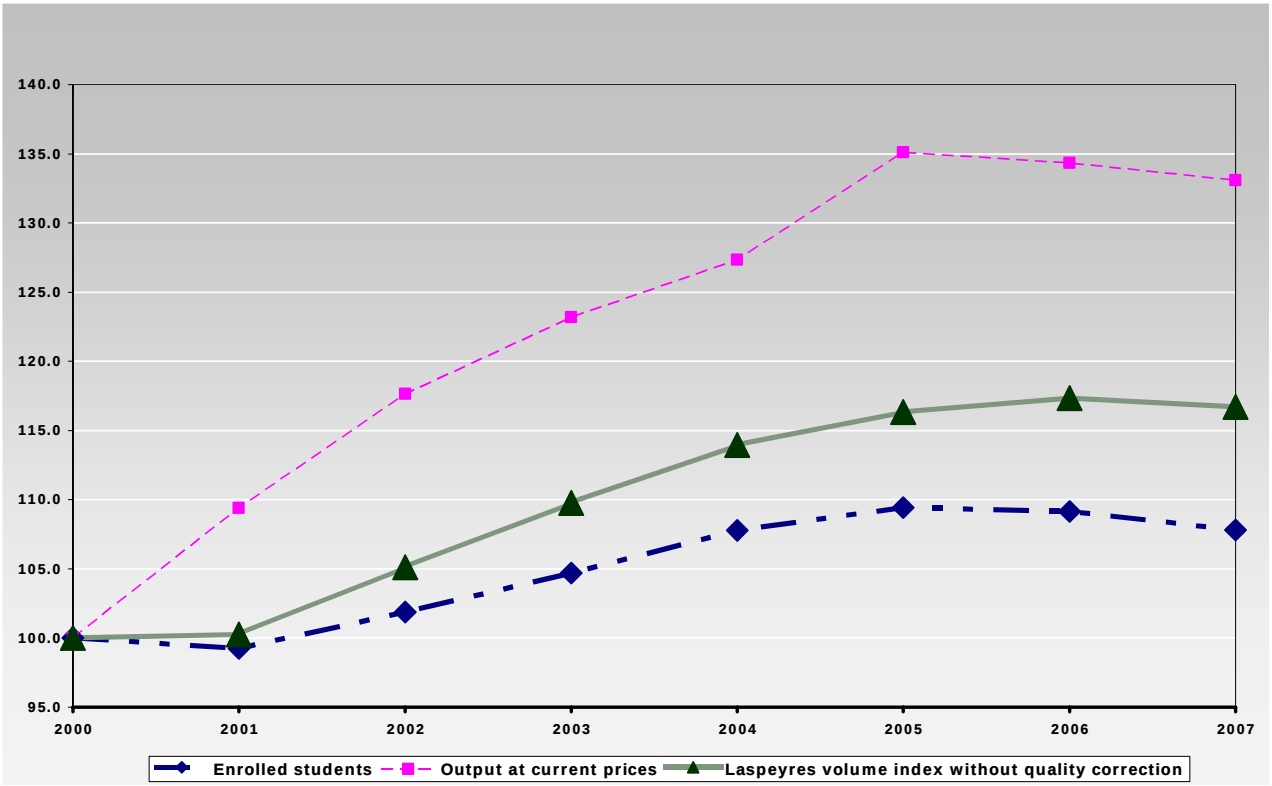
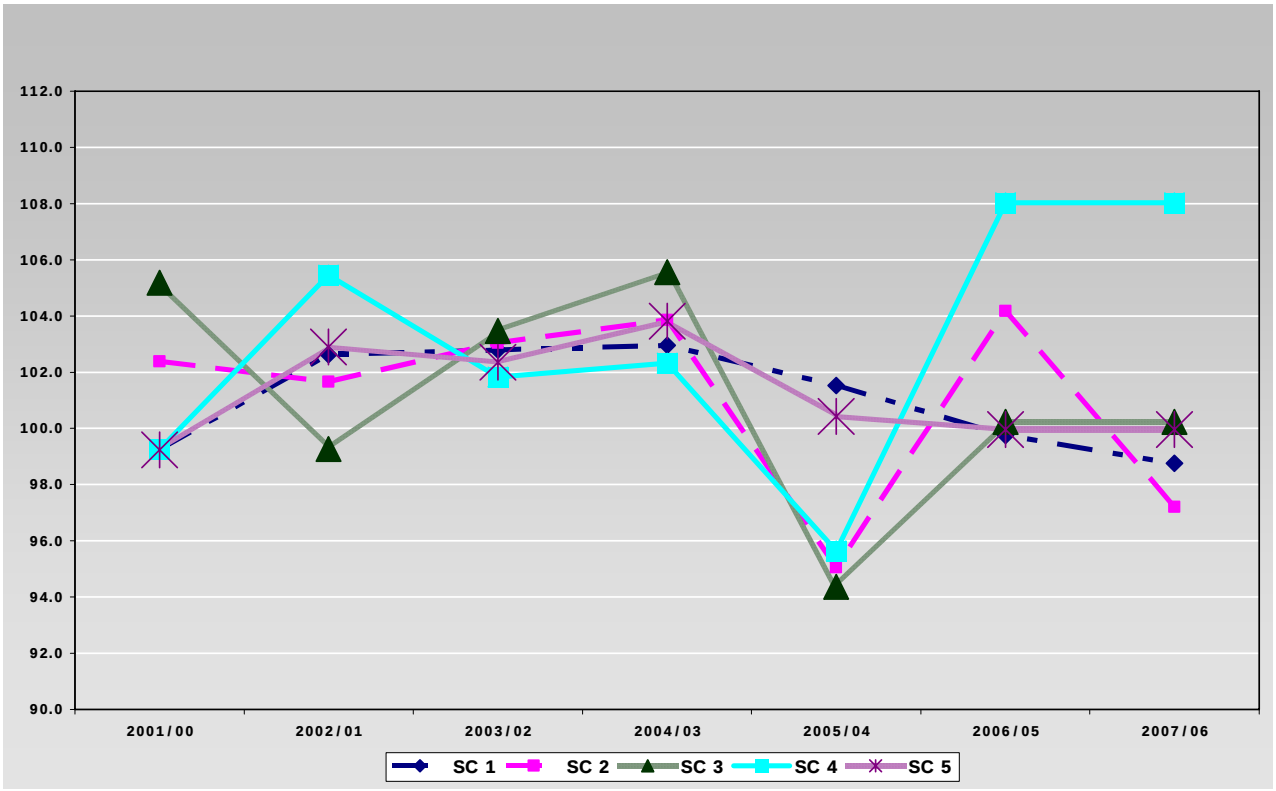


Figure 4.2.3 shows the different quantity indices trends under the different scenarios (see Table 4.2.1 and column 1). Scenario 1, SC 1, is the same of Figure 4.2.1. The second scenario, SC 2 (the method used in Italian National Accounts) is considered the best because it provides a synthesis of one important aspect of university system through two variables. The variables are: the time to achieve the degree and the ratio between regular students and enrolled students.
The third scenario, SC 3, is built using the corrective factor based on the reduction of the distance from the theoretical time from the time spent to graduate. In the 2004 the average indicator of the Italian university system records the highest value of the time series (0.55).
The fourth scenario, SC 4, is calculated adjusting the quantity with the ratio among enrolled "regular students" and total students. The greatest value observed is in 2003 and in 2004 (equal to 0.59).
The last scenario, SC 5, is calculated with a new variable: the average graduation mark. The highest value is registered in the year 2004. The average mark is 102.50 on 110.00.

Figure 4.2.3 - University education: Quantity Indices (previous year = 100)



In the Figure 4.2.4, the different quality adjusted Laspeyres volume indices are compared.

Figure 4.2.4 - University education: Comparison among Laspeyres volume indices (previous year = 100)

