KM 22(1986)
pag 113-130



# THE IMPACT OF SOCIO-ECONOMIC FACTORS ON THE DEMAND FOR EDUCATION

by B. Kuhry*

Summary

This study deals with enrolment in full-time education in the Netherlands from 1974 to 1983. It is aiming at an evaluation of macro-information regarding stocks and flows of pupils. Socio-economic factors considered are national income, salaries, price of education, unemployment levels, emancipation and reserves of ability. Main explanatory factors turn out to be emancipation and unemployment. Results allow an estimation of the "discouraged worker" effect with respect to enrolment and of the price elasticity of the demand for education. The model has been applied for forecasting purposes.

* Centraal Planbureau, Van Stolkweg 14,
2585 JR 's-Gravenhage, tel. 070-514151

## 1. Introduction

Enrolment in secondary and higher education has been studied both from a sociological and economic point of view. From a sociological angle, interest focuses on social background, sex and abilities of pupils on various levels of the educational system. The main theme is social inequality (e.g. Boudon, 1974). The Dutch Central Bureau of Statistics has a long tradition in the collection of longitudinal data yielding excellent material for this type of survey. A recent summary of the results of this approach is given by Dronkers (1983).

From the economic point of view, emphasis is given to consumption and investment motives. In the human capital approach (Becker, 1975) direct and indirect costs of education are compared with the salary profits after completion of the study. Attempts have been made to incorporate the risk of unemployment in the human capital approach (Freeman, 1976). Recent Dutch applications of this theory to university enrolment are Kodde (1985a) and Huijsman et al. (1986).

The present study aims at an analysis of macro-information regarding stocks and flows of pupils in full-time education. Elements are taken both from the sociological and economic approach. The method chosen, estimation of behavioral equations, is a typically economic one. Although various economic incentives such as price of education, differences in salaries and unemployment have been incorporated, no attempt has been made to adopt a human capital framework. A novelty is the simultaneous analysis of enrolment and outflow at all levels of the educational system. Of particular importance is the linkage of the analytical model to an existing forecasting model allowing a direct application of results in forecasting future enrolment.

## 2. The SKILL-model

At the Central Planning Bureau an educational projection system has been developed aiming at a simultaneous prediction of number of pupils, school-leavers and total population by educational attainment. This so-called SKILL-model is operational since 1980, but has been improved and extended in the following years. Recently, a forecast of labour supply by educational attainment has been produced by combining SKILL-results with the labour supply projection of CPB.

SKILL is based on a flow matrix representing the entire educational system. An outline of the structure of this matrix is given in Figure 1. It represents the relationship between stocks of persons in two successive school years. Students are subdivided by school type and grade, the non-schoolgoing population by educational attainment. Apart from flows within full-time education (FTE), departures from and entries into

Figure 1: Structure of the SKILL flow matrix

| stocks in t | stocks in t+1 | Full-time education (FTE) type and grade<br>1 2 3 . . . | Population outside FTE by educational type<br>a b c . . |
|---|---|---|---|
| FTE | 1<br>2<br>3<br>. | (A)<br>Flows within FTE | (B)<br>Schoolleavers (incl. emigration, mortality) |
| Population outside FTE | | (C)<br>Entry into FTE (incl. immigration) | (D)<br>changes by demographic processes processes and Part-time Educ. (PTE) |

it are represented in the matrix. Moreover, changes in the non-schoolgoing population occur as a result of part-time education (PTE), in-service training, international migration, birth, decease and retirement. Data for the reconstruction of this flow matrix are obtained from the Central Bureau of Statistics.

Dividing numbers in this matrix by the corresponding row sums yields flow coefficients. In principle, these allow a stepwise forecasting of future stocks, the stock vector in year t+1 being calculated as the product of the stock vector in year t and the matrix of flow coefficients. Outcomes include pupil numbers, school-leavers and non-schoolgoing population by sex, age, level and field of study.

In this simplified account, the observed matrix of flow coefficients is kept constant over the entire projection period. This procedure may be justified for coefficients representing transitions within school types, but is certainly not appropriate for those representing transitions between school types, entries into and departures from full-time education. Together with the demographic projection prepared by the Central Bureau of Statistics, the prediction of these so-called strategic coefficients constitutes the main dynamic element in the SKILL procedure.

