A note on the Mare model
Arbeitsberichte des Instituts für Soziologie der Universität Leipzig


Redaktion: Dr. Ivar Krumpal

Kontakt

Institut für Soziologie
Universität Leipzig
Beethovenstr. 15
04107 Leipzig

Tel +49 (0) 341 9735 693 (Ivar Krumpal)
640 (Sekretariat Fr. Müller)
Fax +49 (0) 341 9735 669

Email: krumpal@sozio.uni-leipzig.de
Net: http://sozweb.sozphil.uni-leipzig.de/de/institut/arbeitsberichte.html
Inhalt

1 Introduction.................................................................................................................. 4
2 Advantages of the Mare model .................................................................................. 5
3 Statistical conception of the Mare model ................................................................. 6
4 Critique of the Mare model ....................................................................................... 7
5 Summary ....................................................................................................................... 10

References ..................................................................................................................... 11
1 Introduction

For the analysis of changes in educational inequality, several quantitative methods have been developed in educational research. One of them is the school transition model (also known as the Mare model). The school transition model has been criticised on many grounds in recent years. In the following, I introduce the advantages of this model, its analytic conception, its critique and explain why this critique is not such a big problem in empirical analyses as is generally assumed. Finally, I give a summary.
2 Advantages of the Mare model

One of the most important advantages of the school transition approach in comparison to the analysis of highest educational attainment is that it better reflects the reality in which individuals attain their education over the life course, namely in consecutive irreversible steps (Mare, 1993, p. 353). The school transition approach has been made most popular by Robert Mare in the 1980s. He empirically analysed the inequality of educational opportunity as a result of separate educational choices at successive educational transitions using a sequential transition model (Mare, 1980, p. 295). His justification for the school transition approach is that the effect of social origin cannot be correctly revealed by looking only at the highest educational certificates of individuals. According to his view there are at each educational transition different mechanisms at work influencing the decision to persist in education or to withdraw (Mare, 1980, p. 295; Breen & Jonsson 2000: 758). Therefore, it is rather important to analyse whether the association between social background and school continuation decisions changes across educational transitions in the educational career. It can be assumed that at successive educational transitions different familial resources or structural restrictions play an important role for familial school continuation decisions (Mare, 1980).

Another advantage of the Mare model, as already previously mentioned, is that changes in the marginal distributions can be controlled for in the sequential logistic response model that is used for the analysis. In OLS regressions on school years analysing inequality of educational opportunity one cannot separate whether inequality of educational opportunity declines because the educational attainment increases across cohorts for all individuals in absolute terms or because there is a decline in the effect of parental background on schooling (Mare, 1981, p. 74). An illustrative example, which induces changes in the marginal distribution of the outcome variable and in the independent variable of parental education, is educational expansion (Mare, 1981b, p. 102). It leads to both, a more equalizing overall increase in educational attainment of parents as well as an increase of educational attainment for their children across cohorts. According to Mare it depends on the research question which analysis model one wants to use (Mare, 1981a, p. 74). If the researcher is interested in the change in the pure association of social origin on educational attainment, than the Mare model is the appropriate method (Mare, 1980, p. 297). If one is interested whether in absolute terms educational inequality declines because the variance of educational distributions declines over time and becomes more equal, then the OLS regression on years of schooling is more appropriate (Mare, 1981a, p. 86).
3 Statistical conception of the Mare model

To analyse educational inequality at each educational transition, one normally creates several dichotomous dependent variables on whether an individual quits (0) or continues (1) education at each transition point in school. At each following educational transition, only people are ‘at risk’ who have survived the immediately previous educational transition (conditional probability). The transitions are defined as either whether individuals have attended the next higher educational level or whether they have completed or graduated from the next higher educational level (Mare, 1980, p. 295). These dichotomous transition variables can either be synthetically generated using information from the final educational attainment (as it is available in cross-sectional datasets) or be directly constructed using complete retrospective information about the individuals educational career episodes.

For the analysis of the effect of social origin on each of the educational transitions a logistic response model is normally used. In this sequential educational transition models, one can analyse for each individual $i$ from the $t$th birth cohort her or his educational transition probability $p$ at transition $j$ (Mare, 1981a, p. 74):

$$\ln \left( \frac{p_{ijt}}{1-p_{ijt}} \right) = \beta_{jt} + \sum_k \beta_{jkt} X_{ijkt}$$  \hspace{1cm} (1)

The $X_{ijkt}$ is a placeholder for the $k$ independent variables included in the model of $i$th individual in birth cohort $t$ which are influencing the decision of the individual to make the next educational transition $j$ or not. The $\beta$ coefficients represent the impact of the independent variables $k$ at transition $j$ and for birth cohort $t$.