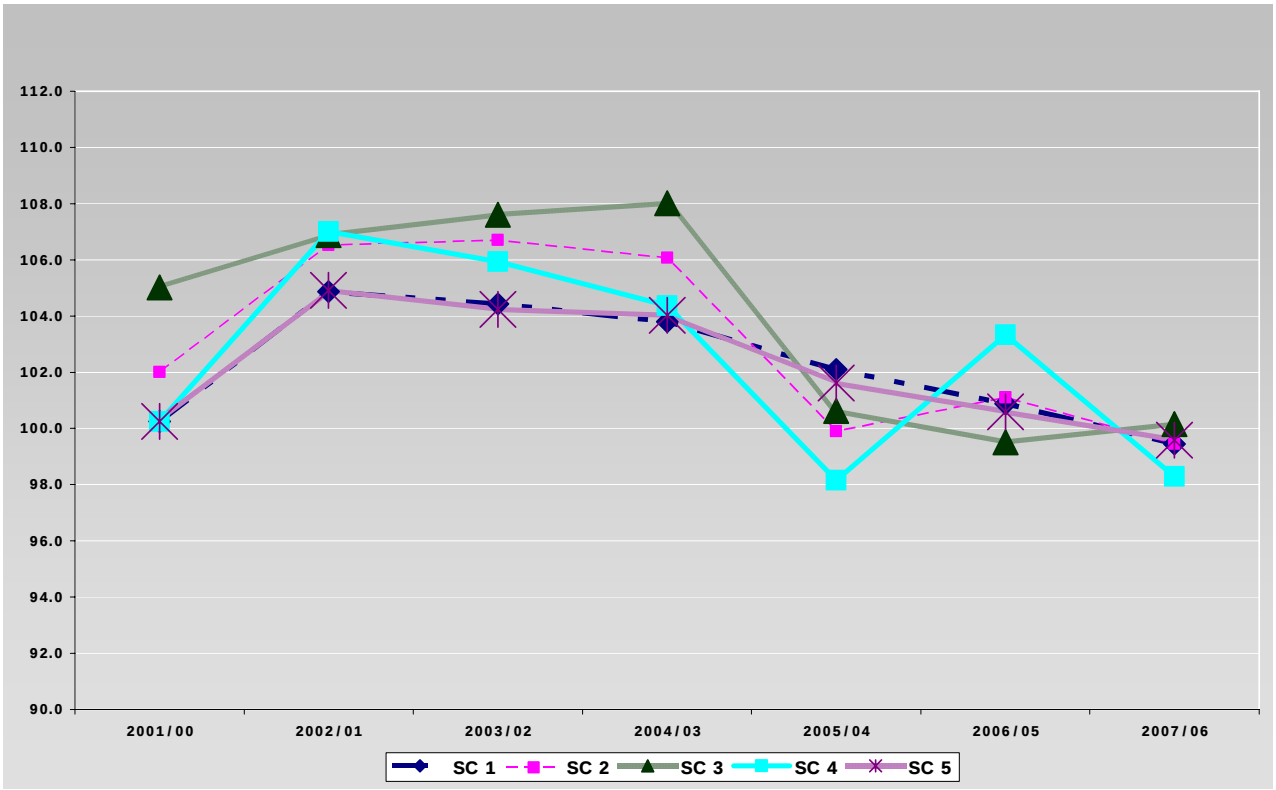
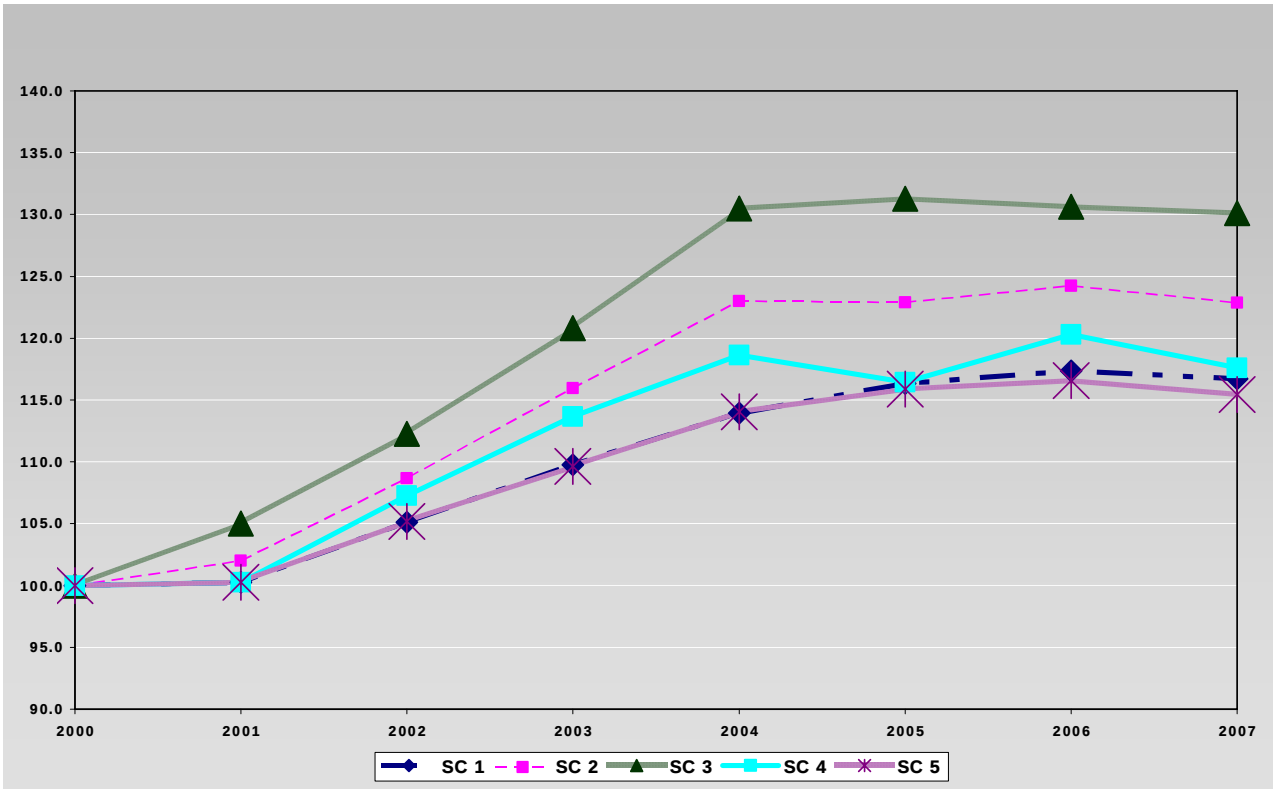


Figure 4.2.5 shows the chained output indices concerning the different scenarios 1 to 5. They have the same trend being linked to the enrolled students and to the previous year output at current price.

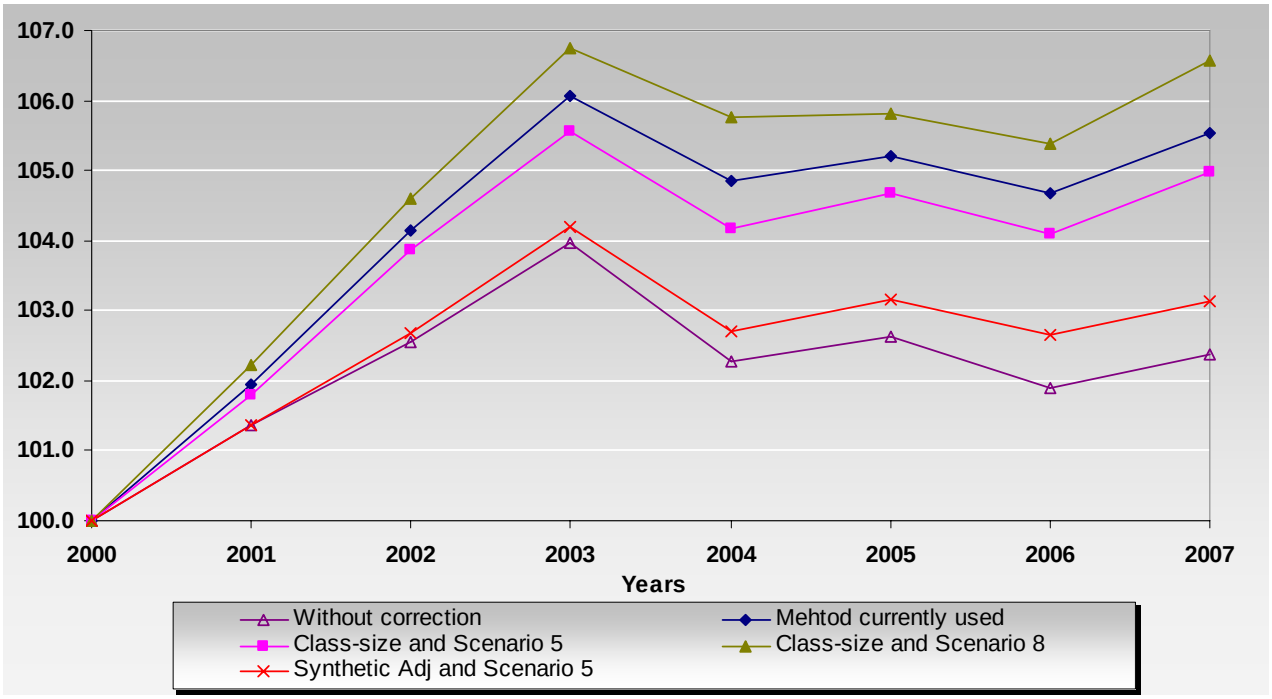
Figure 4.2.5 - University education: Chained Volume indices (2000 = 100)



5. Impact on GDP

The quality corrections seen above have been considered separately for scholastic system and university system. In this paragraph the effects of the corrections both on the output in volume terms and on GDP will be analysed.
The Figure 5.1 refers to the global educational real output represented by the chained series. As shown, the use of a quality correction produces an increase of the volume compared with the series obtained without any application of a quality adjustment.

Figure 5.1 - Global Education Chained Volume indices (2000 = 100)



The results of quality adjustments and their implications on GDP should be considered with caution. As mentioned early in the paper, the data on scholastic system are not referring to the whole of the scholastic population and many problems on basic variables (failures, admissions to the next year, etc.) are not resolved yet. The following data represent the result of an experimental exercise and in this way (as result of an experiment) have to be read.

Table 5.1 - Impact of quality adjustment measures on GDP

	2000	2001	2002	2003	2004	2005	2006	2007
GDP chain-linked volumes (2000 = 100, millions euro)	1,191,057	1,212,713	1,218,220	1,218,013	1,236,671	1,243,525	1,266,420	1,284,868
Government final consumption expenditure in Education/GDP (%)								
Without correction	4.21	4.19	4.22	4.27	4.14	4.13	4.03	3.99
Mehtod currently used	*4.21*	*4.21*	*4.28*	*4.36*	*4.25*	*4.24*	*4.14*	*4.11*
Class-size and Scenario 5	4.21	4.20	4.27	4.34	4.22	4.22	4.12	4.09
Class-size and Scenario 8	4.21	4.22	4.30	4.39	4.28	4.26	4.17	4.15
Synthetic Adj and Scenario 2	4.21	4.19	4.23	4.31	4.19	4.18	4.08	4.04
Synthetic Adj and Scenario 5	4.21	4.19	4.22	4.28	4.16	4.16	4.06	4.02
Synthetic Adj and Scenario 8	4.21	4.20	4.25	4.33	4.22	4.20	4.11	4.08
Government final consumption expenditure/GDP (%)	18.4	18.8	19.2	19.6	19.7	20.0	19.8	19.7

The Table 5.1, as already shown in the Figure 5.1, confirms that the basic calculation of the education volume by using the enrolled students without any correction have the lowest impact on GDP. The highest impact derives from the application of the class-size for the scholastic system and scenario 8[23] for the University system. The method currently used is lying in the second place in a ranking where the different methods are classified by impact on GDP form the highest to lowest one.