Sofar, trend extrapolation has been the main method for predicting future developments in strategic flow coefficients. Appropriate adaptations have been made in cases where intended government actions might interfere with pupils' options (e.g. introduction of new school types or abolition of existing ones). The present study aims at investigating the statistical coherence between enrolment decisions and underlying factors of a psychological, social and economic nature. By doing so, a step can be taken towards the replacement of mechanical trend extrapolation by predictions based on an analysis of reactions to changing environmental conditions. Simultaneously, progress is made towards an integration of the educational model into

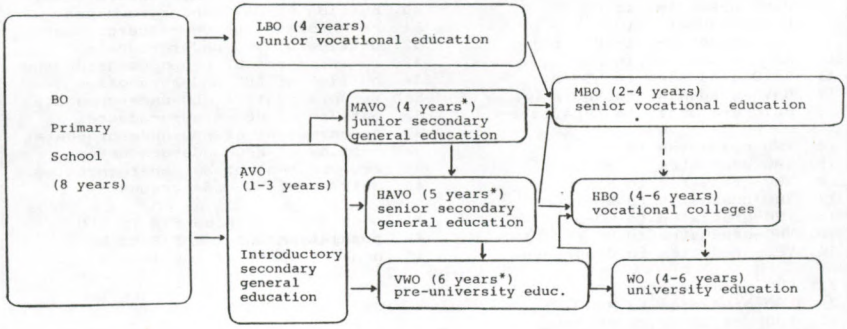
central economic projection models.

For a more detailed description of the SKILL-model, the reader is referred to Kuhry (1985) and Kuhry and Passenier (1986). Recent outcomes are given in C.P.B. (1986b).

## 3. The dutch school system and its strategic junctions

The dutch school system comprises eight years of primary education, four to eight years of secondary education and four to six years of higher education (Figure 2). Primary school and four years of secondary education are compulsory. The first important junction lies at the end of primary education and implies a choice between junior vocational training (LBO) and secondary general education which again allows admission to three levels of advanced vocational training (MBO, HBO and WO).

Figure 2: The Dutch school system




* including introductory years

Within vocational education a variety of fields may be selected which for the present purpose have been classified into three main branches: "technical", "administrative" and "person-related". The first category comprises engineering, science and agriculture; the second one law, economics, commerce and management; and the third one medicine, social studies, teachers' and social workers' training.

For the present purpose, only those strategical options have been considered that concern age groups facing the dilemma of continuing or ending the school career. The coefficients representing the selected junctions in the school system are listed in Figure 3. The present study aims at an explanation of the annual changes in these flow coefficients as available from aggregate data published by the Central Bureau of Statistics.

Figure 3: Selected flow coefficients

1. MAVO-graduates to HAVO
2. MAVO-graduates to MBO-t*
3. MAVO-graduates to MBO-a*
4. MAVO-graduates to MBO-p*
5. MAVO-graduates to departure

6. HAVO-graduates to VWO
7. HAVO-graduates to MBO-t
8. HAVO-graduates to MBO-a
9. HAVO-graduates to MBO-p
10. HAVO-graduates to HBO-t
11. HAVO-graduates to HBO-a
12. HAVO-graduates to HBO-p
13. HAVO-graduates to departure

14. VWO-graduates to HBO-t
15. VWO-graduates to HBO-a
16. VWO-graduates to HBO-p
17. VWO-graduates to WO-t
18. VWO-graduates to WO-a
19. VWO-graduates to WO-p
20. VWO-graduates to departure

21. LBO-graduates to LBO
22. LBO-graduates to MBO
23. LBO-graduates to departure

24. MBO-graduates to MBO
25. MBO-graduates to HBO
26. MBO-graduates to departure

27. re-enrolment of MAVO-undergraduates
28. outflow of MAVO-undergraduates
29. re-enrolment of HAVO-undergraduates
30. outflow of HAVO-undergraduates
31. re-enrolment of VWO-undergraduates
32. outflow of VWO-undergraduates
33. re-enrolment of LBO-undergraduates
34. outflow of LBO-undergraduates
35. re-enrolment of MBO-undergraduates
36. outflow of MBO-undergraduates
37. re-enrolment of HBO-undergraduates
38. outflow of HBO-undergraduates
39. re-enrolment of WO-undergraduates
40. outflow of WO-undergraduates

41. population outside FTE to HBO
42. population outside FTE to WO
43. non-enrolment of population

* t= technical, a= administrative, p= person-related (see text).

