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**STATISTICS DIRECTORATE
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Working Party on National Accounts

MEASURING OUTPUT OF SECONDARY EDUCATION IN THE NETHERLANDS

**To be held on 14-16 October 2008
Tour Europe, Paris la Défense
Beginning at 9:00 a.m. on the first day**

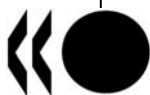
This document has been prepared by Mieke Struik and Peter Hein van Mulligen, Statistics Netherlands and will be presented under item 10 of the draft agenda

The views expressed in this paper are those of the authors and do not necessarily reflect the policies of Statistics Netherlands

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I. Introduction

1. This report describes the results derived from research to find a method to measure the output of secondary education in the Netherlands. The method that is currently in use in the National Accounts is based on a simple pupil count, where pupils are stratified according to their school types.

2. In the current method, the number of pupils attending a certain school type is weighted with the costs of this school type. These costs are part of the budget of the education department. However, it is questionable whether costs are a good indicator of the relative production value of a school type, since costs do not necessarily give any indication on the effectiveness of education. Cost-weighted pupil numbers may then not be the best way to measure output of secondary education.

3. The current method would classify as a B-method as defined by Eurostat (2001) and the OECD (2007). A serious missing part to qualify for an A-method is the lack of adjusting for quality. The aim of this research was to investigate whether a volume method is attainable that gives a more suitable measure of education output which brings a notion of quality into the index and to find a way to measure this in practice. Here, we define the transfer of knowledge and skills as the quality-adjusted output of (secondary) education. Section 2 provides more detail on this concept.

4. In section 3, we explain how we make this concept operational and provide some empirical results. Section 4 explores the remaining issues and gives a preliminary conclusion.

II. Transfers of knowledge and skills as the output of education

5. To measure the output of (secondary) education, we first need a proper definition of this output. From the perspective of an individual pupil, the main reason to receive education is to acquire the skills and knowledge that are necessary to earn income in a later stage of life. From the point of view of the government, the main supplier of education, the goal is to have an educated workforce. So both from a user's and a supplier's perspective, the purpose of education is to increase the skills and knowledge of pupils. We therefore choose the transfer of skills and knowledge as the output of education. This is in line with the concept of output as it is defined by the OECD (2007).

6. Given the concept of output, we need a unit of measurement of the transfer of skills and knowledge. The lowest level of aggregation is that of the individual pupil. For the unit of output, we thus propose the transfer of skills and knowledge to a single pupil in a given year.

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7. Of course, the skills and knowledge a pupil learns in a single year depends on many things. But for the measurement of output, these factors are only really relevant when there is a clear trend in time. If not, they do not influence output growth of education.

8. The following factors have a strong contribution on the acquisition of skills and knowledge:

9. First, there are the characteristics of the pupil, like intelligence, the starting skill and knowledge level and background factors. Regarding background factors and intelligence, we make the assumption that these do not change significantly through time. This assumption cannot be made on the starting level. In the first place, the level of skills and knowledge when a pupil enrolls secondary education depends on the quality of his or her primary education. This quality cannot be assumed to be constant in time. The second reason is that in the Netherlands, the share of pupils with a deficit in skills and knowledge is increasing. This is mainly caused by the increasing share of pupils with a non-Western background, who tend to have a lower mastery of Dutch. Schools have to spend more time and effort to bring the skills and knowledge of these pupils to the desired level.

10. The second factor is the type of secondary education a pupil follows. If there would be only one type, we could measure output with a simple pupil count, other things being equal. But with different school types, an aggregation across these different types is necessary. To aggregate, we need to be able to homogenise the skills and knowledge acquired at the different school types to add them up. Suppose for example that there are two levels of secondary education, where pupils of the higher level learn twice as much as those at the lower level. In that case, the number of pupils at the higher level would count for twice as much as those at the lower level.

11. Note that we assume that the skills and knowledge a pupil on a given school type acquires is spread evenly among the different school years.