6. Conclusions

This paper examines some possible measures, alternative to the ones currently in use in the Italian National Accounts, to account for quality adjustments for Education. The issue of quality has been discussed for a long time since the use of output measures was first put into practice.
With the *2001 Eurostat Handbook on price and volume measures in national accounts* an agreement on the use of quality corrections (the so-called A-methods) seemed to have been reached. As countries went on with the application[24] of these "good practices", several problems appeared both on the theoretical and on the practical grounds.
On the other hand further studies have been developed in several countries[25]. The need of a wider knowledge on the public sector productivity, that could be done only using output measures, has become more and more urgent. The experiments led in some countries in the so called *Spending review* urged for more information on the effectiveness of public spending.
The update of SNA93 and ESA95 renewed the attention on this topic and the difficulty in the implementation was discussed during two Eurostat workshops, held in November 2007 and in March 2008.
In order to not disagree with the 2001 Handbook, where the quality correction for the A methods is explicitly requested, a proposal have been made in order to include quality adjustments only in separate measurements to be included in voluntary satellite accounts, and to keep them off the core of National accounts measurements[26].
In our view the compilation of satellite accounts, as a possible way for the inclusion of quality corrections and, in this sense, for the consideration of A-methods, is dangerous because of the possible misleading results that a double accountability of the government production in volume would determine. The exclusion of quality correction in the NA and its inclusion in a satellite account, designed to expand the NA for possible uses in productivity measurement etc., should determine, in our view, a shadow system of National Accounts which potentially could generate a great confusion for the users, economic and institutional researchers, and for the producers, national accounters, too. Eurostat proposal on the use of satellite account for the A-methods is, in our view, a distortion of the use of satellite account which, nevertheless, should be consistent with the core NA, having some measures in common, and whose main task is to enlarge specific themes of NA without conflicting with NA itself.
The output indicators used should be considered as a whole, fully determined only when including the quality adjustment, whenever the statisticians agree on its inclusion; the consideration of the quality correction should be left to the sensitiveness of the statistician who is in charge of the measure of government output. In this sense the quality correction is considered to provide a full

[23] Scenario 8 concerns the case where the quantity index is based on the "regular enrolled" students and the quality correction is the distance reduction, that is the variation of reduction of the distance between the actual number of years for graduation and the theoretical length. For the other scenarios see Table 4.2.1.
[24] As for the European countries there is on force the Commission Decision 2002/990/EC of 17 December 2002, that establishes the EU Requirements on the removal of C methods (Cf. Commission Decision 2002/990/EC of 17 December 2002, further clarifying Annex A to Council Regulation (EC) No 2223/96 as concerns the principles for measuring prices and volumes in national accounts, Official Journal of the European Communities, L347, 20 December 2002).
[25] The UK Atkinson report played a very important role in this field.
[26] For more details, refer to the document "*Price and Volume measures - Conclusions from the workshop of 13 March 2008*" presented at the 2nd of July 2008 Meeting of the Directors of the European NA.

and exhaustive picture of the government production in the field of education[27]. The case of pupils as basic output indicator[28] for Education is straightforward; the actual demographic trend shows a decrease of younger cohorts that doesn't necessary correspond to a decrease in output.
In order to include some additional indicators in the output measures, it is necessary to share a definition of quality adjustment that, probably, would not be the optimal solution for everybody but, in any case, could represent a common starting point for the comparison of results.
In this way the existing classification of methods could be retained, without considering satellite accounts for the inclusion of quality corrections. The choice of considering the quality components should be left to the countries according to their feeling of what is actually relevant for the construction of the output indicator as a whole.

[27] The case of health should be treated in a similar way.
[28]The example of pupils as an output indicator has also recalled during the Eurostat workshops on quality, November 2007 and March 2008.

ANNEX 1

University education: Data source

To calculate the volume indicator, the average unitary cost indicator, and the quality indicators, the following surveys[29] and databanks, all included in the National Statistics Programme, were used:

1. Survey on University Education carried out by the Statistics Office, Ministry of Education, University and Research, *Enrolled and registered students per academic year:* date of reference 31 July[30]
    - Survey unit: Degree Course (old system), Diploma Course (old system), School aimed at special purposes (old system), Degree Course (new system), Specialised Degree Course (new system), Single Cycle Specialised Degree Course (new system);
    - Variable applied: students enrolled by year of first registration in the university system[31].
2. Survey on University Education carried out by the Statistics Office, Ministry of Education, University and Research, *Graduates per year*
    - Survey unit: Degree Course (old system), Diploma Course (old system), School aimed at special purposes (old system), Degree Course (new system), Specialised Degree Course (new system), Single Cycle Specialised Degree Course (new system);
    - Variable applied: graduates enrolled by year of first registration in the university system[32], graduates by year classified by graduation mark class, total graduates by year.
3. *Database of the degree courses*, Statistics Office, Ministry of Education, University and Research
    - Survey unit: Degree Course (old system), Diploma Course (old system), School aimed at special purposes (old system), Degree Course (new system), Specialised Degree Course (new system), Single Cycle Specialised Degree Course (new system);
    - Variable applied: legal length of the degree course.
4. *Database of professors* (Ordinary Professor, Associated Professor and Researcher), Statistics Office, Ministry of Education, University and Research, date of reference 31 December
    - Survey unit: faculty per athenaeum;
    - Variables applied: number of the ordinary and associated professors, number of the researcher.
5. *Survey on the final balance statements of university bodies*, Istat: calendar year
    - Survey unit: university.

The following variables from various surveys have been used to apply the model for calculating the *standard cost per student*: students per athenaeum, equivalent professors per athenaeum, costs of production per athenaeum, enrolled students per faculty and per athenaeum, equivalent professors per faculty and athenaeum.

[29] The production of statistical data on Universities was disseminated by ISTAT until the 1997/98 academic year. Starting from the following year, the surveys and the publication of the results became part of the tasks under the competence of the Ministry of Education, University and Research (MIUR), as established by the ISTAT/MURST agreement, which included the creation of the Informative System for Evaluation (SIU), with the purpose of monitoring the university system. The statistics produced by this SIU do not follow a standard classification and, as a consequence, they can't be used for our purposes. The surveys are part of the National Statistical Programme.

[30] Student enrolled in academic year (t-1)/t: student who, on 31 July of the year t, is found to be up to date with all the payments of the enrolment fees, that is to say that he/she has been found to have paid the last instalment. See: Website, Ministry of Education, University and Research, Office III – Statistics Service, *Main applied definitions*.

[31] Ibidem, Year of first registration: academic year in which a student enrols for the first time in a study course in an Italian university.

[32] Ibidem.

To calculate the quality indicators, on the other hand, the variables are as follows: enrolled students per year of registration per degree course and per faculty; graduates based on the year of first registration per degree course and per faculty, legal length of the degree course, graduates for graduation mark class per degree course and per faculty and graduates per degree course and per faculty.

University education: model for the formation of the unitary cost per faculty

The model used for estimating the unitary cost is defined by using a methodology based on the *standard cost per student*[33].

The per capita average cost per enrolled student is calculated for each year. In order to estimate the unitary cost of each student, by faculty and for each year, a functional correlation was supposed in which the costs of production for education[34] in different universities (C_t)[35] depend on the number of equivalent professors (D_t)[36] and on the total number of enrolled students (S_t).

The underlying theory is that the overall cost for education in the public university system is:

$$C_t = \beta_{1,t} S_t + \beta_{2,t} DE_t + \varepsilon_t \qquad [1]$$

Where:

$t = 2000, \ldots, 2007$, are the years

$C_t = \sum_{i=1}^{n} C_{i,t}$ is the overall cost of production for didactic purposes

$S_t = \sum_{i=1}^{n} S_{i,t}$ is the number of enrolled students (or enrolled "regular students" or graduates[37])

$DE_t = \sum_{i=1}^{n} DE_{i,t}$ is the number of equivalent professors

$i = 1, \ldots, n$ is the number of universities included in S13.

Based on [1], one obtains the average cost per student (or per "regular student" or per graduate):

$$C_t / S_t = \beta_{1,t} + \beta_{2,t} DE_t / S_t \qquad [2]$$

As one can see, the cost is made up of a constant and of a variable part, related to the number of equivalent professors per student (or "regular student" or graduate).

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[33] This methodology has been developed by the "Observatory for the Evaluation of the University System", Ministry of Education, Universities and Research. Please see *"Il riparto della quota di equilibrio del fondo per il finanziamento ordinario delle università. Proposte per il triennio 1998 – 2000",* DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998. *Calcolo degli indici di costo standard per studente*, statistical annex to DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998.

[34] The "Observatory for the evaluation of the university system" takes into accounts also other variables when specifies the equation.

[35] The value of production of each university for didactic activity was estimated considering the following items: (Expenses for running university bodies, personnel expenses, transfers to departments, financial burdens, tax burdens, expenses for running institutes, centres and clinics, corrective amounts, expenses that cannot be classified in other sections). The overall costs were then reduced proportionally to the importance of didactic with respect to research activities.

[36] The value of equivalent professors for each athenaeum and per university and faculty $DE_{i,l}$ (I = 1, … , n), was obtained with the following formula:

$$DE_{i,t} = (ORD_{i,t} + 0{,}72\ ASS_{i,t} + 0{,}47\ RIC_{i,t}) \times \text{didactic production time}$$

In which ORD is the number of ordinary professors, ASS is the number of associated professors and RIC is the number of researchers.

[37] The last year (2007) is an average between 2005 and 2006 because of the data unavailability.