4. Selection of explanatory variables

a. national income (N)

The real per capita national income exerts an influence on the individual as well as on the national level. On the individual level it provides the resources available for financing studies, on the national level the funds for supplying educational facilities. Differences in national income offer some explanation for the temporal development of enrolment rates in separate countries as well as for differences in enrolment between rich and poor countries (see for an elaborate discussion Blaug, 1970).

b. price of education (P)

Education may be regarded as a consumption good increasing the quality of life (during and after study). As such, the demand for education may be influenced by quality and variety of educational facilities and by the private price of education. An important entity is the price elasticity of the demand for education, the degree in which an increase in price induces a decrease in enrolment. A distinction can be made between direct costs, consisting of tuition fees, and indirect costs, consisting of earnings foregone (corrected for grants and other subsidies). Preliminary estimation results indicated that only the direct cost component has explanatory power. Hence, only the latter component has been included in the final analysis.

c. income prospects (W)

A higher level of educational attainment in general yields better income prospects. It is reasonable to assume that an improvement of the relative income after completing a study will have a positive effect on enrolment. The reverse may be expected in case of worsening income prospects. A micro-

economic study by Kodde (1985) supports this view, although other aspects such as the interest in a certain profession, unemployment risks and self-development turn out to be factors of greater importance.

As a proxy for salary developments by educational level, the relative increase of salaries for appropriate ranks in the civil service is taken. In view of the fact that salaries in the public sector have fallen behind those of the private sector in this period, this choice is hardly satisfactory. However, no coherent data are available for other categories of workers.

d. unemployment (U)

One would expect a rise of the enrolment rate as a result of an increase in the general unemployment level. A prime motive for setting up the present study is the quantification of this so-called discouraged worker effect. Moreover, enrolment may be expected to shift from fields with high unemployment risks to fields with better prospects.

Data on the development of unemployment by educational level are available from the Ministry of Social Affairs. The corresponding labour supply data are supplied by Labour Force Surveys of the Central Bureau of Statistics. Tedious corrections have to be carried out as a result of changing definitions of educational categories.
A problem is involved in selecting a suitable lag for unemployment reactions. It may even be reasonable to assume some kind of anticipation. As a first choice, developments in unemployment in the previous year were taken. Results did not improve by introducing lags of one more year.

e. emancipation (S)

There is a traditional difference between the educational careers of men and women. Males show a preference for tech-

nical fields and women for "person-related" fields (teaching, medical studies, socio-pedagogical studies, etc.). Moreover, females systematically choose for lower types of advanced education and depart earlier from the educational system. Especially with respect to educational level, the traditional arrears of females are decreasing steadily. With respect to field, emancipatory processes are slow but persistent.

This prevalent tendency for emancipation is incorporated in the present study as an exogenous factor defined as the difference between male and female flow coefficients for females, and the reverse for males. The estimated coefficients can be interpreted as emancipation rates. A preliminary investigation revealed that the emancipation variable only has explanatory power for female behaviour. Therefore, it has been omitted in male cases.

f. reserves of talent (R)

On the individual level, ability has a considerable influence on the educational career. In the past, social and financial factors used to play an obstructing rôle in the enrolment of persons whose parents belonged to the lower income class. As a result, substantial reserves of talent remained unused (Van Heek, 1968, Boudon, 1974). In connection with the spectacular increase of the enrolment rate in the last decades, these reserves appear to be almost depleted. A correlation still can be observed between enrolment and social background, but this is mainly due to differences in educational achievement (Faasse et al., 1986).

Therefore, one might expect the occurrence of saturation effects: the higher the proportion of a generation reaching a certain educational level the less the proportion opting for a continuation of studies at a still higher level. An appropriate operational definition of this exogenous factor

may be the size of the stock of reference (e.g. graduates from a certain school type) divided by the size of the total corresponding age generation.

## 5. Specification of the model

The model is formulated in terms of annual changes rather than in terms of the observed levels.