12. The third factor is the general quality of secondary education. In the Netherlands, probably like in many other countries, there is a strong discussion that the quality of both primary and secondary education is declining rapidly. On the other hand, this tends to be a discussion of all ages. The quality of education may not decline as fast as is sometimes suggested and in some respects, one could plausibly argue that the quality of education is increasing. The fact is that today's pupils learn different things than they did fifty or even ten years ago, because society rewards other skills than fifty or ten years ago.² In any case, to properly measure output of education, a quality adjustment is called for.

13. Unfortunately, there are serious measurement problems that prevent us from taking all these factors into account. Ideally, we want to know on an individual pupil base the amount of skills and knowledge gained within one year. For that, we would need at the least the skill level of an individual pupil at the start and the end of the school year. Using grades is not an option. In the first place, these are only available for the final exam year and in the second place these are not reliable indicators of the level of skills and knowledge. Average grades tend to be almost completely constant over time, mainly because the exams and grades are adjusted according to pupils' performance.

14. To measure skill levels, we need time invariant yearly tests that not only measure the development of skills and knowledge of an individual pupil, but also that of the general level of skills and knowledge as a whole. Such tests do not exist and may not even be developed. With this in mind, we have to make some simplifying adjustments for measuring education output.

² A parliamentary investigation on the modernization of secondary education has found no conclusive evidence of a decline of the overall level of education. However, the investigation did not provide very detailed quantitative analyses.

15. First, we assume that the quality of education as a whole and the characteristics of pupils remain constant. This may not be too far-fetched in the case of quality: some aspects of education worsen, whereas others improve, possibly resulting in a net constant trend in time. For pupils' characteristics, this seems less plausible. There is clear evidence that the share of pupils with a lesser command of Dutch is increasing. Not accounting for this rising share results in an underestimation of the actual output, because these pupils need to increase their skills and levels more than other pupils to be able to meet the final exam requirements. Combined with the rising costs of secondary education, especially of the lower levels where these pupils are concentrated, this could result in an underestimate of productivity growth in education.

16. Our second assumption is that it is possible to homogenise the skills and knowledge students acquire at different school levels. We do this by attaining relative 'skill and knowledge values' to the different levels of education. We use two approaches to determine these relative values, as explained in the next section.

17. Summing up, our output index for secondary education looks as follows:

$$I_{SE}^t = \frac{\sum_i \alpha_i q_i^t}{\sum_i \alpha_i q_i^0} \quad (1),$$

where q_i^t is the number of pupils in year t that completes a school year in school type i and α_i^t is the relative value of this school type. Note that we only consider pupils that successfully complete a school year. Those that repeat a school year are for the purpose of this method assumed to have gained no additional skills and knowledge. This is mainly a simplifying assumption. The total amount of skills and knowledge gained when a pupil gains his diploma at the end of the last school year is assumed to be the same for all pupils of this school type. The number of years it took a pupil is assumed not to change that. Likewise, pupils who skip a class are assumed to have gained twice the normal amount of skills and levels.

III. Implementing the alternative approach and some results

18. We applied our approach to a subset of secondary education in the Netherlands. This subset includes three different school types, known by their acronyms as VMBO (vocational secondary education), HAVO (general secondary education) and VWO (pre-academic secondary education). This subset represents around 65% of all pupils. Most of the missing part of the pupils (more than 30%) follows advanced vocational secondary education (MBO), which pupils can only enrol if they have completed one of the other three school types. The reason to study only this subset for now is that the advanced vocational secondary education is not easily related to the other school types.

19. The different school types serve to prepare students for different kinds of follow-up education. Pupils from vocational secondary education are expected to move on to advanced vocational secondary education. General secondary education is meant as a preparation for vocational tertiary education (polytechnics) and pupils from pre-academic secondary education are, not surprisingly, prepared for university.

20. Given these different purposes of the different school types, the level and kind of skills and knowledge varies greatly between the school types. We cannot simply add up the amount of skills and knowledge acquired by pupils in one school type (measured by the number of pupils who completed a year in that school type) and those on other school types. To homogenise the different sets and levels of skills and knowledge, we use equation (1).