The relation [2] can be written for each faculty, then per capita cost for the generic faculty J is equal to:

$$c_{j,t} = \hat{\beta}_{1,t} + \hat{\beta}_{2,t} f_{j,t}^{*} \quad j = 1, \ldots, 18 \quad [3]$$

where $c_{j,t} = C_{j,t} / S_{j,t}$ and $f_{j,t}^{*} = DE_{j,t} / S_{j,t}$ is the ratio between equivalent professors and students (or "regular students" or graduates) that is different for each faculty.
In order to define a unitary average cost to attribute to each faculty, it is necessary to estimate the various $f_{j,t}^{*}$.
The $f_{j,t}^{*}$ can be determined with a simple regression model; thus, for the faculty j, one will have:

$$DE_{j,t} = f_{j,t}^{*} S_{j,t} \quad [4]$$

University education: volume index

The index used for the university production is a PYP Laspeyres volume index, in which the weighting is the per capita cost in the year *t-1* and the quantity, referring to the current year t, is the number of: enrolled students (or enrolled "regular students" per faculty or the graduates per faculty).
The index takes on the following form:

$$L_{t/t-1} = \frac{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,t}}{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,(t-1)}}$$

where:
t is the time unit
C is the unitary cost of: a enrolled student or a enrolled "regular student" or a graduate of the faculty *j*
S is the number of enrolled students or enrolled "regular students" or graduates in the faculty *j*.

University education: quality indicators

The methodology applied involved the use of the annual variation of indicator calculated per faculty $q_{j,t}$. The indicators proposed are:

1. The ratio between the enrolled "regular students" in the course SC_{jt}[38] and the total number of enrolled students S_{jt}

$$q_{jt} = (SC_{j\,t} / S_{j,\,t}) \quad [5]$$

2. The reduction of the distance between the actual number of years for graduation LE_{jt} and the theoretical length LT_{jt}.[39]

[38] Regular students (students who did not exceed the legal length of their degree) were calculated considering the year of first registration in the Italian university. This is not valid for students enrolled in specialised degree courses, introduced with the new didactic system. The indicator is at most equal to one if all enrolled students are attending their proper year of attendance. Those faculties for which the indicator is close to 1 are the most efficient.
[39] The actual time for graduation is calculated for graduates from each degree, considering the year of first registration and then grouping by faculty the various actual times. The theoretical time was calculated considering the legal length of every degree attended by graduates, and then again grouping them by faculty. The correlation between theoretical time and actual time is 1 if all students graduate within the legal duration of the course. In this case, too, if the index is close 1, this means that the university education process has an effective result.

$$q_{jt} = (LT_{j,t} / LE_{j,t}) \qquad [6]$$

3. The synthetic indicator construct as average of 1. and 2.

$$q_{jt} = ((SC_{j\,t} / S_{j,t}) + (LT_{j,t} / LE_{j,t})) / 2 \qquad [7]^{40}$$

4. The average graduation mark achieved.

$$q_{j,t} = \frac{\sum_{j=1}^{18} GS_t(\mu)}{TD_t}$$

where GS is the number of graduates classified by graduation mark class, TD is the number of total graduates, μ is the median of graduation mark class[41].

The corrective factor applied is:

$$q_{j,t} / q_{j,(t-1)}$$

The PYP Laspeyres volume index, corrected with the quality factor for the part concerning university education, becomes:

$$L_{t/t-1} = \frac{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,t} \cdot \frac{q_{j,t}}{q_{j,(t-1)}}}{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,(t-1)}}$$

where:
t is the time unit
C is the unitary cost of a student of the faculty *j*
S is the number of students enrolled in the faculty *j* (or "regular students" enrolled in the faculty *J*, or the graduates of the faculty *j)*
q is quality indicators in the faculty *j*

[40] Considering the fact that the two indicators have the same direction, they both tend towards the unit, it was preferred the simplest way of summarising them with an unweighted average in order to measure the efficiency of the educational procedures, supposing that both indicators have the same weight.
[41] For the "class 110 on 110 cum laude" the value imputed is 115.

ANNEX 2

Faculty and group of homogenous faculties

FACULTY		Group
1	Environmental Sciences Natural, Physical and Mathematical Sciences Biotechnology Science and Technology	**Sciences**
2	Pharmacy	**Pharmacy**
3	Medicine and Surgery	**Medicine and Surgery**
4	Engineering Aerospace engineering Industrial Chemistry	**Engineering**
5	Architecture Arts and Design	**Architecture**
6	Agriculture	**Agriculture**
7	Veterinary Medicine	**Veterinary Medicine**
8	Sociology	**Sociology**
9	Political science	**Political science**
10	Law	**Law**
11	Letters and Philosophy Communication Sciences Library and Archive Studies Philosophy Musicology Humanities	**Letter**
12	Language and Foreign Literatures Language and Foreign Modern Literatures Italian Language and Culture Modern language for Interpreters and Translators Modern language Islamic studies Oriental Studies	**Language**
13	Cultural Heritage Preservation of the Cultural Heritage	**Cultural Heritage**
14	Psychology Social Sciences	**Psychology**
15	Economics Banking, Finance and Insurance	**Economics**
16	Educational Sciences Humanities and Social Sciences	**Education**
17	Statistics	**Statistics**
18	Exercise and Sport Science	**Exercise and Sport Science**

ANNEX 3

This annex reports the figures used for the calculation of the Laspeyres volume index: Output at current prices, enrolled students, enrolled "regular students", graduates, distance reduction, average graduation mark.

University Output at current prices (millions euro)

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	745	763	693	854	798	907	910	910
02 Pharmacy	130	137	163	162	149	168	165	170
03 Medicine and Surgery	953	1,032	941	928	881	977	1,063	1,008
04 Engineering	578	644	769	655	680	779	772	780
05 Architecture	138	155	193	187	196	189	183	185
06 Agriculture	173	186	191	183	171	204	204	210
07 Veterinary Medicine	79	86	97	91	74	86	88	94
08 Sociology	14	16	15	22	25	30	28	29
09 Political Science	133	141	169	207	224	197	199	168
10 Law	153	198	247	271	380	364	345	352
11 Letter	477	512	595	597	625	626	574	596
12 Language	92	102	122	134	140	149	146	122
13 Cultural Heritage	11	13	18	17	18	19	18	19
14 Psychology	31	36	43	66	89	86	80	81
15 Economics	235	282	342	404	451	436	413	428
16 Education	58	72	104	140	183	176	159	145
17 Statistics	33	36	39	38	34	36	36	36
18 Exercise and Sport Science	0	1	4	12	18	20	35	35
Total	**4,033**	**4,412**	**4,745**	**4,968**	**5,136**	**5,449**	**5,418**	**5,368**

University education: Enrolled students

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	125,259	124,760	127,695	133,360	139,885	143,799	146,618	148,449
02 Pharmacy	42,412	43,779	44,207	46,567	48,553	52,781	52,263	53,773
03 Medicine and Surgery	97,220	101,264	116,412	123,898	132,785	139,872	147,428	148,298
04 Engineering	209,534	211,330	216,832	224,309	229,145	229,995	227,909	225,820
05 Architecture	78,866	75,158	75,367	75,852	77,158	77,186	76,136	75,861
06 Agriculture	27,204	26,883	27,611	28,837	29,729	29,608	29,175	27,967
07 Veterinary Medicine	13,794	13,571	13,757	14,143	14,605	14,841	14,727	14,904
08 Sociology	22,243	24,777	23,002	14,713	15,186	17,749	16,566	15,152
09 Political Science	93,044	90,194	91,872	95,943	101,900	100,815	99,976	99,466
10 Law	265,301	252,358	241,830	234,532	230,118	227,507	221,344	209,413
11 Letter	216,385	212,600	220,379	242,890	247,190	249,607	245,100	239,306
12 Language	42,716	45,475	48,939	52,120	53,859	55,918	57,089	57,363
13 Cultural Heritage	7,201	7,259	7,261	7,396	7,390	6,663	5,905	5,125
14 Psychology	31,475	30,170	35,386	44,220	45,825	48,375	48,963	49,388
15 Economics	214,706	206,755	205,534	207,555	210,493	207,215	210,237	209,736
16 Education	82,970	91,576	102,301	96,624	106,464	111,138	109,288	106,960
17 Statistics	6,622	6,146	5,366	4,746	4,316	4,000	4,000	3,953
18 Exercise and Sport Science	4,026	5,151	6,717	7,619	9,540	13,105	13,016	13,361
Total	**1,580,978**	**1,569,206**	**1,610,468**	**1,655,324**	**1,704,141**	**1,730,174**	**1,725,740**	**1,704,295**

University education: Enrolled “regular students”

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	73,199	73,187	76,107	81,012	85,604	85,678	88,739	92,451
02 Pharmacy	28,567	29,161	28,775	30,455	32,570	35,327	34,944	36,383
03 Medicine and Surgery	71,312	76,102	89,891	95,519	101,999	106,339	112,914	112,409
04 Engineering	123,123	124,087	128,010	131,774	131,336	129,031	133,157	137,832
05 Architecture	35,344	35,455	37,174	39,644	42,864	43,037	43,636	44,872
06 Agriculture	18,631	17,593	16,823	17,236	17,157	16,655	16,212	15,735
07 Veterinary Medicine	8,306	7,906	7,791	8,229	8,691	8,619	8,737	8,990
08 Sociology	15,029	16,947	14,929	7,358	8,044	8,569	8,398	7,789
09 Political Science	46,895	46,280	49,093	54,318	60,671	56,522	57,663	58,837
10 Law	123,919	113,280	107,687	106,149	107,700	97,259	102,484	109,451
11 Letter	120,072	119,173	125,242	145,265	148,733	137,357	136,215	137,071
12 Language	25,656	28,046	29,967	32,218	33,360	31,367	33,948	35,605
13 Cultural Heritage	4,635	4,591	4,006	3,725	3,360	2,574	2,443	2,186
14 Psychology	19,888	19,057	24,008	30,497	31,408	29,485	29,759	31,897
15 Economics	111,372	107,576	111,084	116,941	121,757	114,205	122,251	128,517
16 Education	53,935	60,955	68,425	61,182	65,602	64,455	63,778	64,655
17 Statistics	3,447	3,223	2,818	2,537	2,567	2,479	2,772	2,884
18 Exercise and Sport Science	2,704	4,018	5,525	6,201	7,020	8,673	8,424	8,731
Total	**886,034**	**886,637**	**927,355**	**970,260**	**1,010,443**	**977,631**	**1,006,474**	**1,036,295**