For a set of flow coefficients corresponding with the options of a particular stock of pupils or graduates, a set of equations of the following type is postulated:

$$\Delta c_i = a_0 b_i + a_1 b_i \overset{\circ}{N} + a_2 d_i \Delta R + a_3 S_i + a_4 c_i (\overset{\circ}{P}_i - \overline{\overset{\circ}{P}})$$

$$+ a_5 c_i (\overset{\circ}{W}_i - \overline{\overset{\circ}{W}}) + a_6 c_i (\Delta U_i - \Delta\bar{U}) + a_7 b_i \Delta G$$

Here, c stands for the flow coefficients, N for per capita national income, R for utilization of talent, S for differences in flow behaviour between men and women, P for price of education, W for wages, U for specific and G for general unemployment rate. b and d are dummies explained below. The symbol $\Delta$ stands for absolute annual changes, the superscript $^\circ$ for relative annual changes. The suffix i denotes the available options. Yearly changes refer to the transition from year t to t+1. Variables and dummies indicating levels ($S_i$, $c_i$, $d_i$ and $b_i$) refer to year t.

Since the same parameters are assumed to apply to all equations corresponding to flows from the same stock of origin, the available number of observations for each stock of origin equals the number of years multiplied by the number of options.

Since flow coefficients add up to unity for each stock of origin, changes in flow coefficients must add up to zero. The construction of the independent variables ensures that effects

over the different options also add up to zero. Variables characterized by different values for the options involved are corrected by subtraction of their mean, variables which have the same value for all options are multiplied with a dummy (b or d) in order to ensure a zero sum. $b_i$ is defined as -1 in case of outflow and $c_i/(1-c_v)$ in all other cases ($c_v$ being the coefficient of outflow). Similarly $d_i$ equals $c_i/c_h$ for flows towards the highest educational level and $-c_i/(1-c_h)$ for all other flows including outflow ($c_h$ being the sum of all flow coefficients of the first type).

A shortcoming of these constructions involving dummies is the generation of spurious components in the correlation between variables. This must be kept in mind when interpreting results. Moreover, computed t-values must be corrected in view of the mutual dependence of flow coefficients (Nieuwenhuis, 1977).

In the estimation procedure, yearly data for the period 1974 to 1983 have been used. Since the model is formulated in terms of annual changes, the observation period is 9 years.

## 6. Results of estimation procedure

In the first estimation runs both the salary variable and the national income variable appeared to lack explanatory power and have therefore been eliminated in the final analysis. This is not very satisfactory from an economists point of view. It remains quite possible that enrolment might have increased more rapidly in a situation of increasing salary differences, but such an effect could not be traced in the relatively simple macro-analysis carried out here. In the case of national income, an alternative solution would have been to fix the elasticity of national income on the basis of observations over several decades.

After carrying out the above adaptations, the model was re-estimated. Results are given in Table 1. With respect to the

Table 1: Results of estimation (after elimination of some variables)

| variable<br>expected sign | c | R<br>- | E<br>+ | P<br>- | U<br>- | G<br>+ | $R^2$ | VNR | n |
|---|---|---|---|---|---|---|---|---|---|
| Males | | | | | | | | | |
| MAVO-graduates | +0.002 | -0.532 | | -0.365 | -4.240* | +0.801 | 0.485 | 1.63 | 45 |
| HAVO-graduates | -0.011 | -0.260 | | -0.269 | +1.028 | +1.888* | 0.328 | 0.91 | 72 |
| VWO-graduates | +0.010 | -2.911 | | -0.286 | -2.357 | -0.349 | 0.152 | 2.87 | 63 |
| LBO-graduates | +0.006 | -0.180 | | +0.587 | -0.746 | +0.749 | 0.643 | 2.37 | 27 |
| MBO-graduates | +0.009 | +0.509 | | +0.336 | +2.294 | -0.143 | 0.257 | 2.77 | 27 |
| all graduates second level | +0.002 | -0.175* | | +0.083 | -2.592* | +0.522* | 0.237 | 1.92 | 234 |
| without certif. third level | -0.001 | -0.098* | | -0.406* | -4.358* | +0.143 | 0.347 | 0.97 | 90 |
| without certif. | +0.009 | -0.595* | | -1.149* | +6.302 | +0.844 | 0.498 | 2.49 | 36 |
| entries HBO/WO | -0.002 | +0.073 | | -0.099 | -2.846 | -0.186 | 0.248 | 2.84 | 27 |
| Females | | | | | | | | | |
| MAVO-graduates | +0.009 | -0.364 | +0.025* | -0.322 | -4.422* | +0.749 | 0.705 | 1.47 | 45 |
| HAVO-graduates | -0.028* | -0.845 | +0.051* | -0.536* | +3.625* | +2.907* | 0.695 | 1.03 | 72 |
| VWO-graduates | -0.003 | -1.843 | +0.029 | -0.171 | +0.570 | +0.569 | 0.121 | 1.86 | 63 |
| LBO-graduates | +0.009 | +0.119 | +0.050 | +0.586 | -2.080 | -0.082 | 0.582 | 1.70 | 27 |
| MBO-graduates | -0.011 | -0.035 | +0.111 | +0.006 | -120.8 | +1.164* | 0.527 | 2.67 | 27 |
| all graduates second level | -0.005 | +0.139* | +0.028* | -0.010 | -2.268* | +0.594* | 0.322 | 1.38 | 234 |
| without certif. third level | -0.002 | -0.059 | +0.212 | -0.157 | -2.083 | +0.137 | 0.172 | 1.54 | 90 |
| without certif. | +0.009 | -0.647 | -0.075 | -0.425 | -1.994 | +0.340 | 0.383 | 2.92 | 36 |
| entries HBO/WO | +0.009 | +0.068 | -0.094 | -0.142 | +0.839 | +0.028 | 0.593 | 2.66 | 27 |