21. The next step is to identify the relative values α of the different school types. Here, we use two different approaches. The first uses the system by which Dutch pupils move up to other school types. The second approach uses PISA-scores attained by pupils from the different school types.

22. Instead of moving on to the usual follow-up education, Dutch pupils who finished one school type can move on to another type of secondary education. So a pupil who got his diploma in vocational secondary education can enrol general secondary education and even pre-academic secondary education after that, eventually moving on to university.³ This ‘piling’ of diplomas has been out of fashion for some time, but has been regaining popularity recently.

23. Moving up to a higher level of secondary education is done according to a fixed scheme. Pupils who finished vocational secondary education (which lasts four years) to proceed to the fourth grade of general secondary education, which lasts five years. After this, they can move on to the fifth grade of pre-academic secondary education, which has six grades.

24. Using this system, we can derive relative values of one year of education at a certain school type. For instance, pupils can start the fourth grade of general secondary education by either completing the third grade or by completing vocational secondary education, which lasts four years. This makes three years of general secondary education basically equivalent to four years of vocational secondary education. The value of one year of general secondary education relative to one year of vocational secondary education is then equal to $1\frac{1}{3}$. Analogously, the relative value of one year of pre-academic secondary education compared with general secondary education is $1\frac{1}{4}$.

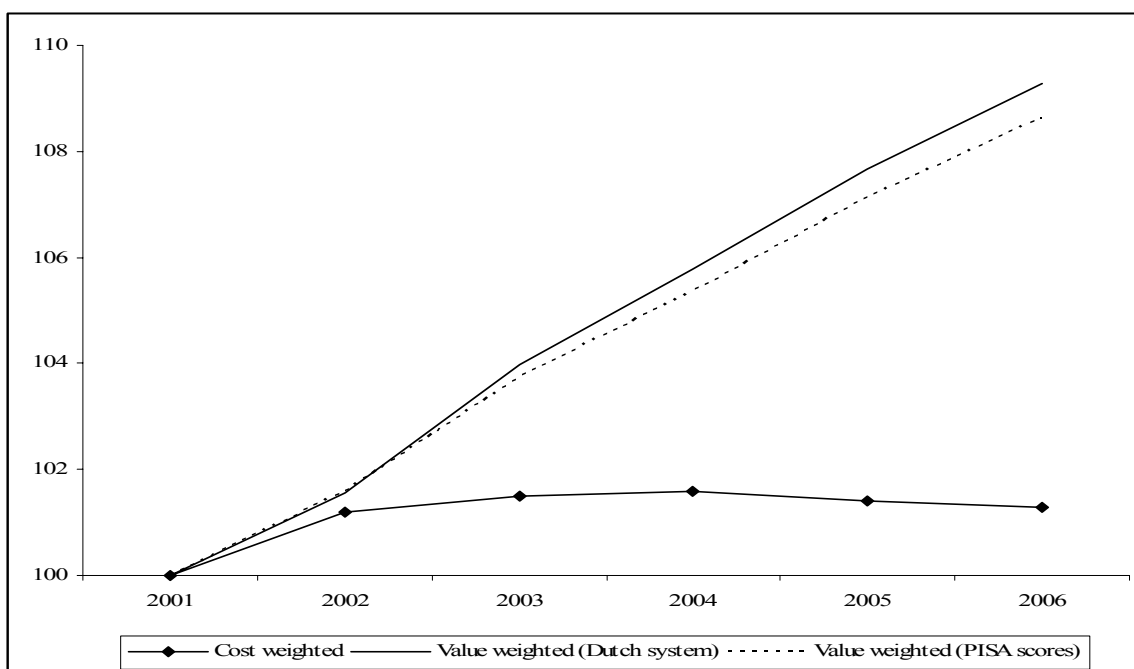
25. If we choose vocational secondary education as our base, the values for α of the three school types are 1, $1\frac{1}{3}$ and $1\frac{1}{3} \times 1\frac{1}{4} = 1\frac{2}{3}$ respectively.