University education: Graduates

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	12,361	12,971	16,059	16,823	19,589	21,565	22,540	22,053
02 Pharmacy	3,377	3,701	4,411	5,537	5,163	5,233	5,270	5,252
03 Medicine and Surgery	13,740	13,827	19,770	25,731	28,511	29,274	29,541	29,408
04 Engineering	19,687	21,289	25,384	30,560	34,506	39,081	39,426	39,254
05 Architecture	8,478	8,226	9,323	10,962	11,471	12,657	12,840	12,749
06 Agriculture	2,031	2,451	3,097	3,579	4,157	4,375	4,363	4,369
07 Veterinary Medicine	1,180	1,198	1,530	1,735	1,498	1,462	1,479	1,471
08 Sociology	1,193	1,404	1,675	1,973	1,859	2,631	2,610	2,621
09 Political Science	8,559	9,988	10,320	11,550	15,343	20,523	18,638	19,581
10 Law	21,681	23,239	24,297	28,897	27,426	28,732	27,602	28,167
11 Letter	16,710	18,631	21,942	24,876	30,428	37,709	39,255	38,482
12 Language	3,224	4,013	4,679	5,491	6,981	9,166	9,148	9,157
13 Cultural Heritage	264	420	542	642	863	1,075	1,006	1,041
14 Psychology	3,263	3,292	3,573	5,713	7,540	9,810	10,108	9,959
15 Economics	24,514	24,061	27,223	30,374	33,818	35,297	35,348	35,323
16 Education	5,577	7,208	9,501	10,880	14,354	16,946	17,626	17,286
17 Statistics	890	964	1,197	1,289	1,066	966	829	898
18 Exercise and Sport Science	348	822	1,012	860	1,343	2,132	2,143	2,138
Total	**147,077**	**157,705**	**185,535**	**217,472**	**245,916**	**278,634**	**279,772**	**279,203**

University education quality adjustment: Distance reduction*

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	0.46	0.52	0.53	0.54	0.57	0.55	0.55	0.55
02 Pharmacy	0.45	0.55	0.56	0.57	0.60	0.57	0.57	0.57
03 Medicine and Surgery	0.79	0.63	0.63	0.65	0.64	0.66	0.64	0.65
04 Engineering	0.40	0.51	0.53	0.56	0.58	0.56	0.55	0.55
05 Architecture	0.33	0.48	0.50	0.54	0.55	0.55	0.54	0.54
06 Agriculture	0.44	0.57	0.57	0.56	0.57	0.53	0.52	0.53
07 Veterinary Medicine	0.41	0.54	0.53	0.57	0.55	0.55	0.55	0.55
08 Sociology	0.55	0.51	0.52	0.48	0.48	0.48	0.47	0.47
09 Political Science	0.47	0.47	0.47	0.49	0.54	0.58	0.55	0.56
10 Law	0.46	0.44	0.44	0.42	0.46	0.47	0.47	0.47
11 Letter	0.48	0.47	0.48	0.50	0.53	0.52	0.51	0.51
12 Language	0.48	0.48	0.49	0.51	0.54	0.52	0.51	0.51
13 Cultural Heritage	0.48	0.43	0.46	0.47	0.46	0.46	0.45	0.45
14 Psychology	0.50	0.56	0.56	0.62	0.66	0.62	0.60	0.61
15 Economics	0.47	0.45	0.47	0.50	0.54	0.51	0.52	0.52
16 Education	0.55	0.55	0.54	0.54	0.56	0.55	0.55	0.55
17 Statistics	0.52	0.51	0.52	0.54	0.56	0.57	0.57	0.57
18 Exercise and Sport Science	0.79	0.81	0.66	0.90	0.76	0.65	0.58	0.61
Total	**0.47**	**0.49**	**0.51**	**0.52**	**0.55**	**0.54**	**0.54**	**0.54**

* *Used for Scenarios: 3, 8, 13*

University education quality adjustment: Average graduation mark*

Groups	2000	2001	2002	2003	2004	2005	2006	2007
01 Sciences	104.15	104.29	103.92	104.35	104.46	104.27	104.19	104.23
02 Pharmacy	99.61	99.56	99.99	98.80	101.02	100.70	99.85	100.27
03 Medicine and Surgery	106.21	106.00	106.50	106.00	105.27	104.57	104.22	104.39
04 Engineering	99.47	100.02	100.04	99.89	100.11	99.91	100.03	99.97
05 Architecture	103.27	103.75	103.82	103.17	103.66	103.48	103.52	103.50
06 Agriculture	104.55	104.99	104.61	103.98	104.17	104.03	103.40	103.71
07 Veterinary Medicine	101.60	101.63	102.37	102.65	102.78	103.14	102.91	103.02
08 Sociology	103.21	100.97	101.81	98.78	105.95	104.06	103.75	103.91
09 Political Science	99.70	99.48	99.94	100.34	101.82	99.24	99.69	99.46
10 Law	96.89	96.29	95.89	96.73	97.41	96.99	96.45	96.72
11 Letter	108.00	107.91	107.69	107.38	107.20	106.51	105.69	106.10
12 Language	106.82	106.92	106.90	106.58	106.26	105.48	104.58	105.03
13 Cultural Heritage	109.67	108.23	108.44	108.06	108.11	107.89	107.77	107.83
14 Psychology	101.38	100.67	100.49	100.28	103.46	102.05	101.15	101.60
15 Economics	98.55	98.46	98.66	98.05	98.79	98.66	98.46	98.56
16 Education	105.91	104.72	104.97	104.84	105.59	105.56	105.24	105.40
17 Statistics	100.01	100.30	99.17	99.44	102.85	101.52	101.71	101.62
18 Exercise and Sport Science	110.04	109.20	107.78	101.56	99.63	99.74	98.62	99.18
Total	**101.78**	**101.76**	**102.01**	**101.83**	**102.50**	**102.06**	**101.83**	**101.94**

* *Used for Scenarios: 5, 10, 15*

The figures 6 to 10 show the exercises made by the combination between the new quantity measure - enrolled “regular students” - and the different quality adjustments (scenarios 6 to 10, see table 4.2.1, column 2).

Figure 6. University education: output growth at current price, output real growth and quantity indices (previous year = 100)

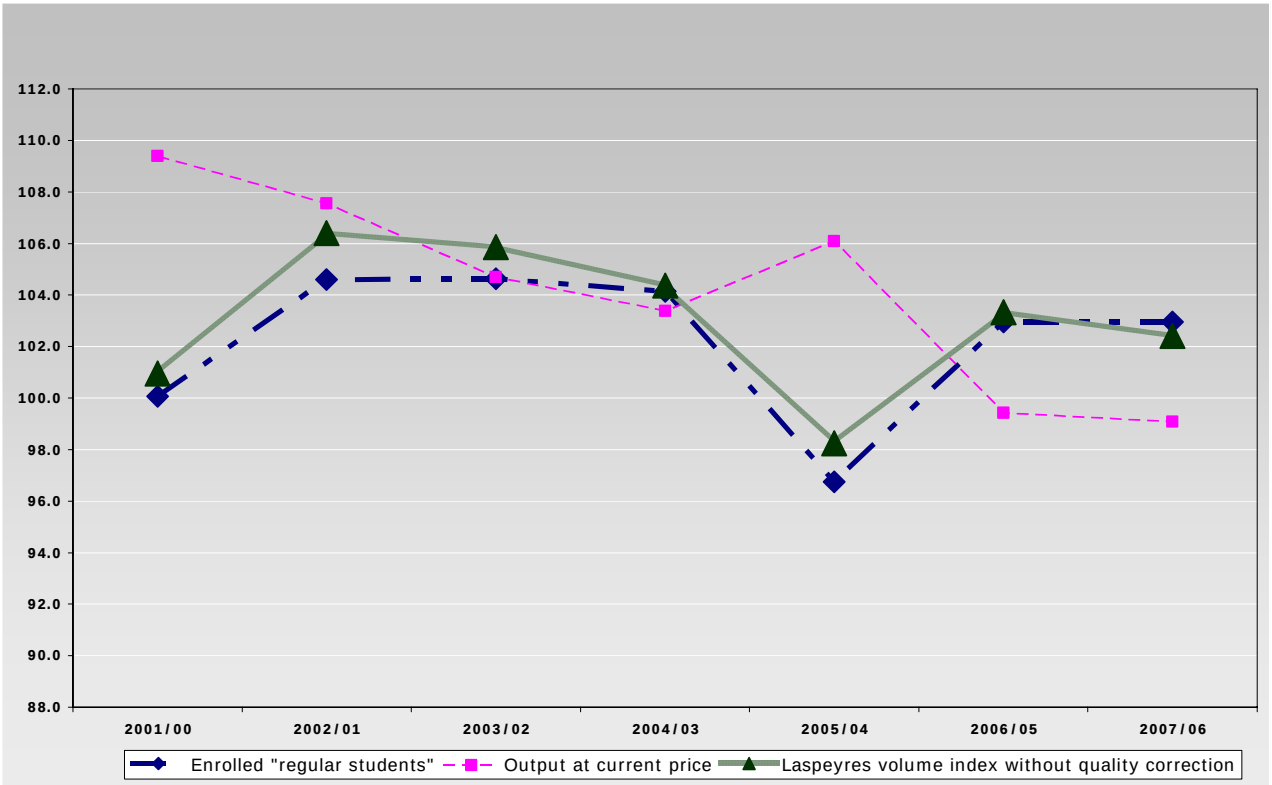


Figure 7. University education: output growth at current price, output real growth and quantity indices (2000 = 100)