The Mare model became internationally very popular among educational researchers in the 1990s. Some of the most well-known applications of the Mare model can be found in the internationally comparative book on educational inequality by Shavit and Blossfeld (1993), in Breen and Jonsson’s (2000) modification to include more complex school systems and in Lucas’ (2011) work, in which he applied the school transition model to panel data with time-varying covariates.
4 Critique of the Mare model

Besides its popularity, however, the Mare model has been criticized on several grounds. First, it is argued that the Mare model cannot be interpreted causally due to unobserved heterogeneity affecting the estimated effect of social origin on school continuation probabilities (Cameron & Heckman, 1998, p. 272). In particular, the identified waning effect of social origin across successive educational transitions in the educational career, which is so typical for the Mare model, may not reflect a real decline of educational inequality in the career, but may be produced by the specific statistical model that is used (Cameron & Heckman, 1998).

The first problem of the logistic response model is its non-linear function (Cameron & Heckman, 1998, p. 281). In the literature, there are two different justifications for the use of the logistic regression model. One assumes that there is a latent metric variable behind the observed binary outcomes with a standard logistic distribution and a variance fixed to 3.29 (Mood, 2010, p. 68). This approach is derived from the choice models of economists. If the latent variable \( y^* \) is smaller than 0, then the observed dichotomous outcome \( y \) is 0 and if \( y^* \) is larger and equal than 0, \( y \) is 1. In the other approach, used by statisticians, the dependent variable of the regression model is simply transformed in a way so that the probability of making an educational transition can only vary between 0 and 1 (Kuha & Mills 2017; Razzaghi, 2013, p. 165; Powers & Xie, 2008). In the following, I only focus on the latent variable model of economists because the critique of the Mare model is mainly based on this representation. In this view, unobserved heterogeneity among logistic response models can vary so that the comparison of logits or odds ratios across transitions or birth cohorts is problematic, even if the included explanatory variables are identical across models. In the economic latent variable model, the dependent variable is then dependent on the scale of the unexplained error term: If the scale of the error term changes, then also the variance or scale of the dependent variable changes. It might be that important unmeasured characteristics between the educational transition models are not identical because it is very likely that at later transitions there are individuals who were already selected for some unmeasured characteristics that do not play a role anymore at later transitions (Buis, 2017). Consequently, the variance of the error term at later transitions should be smaller than at earlier transitions. Because the variance or scale of the dependent variable is related to the variance of the error term, the dependent variables of different transitions vary (Mood, 2010, p. 69). Therefore, it is not possible to compare the effect sizes of coefficients across educational transitions. Xie (Xie, 2011, p. 346) calls this issue ‘outcome incommensurability’.
The second problem inherent in the sequential transition model is that the population at each successive transition becomes more and more homogenous and this selection process leads to a correlation between measured and unmeasured factors, which were previously uncorrelated (Mare, 1980, 1981a, 1993). Therefore, the observed effects of explanatory variables, which are included in the model, such as social origin, may be biased (Mare, 1993, p. 357). Two examples given by Mare (1993, p. 354) himself for unobserved factors that are likely to influence the effect of social origin are ability and motivation. One can assume that at an educational transition only the most skilled and motivated children of lower social origins will make this educational transition, while also less skilled and less motivated children from higher social origins will make the educational transition to the next level. The effect of social origin on successive educational transitions may therefore decline not because the association between social origin and the transition probability declines, but because only the most skilled and motivated children from lower social origin survived. They will make the next educational transition anyway, because they are capable to succeed in school independent of the support of their families. Xie (2011, p. 346) calls this problem ‘population incommensurability’.

Although the Mare model cannot be interpreted causally, it is still legitimate to use it for descriptive purposes (Buis, 2017; Xie, 2011, p. 345). Mare (2011, p. 242) even argues that most questions concerning social inequality are motivated by description rather than causal explanation. As examples, he mentions the analysis of mobility tables and other multivariate analyses in which partial associations between social origin factors and educational and social attainments are estimated.

Nevertheless, there are several attempts to overcome the causality problem. For example, Cameron and Heckman (1998, p. 285) try to circumvent the sequential transition model problem by applying an ordered discrete-choice model. In addition, there is a special issue of the Research and Social Stratification and Mobility journal (year 2011 Volume 29) which is devoted to the methodological problems of the Mare model and possible solutions. Besides all these new models, Mare (2011, p. 243) makes clear that one should think about the kind of unobserved heterogeneity itself. In particular, it is important whether it is exogenous or endogenous with respect to social origin. He states that for instance ability is at least in part endogenous to family background:

‘...one usually wishes to control for exogenous covariates of the treatment, but not endogenous variables that may represent mechanisms through which treatments exert their effects. A blanket control for all unobserved variables is likely to overcontrol for
the effects of the treatment. [...] Similarly, in models of school transitions, it is important to distinguish, at least in principle, between unobserved heterogeneity that is simply correlated with measured family background and which thus should be taken into account, and unobserved heterogeneity that is in fact a consequence of measured family background and which thus should not be controlled. Again, outside of an experimental context, this problem can only be addressed with an explicit model of how unobserved heterogeneity works.’ (Mare, 2011, pp. 243–244)

A third objection by Cameron and Heckman (1998, p. 267) is that the Mare model ignores the fact that school dropouts could later return to school again. However, one can get around this problem if one would use individuals’ highest educational attainment levels to (re-)construct educational transitions or in retrospective datasets, one could only analyse individuals who practically have already left the educational system (e.g. analyzing only individuals who are older than 30 years).