26. Alternatively, PISA-scores can also be used to value the skills and knowledge acquired at the different school types. PISA is a recurring standardised test to measure performance of 15-year olds in OECD countries. It takes place every three years, the latest one being in 2006. For the Netherlands, average PISA scores are known for pupils attending the three different school types. In 2006, these are 478, 583 and 631 for vocational, general and pre-academic secondary education, respectively. Using these scores as the relative values of a single school year in the different school types and again using vocational secondary education as our base, the relative values are 1, 1.12 and 1.32, respectively. These relative values are somewhat lower than the ones based on the Dutch system of moving on between school types, suggesting that the relative values of the lower levels of secondary education are underestimated.

27. This may or may not be the case. The PISA-scores are those for 15-year olds. At that age, pupils tend to be in third grade and it may well be the case that the biggest discrepancies between the school types occur after third. Another possibility is that PISA scores show no linear trend with increasing test performance, so that simply dividing raw PISA scores does not give a good indication of the relative skill and knowledge levels of pupils.

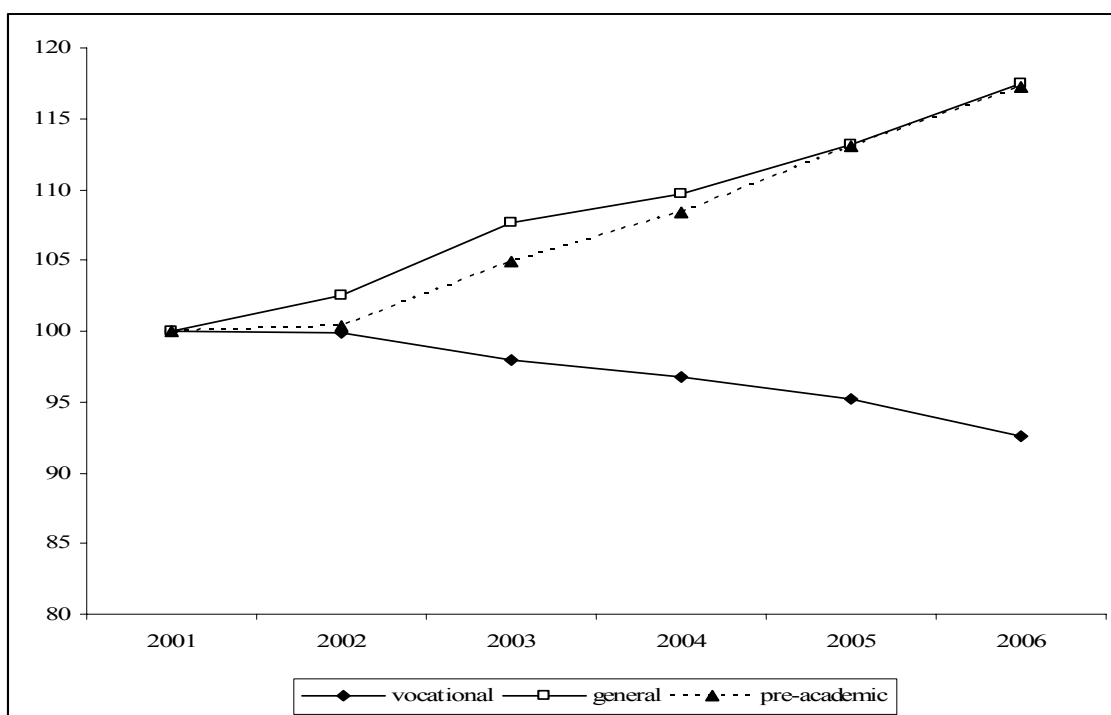
28. Whatever the cause of the difference, we used both approaches to compare our alternative output-indexes with the current one in the Dutch National Accounts, which is a cost-weighted index of pupil numbers. The results are shown in graph 1.

³ Such cases are rare, but not unusual.



Graph 1. Output of Dutch secondary education, aggregated with costs or relative values

29. The results from graph 1 are rather striking. Weighting the number of pupils from the different school levels with the costs of these different levels seems to seriously underestimate the output of secondary education. This can be explained when we take a look at the development of the number of pupils in the different school types, as shown in graph 2.