R= utilization of talent, E= emancipation, P= price of education, U= specific unemployment, G= general unemployment
* significant at .95 level VNR = Von Neuman Ratio n = number of observations

remaining variables, original hypotheses regarding the impact on the enrolment rate are broadly confirmed. Out of the 81 estimated coefficients (excluding constant terms) 59 have the correct sign; 21 are significant of which 19 have the expected sign. Part of the discrepancies may be explained. The degree of utilization of talent is not properly measured in the case of external inflow into higher education. The expected negative effects of this factor may not occur for females due to the fact that a saturation level is not yet within reach. Tuition fees may influence enrolment only inasmuch as they are not compensated by subsidies; certain flows such as those from LBO to MBO may predominantly consist of pupils recruited from the lower social classes which usually profit from such subsidies.

Although outcomes are not as unequivocal as one might have hoped, they undoubtedly support some of the initial hypotheses. As a result of increasing enrolment at a certain level of full-time education saturation effects do occur involving a decrease of the flow to the next higher level. There is a marked tendency of females to develop a flow pattern more and more similar to that of males. An increase of tuition fees apparently leads to a reduction of enrolment and an increase of drop-out rates. An increase of the general unemployment level appears to produce extensive discouraged worker effects in the form of increased enrolment. Changes in the unemployment pattern by educational level and field directs preferences towards studies with better prospects. Constant terms are in general low and non-significant, implying that as a rule there is no unexplained residual trend in the flow coefficients studied.

## 7. Model exercises

When the model is used for forecasting and simulation purposes, it seems reasonable to eliminate variables for which

the sign of the estimated parameters is not in accordance with the underlying hypothesis. After elimination of these variables, the model has been re-estimated.

Application of the model for forecasting purposes requires information on the future development of exogenous factors. Two of these, emancipation and utilization of talent, are generated by the model itself. Since hypotheses on the impact of salary prospects could not be corroborated, this variable ultimately was eliminated from the study. As a result, a (tedious) prediction of salary developments is not required. The development of tuition fees is based on multi-annual plans of the government involving a rise with 25% in 1986, but only a compensation for price increases the following years. Information on the development of national income and general unemployment level may be obtained from an available economic forecast (C.P.B., 1986a). The latter also includes information on the development of unemployment by educational level and field.

Here, two difficult problems are encountered. The first is a correct assessment of labour demand by educational level and fields allowing for substitution processes. In the above mentioned study, the projection of labour demand by educational level and field was based on a projection of total labour demand by economic sector combined with a trend extrapolation of the shares of educational categories per sector, followed by a rough correction for substitution effects on the basis of qualitative arguments (van Opstal and Kuhry, 1986). In the near future, a more satisfactory procedure will be worked out.

The second problem involves the mutual dependence of education and labour supply forecast on the one hand and labour demand and unemployment forecast on the other. Two strategies are feasible in such a case: a year by year forecast of all separate elements requiring a close integration of all forecasting models involved or a repeated cyclic application of the different models leading to converging results. For technical reasons, only the latter approach is feasible. However,

due to the time and costs involved, this cycle up to now has been completed only once.

In some respects forecast results on the basis of the approach developed in this study differ drastically from those obtained by trend extrapolation of the educational flow pattern. The most important differences relate to the behaviour of MAVO- and HAVO-graduates (both types of secondary general education). As a result of an expected improvement of the labour market situation for graduates from these types of education, the tremendous increase of the inflow of these graduates into vocational education as well as the marked decrease of numbers leaving full-time education are expected to come to an end, yielding more stable flow patterns.