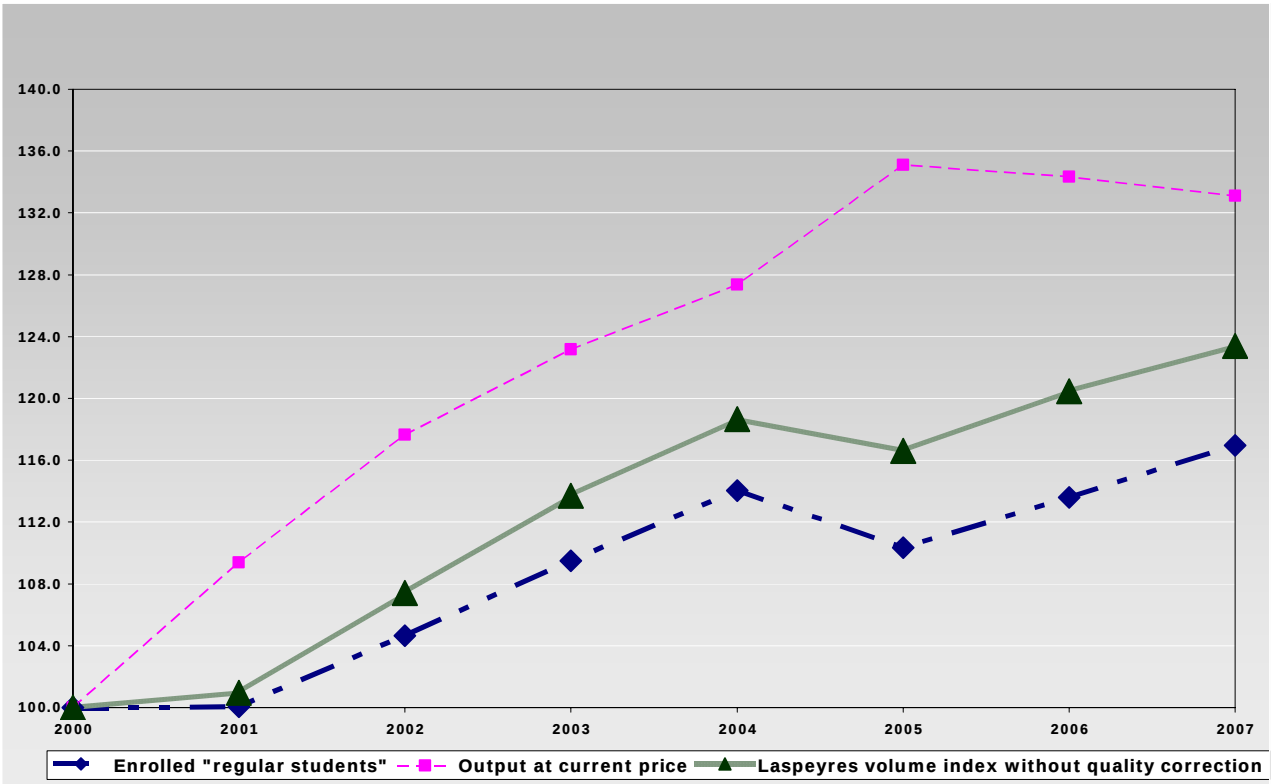


Figure 8. University education: Quantity Indices (previous year = 100))

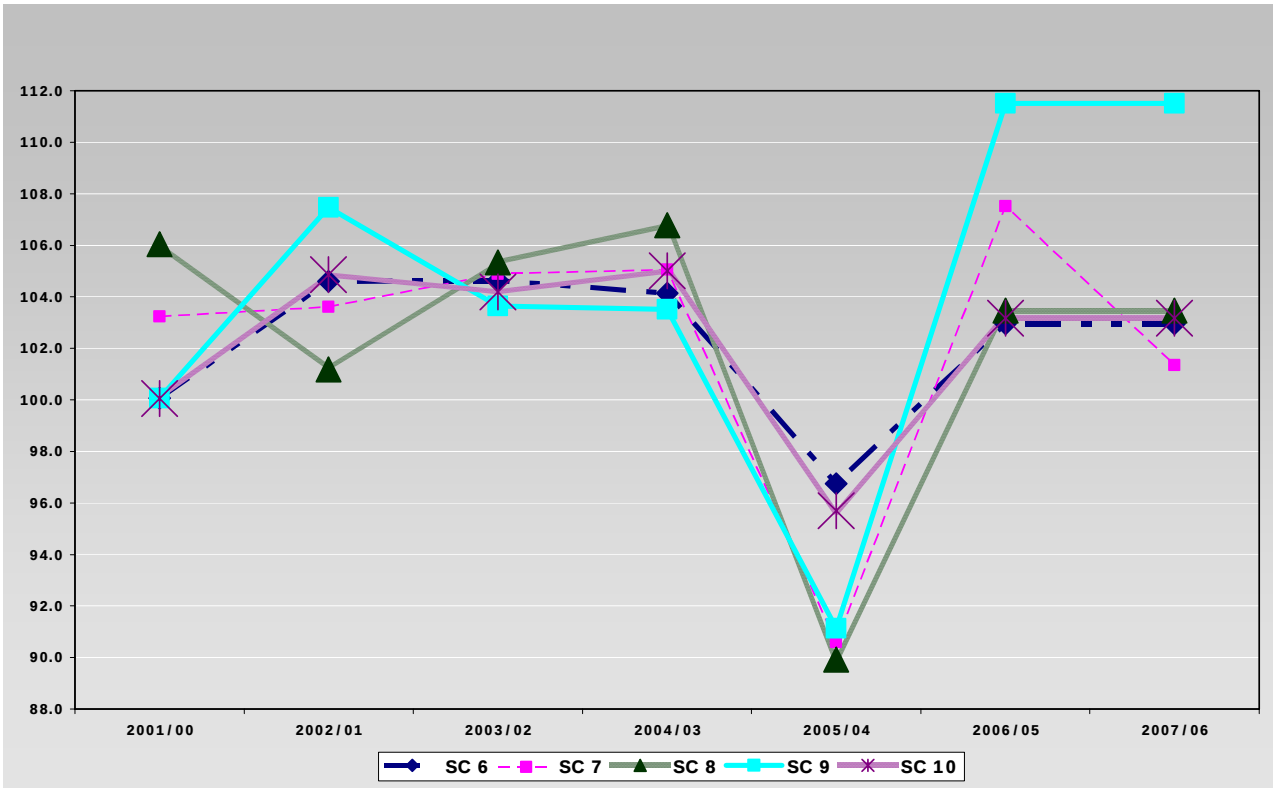


Figure 9. University education: Comparison among Laspeyres volume indices (previous year = 100)

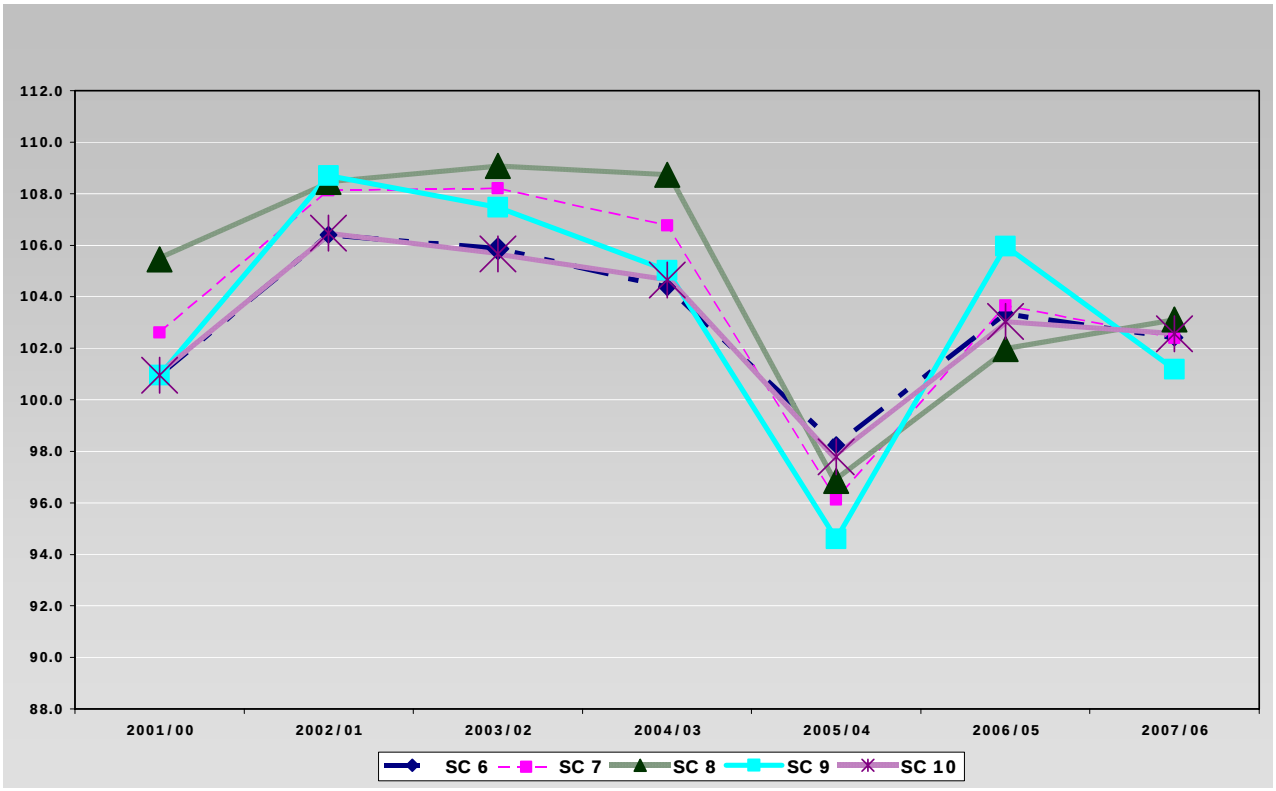
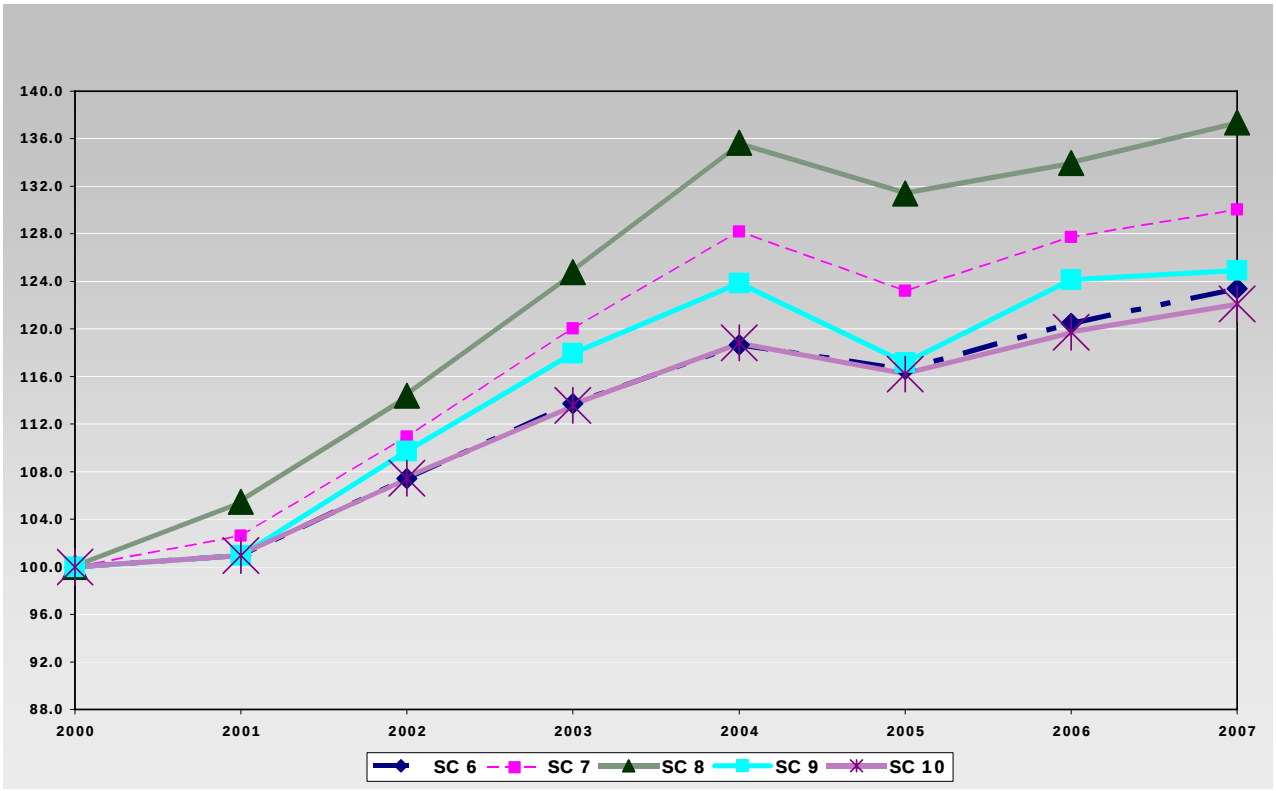