Graph 2. Development of the number of pupils in the three levels of secondary education

30. Graph 2 shows a clear and steady decline in the number of pupils in the lowest level of secondary education, whereas the two other levels show an average increase in of more than 3% per year. These growth rates obscure the actual numbers of pupils. In 2006, around 450,000 pupils attended vocational secondary education, whereas the other two had around 220,000 pupils each. In the period studied, the share of pupils in vocational secondary education dropped from 49% to 43%.

31. The costs per pupil in vocational secondary education are a lot higher than those in the other two types of secondary education. This is to a large extent related to the high share of pupils with a lower mastery of Dutch, to which we referred earlier. Together this means that the share in total costs of vocational secondary education is larger than that of the other two types combined. This means that a cost-weighted output index, where the numbers of pupils are treated as output, a decrease in the number of pupils in vocational secondary education means that the overall output index is likely to have a trend that is much lower than that of an index where the relative 'skill and knowledge values' are used as weights.

32. Looking back at graph 1, this is precisely what happens. Both valued-weighted indexes are far above the cost-weighted index. This reflects the rising share of pupils in the higher levels of education relative to those in the lower level. Since the relative values using the Dutch system of moving on between school levels are somewhat higher than those obtained using PISA-results, the former has a slightly, but substantial, steeper trend than the latter.

33. Another trend that suggests that the output of secondary education is actually rising is that of the share of pupils that have to repeat a class. The more pupils need to repeat a class, the more the education system fails to pass on relevant skills and knowledge. Of course, this assumes that the level of skills and knowledge that are taught (meaning the 'quality' of education output) is not decreasing, so that pupils more easily meet the standards to complete a year.

IV. Evaluation

34. Assuming that pupils in the higher levels of secondary education acquire more skills and knowledge than those in lower levels of education, the alternative output indexes that were explored here seem to give a better view of the amount of skills and values passed on by secondary education than the current index in the Dutch National Accounts. When the share of pupils in the higher levels sharply increases, one would expect a rising index of the output of secondary education. The value-weighted index show such an increase, but the cost-weighted index decreases because of the large share in costs of vocational secondary education.

35. That seems a clear improvement over the existing method, but the alternative method is not without drawback. In the first place, we had to make a lot of assumptions for the alternative method. Many of these assumptions, regarding the quality of secondary education in general and the share of students with a lower mastery of Dutch are assumptions that are not specific to this method. The current method in the Dutch National Accounts implicitly makes similar assumptions. Increasing numbers of pupils with a lower mastery of Dutch in vocational secondary education are there reflected in the increasing costs of this school type, but is far from clear whether there is a direct relation with the output of this school type.

36. A more important assumption for the proposed alternative is that there is a way to homogenise the skills and knowledge of the different school types. For example, what is the relative value of being able to translate Homer (taught at some pre-academic schools) compared with basic vocational skills such as metalworking? The overall relative value suggests that this is $1\frac{2}{3}$ or 1.32, but how plausible are these values? And is it even possible to determine such a relative value, regardless of its size? This is an important issue, in which we need to investigate more.

37. Then there is the problem that the alternative methods are not easily reconciled with standard practice in National Accounts. In National Accounts, it is customary to weigh non-market output with costs and not some notion of value, since costs are taken to represent value. Again, this needs some further work. Would it be possible to treat the relative values as a notion of quality and extend this to other forms of government output?

38. Finally, there are some practical problems to which we have spent little attention here. The alternative methods ignore advanced vocational education, which represents about a third of all pupils in secondary education. Then there is the problem of the mixed first few grades in many schools, where pupils only enter either type of school in their second or even third grade. Before that, no distinction can be made between different levels. These are practical issues which currently prevent the alternative method to be employed in National Accounts, but can probably be easily solved compared with many of the more conceptual problems.

39. On balance, there remains a lot of research to be done to achieve an index that properly measures output of secondary education. However, for now we believe that the alternative suggested here provides a better measure of the output of secondary education than the current index used in the Dutch National Accounts.

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