After the prediction of strategic flow coefficients using the model explained in paragraphs 5 and 6, the effects on future school populations have been estimated using the SKILL-model explained in paragraph 2. The final outcomes for the central projection are given in CPB 1986b.

The magnitude of estimated elasticities varies considerably. Moreover, interpretation of these outcomes is not always easy owing to transformations of variables and pipeline effects in the educational system. One of the advantages of the integral model presented here is that it allows an estimation of over-all effects of exogenous factors and thus may produce general conclusions which could not be reached if the analysis would be restricted to separate school types.

For this purpose, two what-if simulations have been carried out. In the first one, enrolment was simulated for a situation in which general and specific unemployment would have remained constant at the level of 1981. In the constant unemployment case, the number of pupils in full-time education would have been 27 000 persons lower in 1983 and 43 000 persons lower in 1985. These figures include an increase of the size of the so-called short senior vocational education with 11 000 in 1985. Since this latter increase is not only due to discouraged worker effects but also to government action

(introduction of educational opportunities for potential school-leavers at lower educational levels), the pure labour market effect may be estimated at 37 000 for the period 1981-1985. Since the number of unemployed increased in the same period from 480 to 815 thousand, the discouraged worker effect with respect to enrolment is estimated to amount to 11%.

Similarly, the effect has been estimated of omitting a planned 25% rise of tuition fees in 1986. According to our calculations, this would imply an increase of the number of pupils in advanced full-time education with approximately 11 000 pupils by 1990. Price elasticities for senior vocational education, vocational colleges and university education are estimated to amount -.06, -.14 and -.04 respectively. These outcomes correspond to an overall 100% increase of tuition fees and range between that of Kodde, 1985b (-0.01 for inflow in higher education of graduates from secondary general education) and that of de Groot, 1984 (-0,2 to -0.4 for adult education).

REFERENCES

G.S. Becker (1975) - "Human Capital", Columbia University Press, New York and London.

M. Blaug (1970) - "An Introduction to the Economics of Education, Penguin Press, London.

R. Boudon (1974) - "Education, Opportunity and Social Inequality", John Wiley, New York.

C.P.B. (1986a) - "Centraal Economisch Plan 1986" met daarin opgenomen "De Nederlandse Economie in 1990", Centraal Planbureau, Den Haag.

C.P.B. (1986b) - "De onderwijsprognose 1986: leerlingen, schoolverlaters en bevolking naar opleidingsniveau tot 2000", Werkdocument 9, Centraal Planbureau, Den Haag.

J. Dronkers (1983) - "Have inequalities in educational opportunity changed in the Netherlands? A review of empirical evidence". The Netherlands Journal of Sociology, Vol. 19-2.

J.H. Faasse, B. Bakker, J. Dronkers and H. Schijf (1986) - "Voor en na de mammoet". Mens en maatschappij, jaargang 61 (1).

R.B. Freeman (1976) - "The overeducated American", New York, Academic Press,

H. de Groot (1984) - "De prijs van avondonderwijs", Sociaal en Cultureel Planbureau, Stukwerk 24.

F. van Heek (1968) - "Het verborgen talent: milieu, schoolkeuze en schoolgeschiktheid", Boom, Meppel.

R. Huijsman, T. Kloek, D.A. Kodde, and J.M.M. Ritzen (1986) - "An empirical analysis of college enrolment in the Netherlands" (forthcoming).

D.A. Kodde (1985a) - "Micro-economic analysis of demand for education", Thesis, Rotterdam.

D.A. Kodde (1985b) - On estimating the impact of tuition on the demand for education from cross-sections. Economics Letters 18, 293-296.

B. Kuhry (1985) - "Het onderwijsmodel SKILL", Centraal Planbureau, Den Haag, Notitie 1985/IV/19.

B. Kuhry and J. Passenier (1986) - "SKILL, a Forecasting Model for Education and Labour Supply", EC-Symposium, "Education/training and Labour Market Policy".

A. Nieuwenhuis (1977) - "Schatten van verdeelmodellen", Centraal Planbureau, notitie 1977/IV/10.

R. van Opstal and B. Kuhry (1986) - "Arbeidsaanbod en werkgelegenheid naar opleiding, 1985-1990". Centraal Planbureau, notitie 1986/II/5.