Figure 10. University education: Chained Volume indices (2000 = 100)



The figures 11 to 15 show the exercises made by the combination between the new quantity measure – graduates - and the different quality adjustments (scenarios 11 to 15, see table 4.2.1, column 3).

Figure 11. University education: output growth at current price, output real growth and quantity indices (previous year = 100)

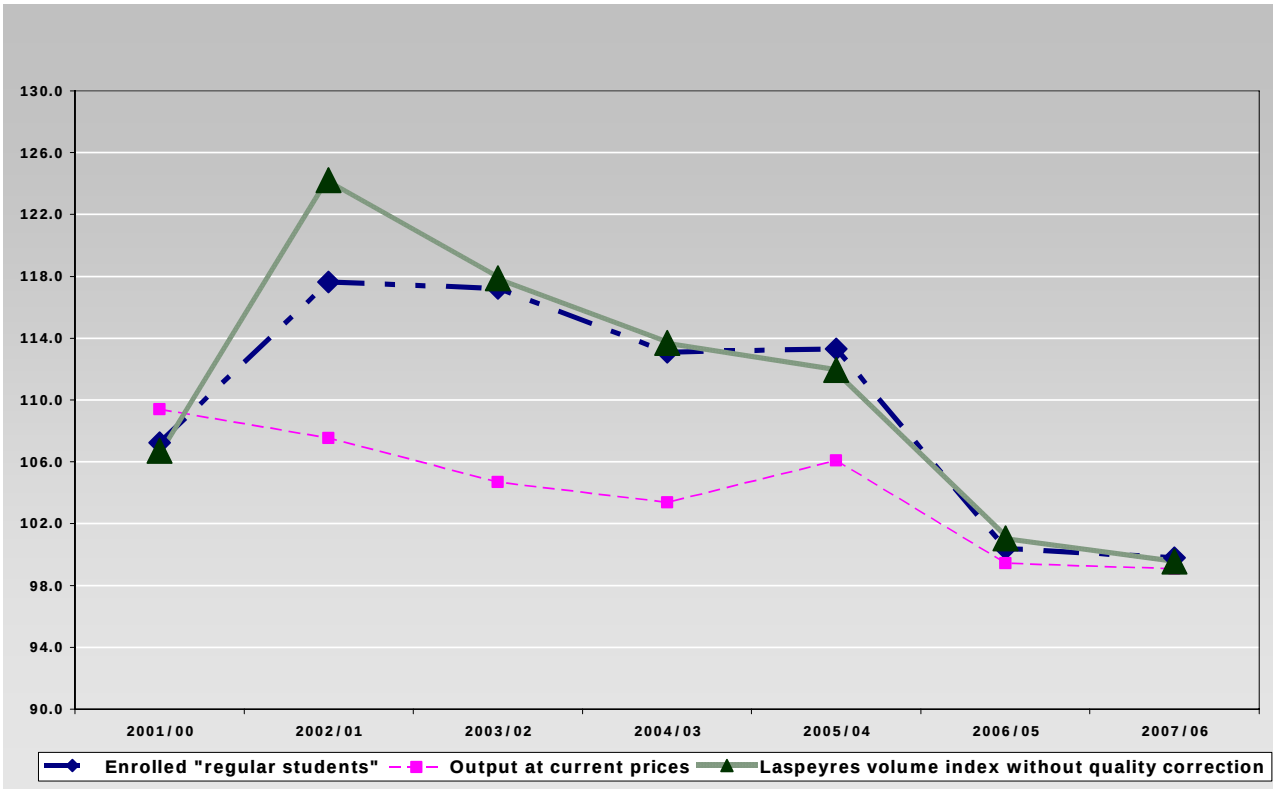


Figure 12. University education: output growth at current price, output real growth and quantity indices (2000 = 100)

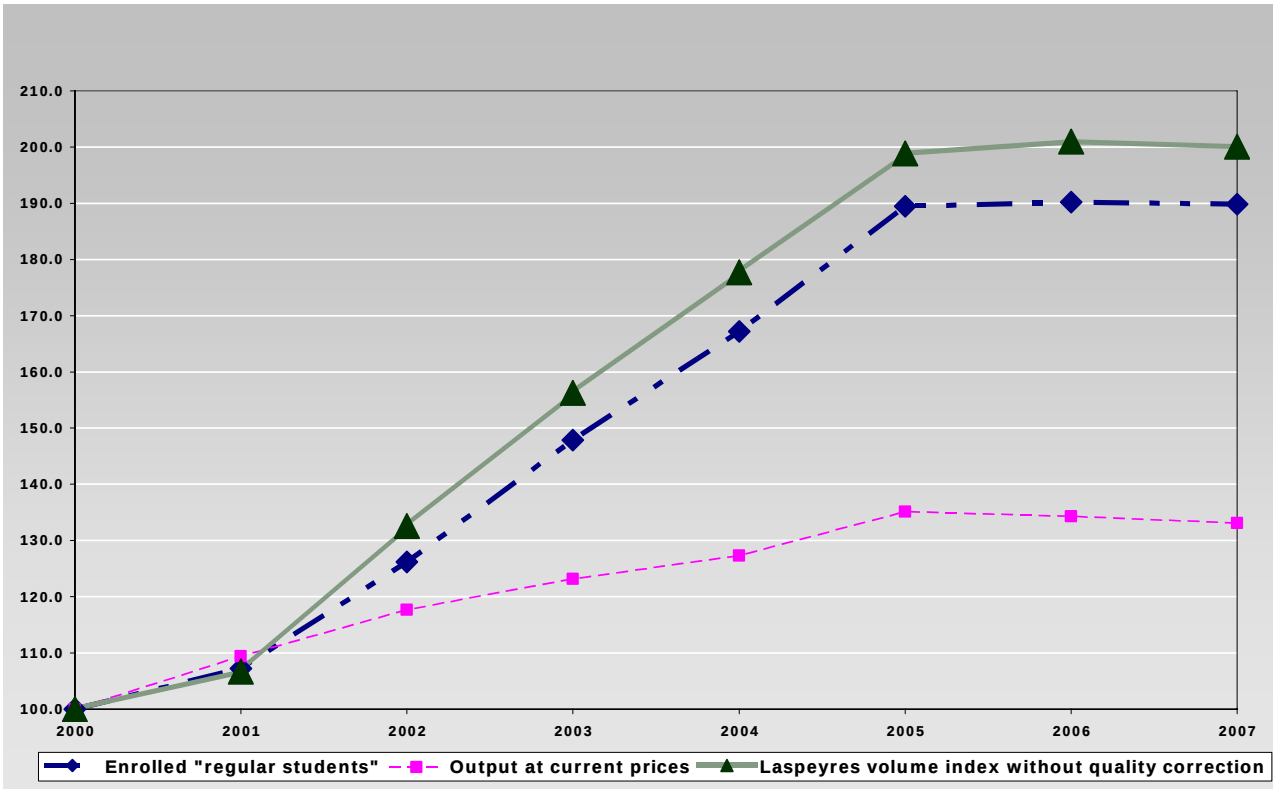


Figure 13. University education: Quantity Indices (previous year = 100)

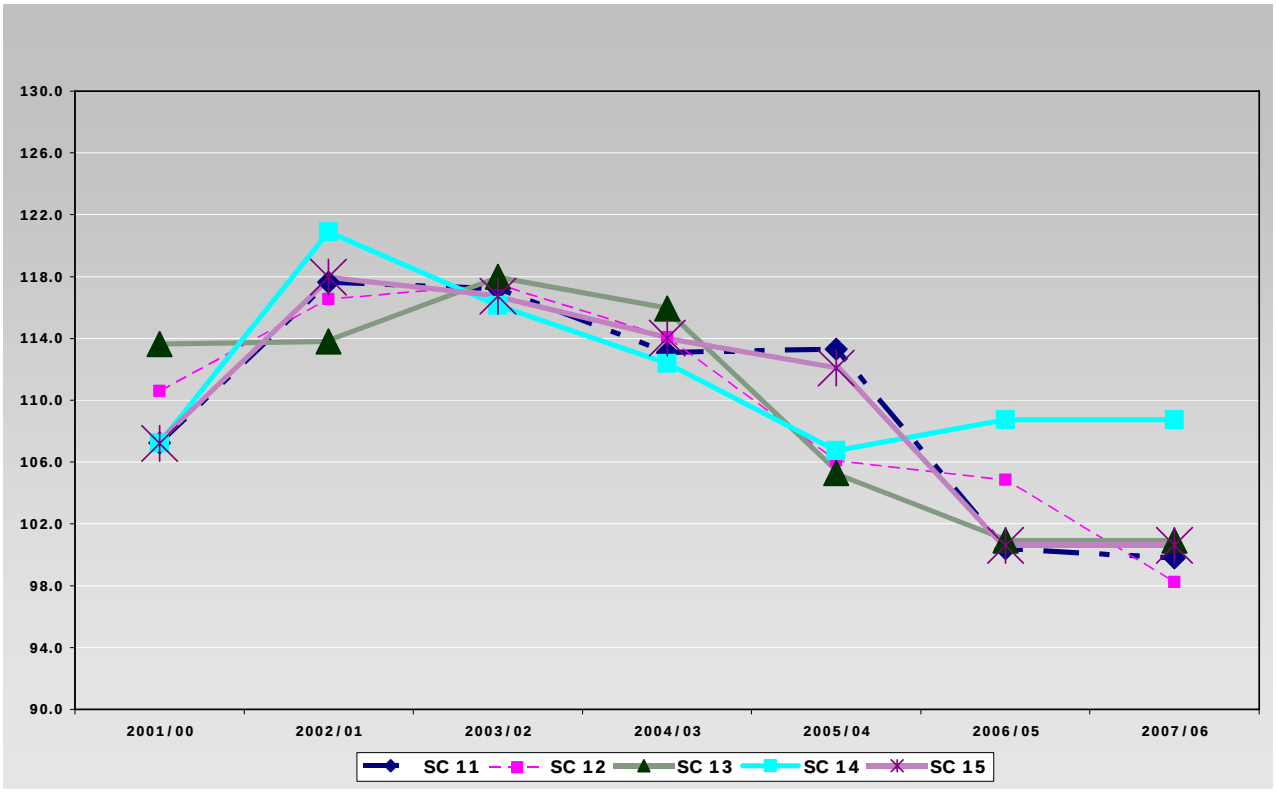


Figure 14. University education: Comparison among Laspeyres volume indices (previous year = 100)

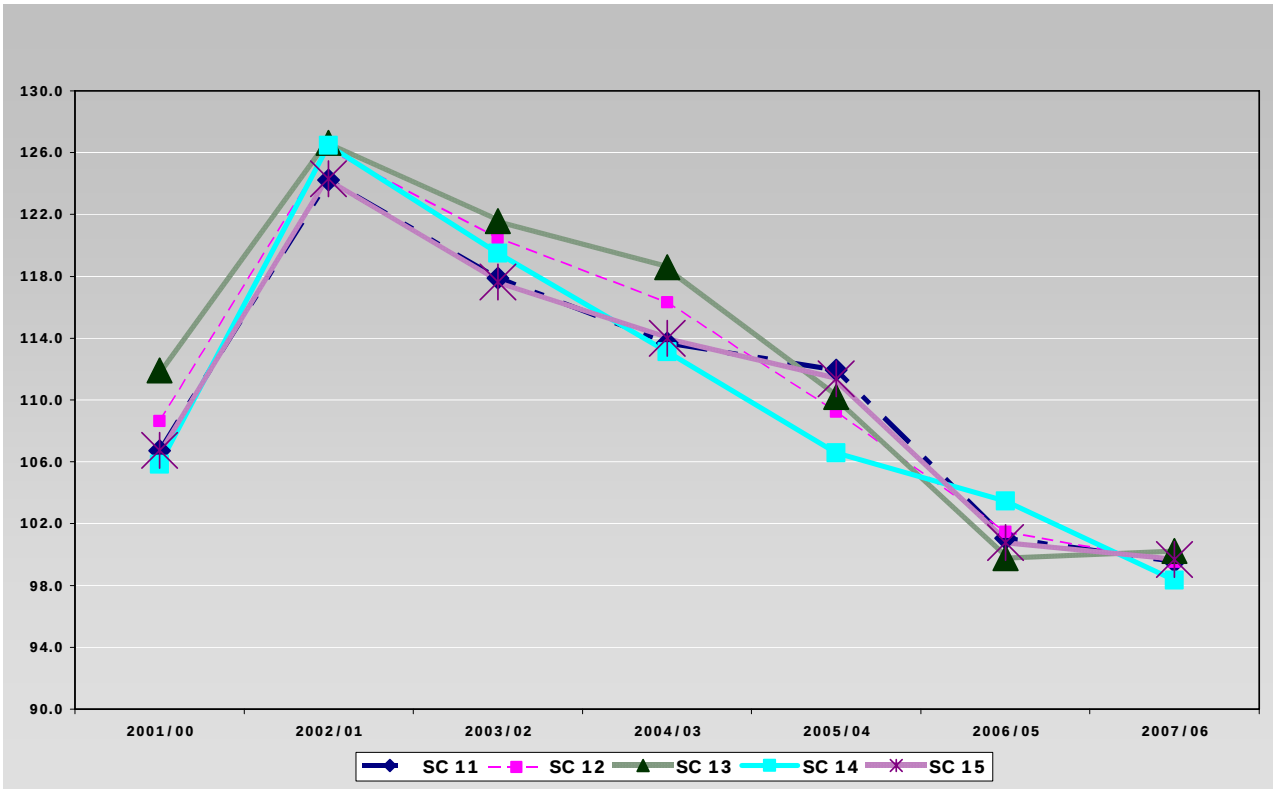
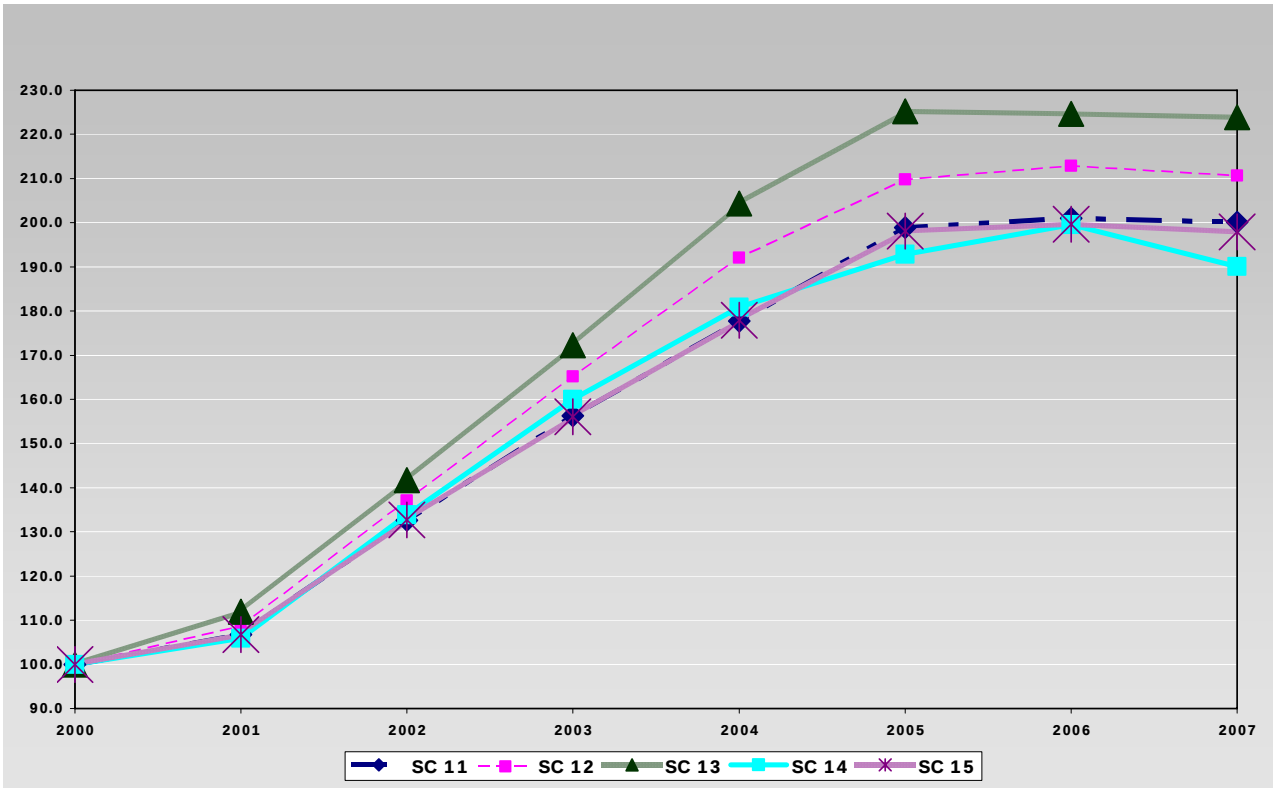


Figure 15. University education: Chained Volume indices (2000 = 100)



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