Finally, Breen and Jonsson (2000) mentioned another limitation of the Mare model. It assumes that all individuals pass through school at only one school path. This might be appropriate for the school system in the United States. However, in Europe, there are many countries, in which different parallel school tracks exist. In particular, one can distinguish a vocational and academic track. It is quite likely that the probability to make the next educational transition depends highly on the previously chosen educational pathway or it is even not possible to make the next educational transition under some pathways. Students that make an equal number of transitions and complete an equal number of school years may still have different labour market returns, because they chose different educational branches. In addition, the effect of family on school continuation decisions could depend on the school branch children are attending. In the traditional Mare model, it is not possible that the social origin effect can differ between different school tracks. However, Breen and Jonsson (2000) applied a sequential multinomial transition model, which allows for differing social origin effects for distinct school branches to solve this problem.
5 Summary

The Mare has become very popular among educational researchers due to several empirical advantages. In particular, it better reflects how children, youth and young adults obtain their education in successive steps over their educational career and it allows controlling for changes in the marginal distributions in the process of educational expansion. However, since the last two decades several limitations of the Mare model have been discussed. For example, due to unobserved heterogeneity a causal interpretation is not possible and that it ignores school drop-outs and multiple educational pathways. This working paper argues these critiques should not discourage educational researchers to apply the Mare model. For descriptive reasons the Mare model is still an important and illuminating tool. Furthermore, one can analyse only students that have already finished their educational careers, avoiding problems of school dropout. Finally, multinomial logistic regressions can be used for educational systems with several educational pathways.
References


Razzaghi, M. (2013). The Probit Link Function in Generalized Linear Models for Data Mining...


Bisher erschienene Arbeitsberichte des Instituts für Soziologie

für eine vollständige Übersicht der z.T. als PDF zur Verfügung stehenden Texte siehe:
http://sozweb.sozphil.uni-leipzig.de/de/institut/arbeitsberichte.html

Nr. 1 (01/99)
Tätigkeitsbericht des Instituts für Soziologie 1997/98.

Nr. 2 (01/99)

Nr. 3 (03/99)

Nr. 4 (04/99)

Nr. 5 (07/99)

Nr. 6 (11/99)
Kerstin Tews: Umweltpolitik in einer erweiterten EU. Problematische Konsequenzen des einseitigen Rechtsanpassungszwangs am Beispiel der umweltpolitischen Koordination zwischen der EU und Polen.

Nr. 7 (01/00)

Nr. 8 (03/00)

Nr. 9 (06/00)

Nr. 10 (07/00)
Martin Abraham & Per Kropp: Die Bedeutung sozialer Einbettung für Konsumentenentscheidungen privater Akteure. Bericht an die Deutsche Forschungsgemeinschaft.

Nr. 11 (08/00)

Nr. 12 (08/00)
Jan Skrobak: Soziale Identifikationstypen? - Anmerkungen zur ganzheitlichen Erfassung der Typik von “Identifikation”.

Nr. 13 (09/00)
Sonja Haug: Soziales Kapital, Migrationsentscheidungen und Kettennationsprozesse. Das Beispiel der italienischen Migranten in Deutschland.

Nr. 14 (11/00)

Nr. 15 (12/00)

Nr. 16 (12/00)
Olaf Struck: Continuity and Change. Coping strategies in a time of social change.

Nr. 17 (12/00)

Nr. 18 (05/01)

Nr. 19 (05/01)

Nr. 20 (08/01)

Nr. 21 (08/01)
Olaf Struck (Hrsg.): Berufliche Stabilitäts- und Flexibilitätsorientierungen in Ostdeutschland. Ergebnisse eines Forschungspraktikums.

Nr. 22 (11/01)

Nr. 23 (11/01)

Nr. 24 (11/01)

Nr. 25 (11/01)

Nr. 26 (04/02)

Nr. 27 (04/02)
Sylke Nissen: *Die Dialektik von Individualisierung und moderner Sozialpolitik: Wie der Sozialstaat die Menschen und die Menschen den Sozialstaat verändern.*


Georg Vobruba: *Die sozialpolitische Selbstermächtigung von Politik.*


Andreas Diekmann, Thomas Voss: *Social Norms and Reciprocity.*

Martin Abraham: *With a Little Help from my Spouse: The Role of Trust in Family Business.*

Ulf Liebe: *Probleme und Konflikte in wirtschaftlichen Transaktionen.*

Manuela Vieth: *Sanktionen in sozialen Dilemmata. Eine spieltheoretische Untersuchung mit Hilfe eines faktoriellen Online-Surveys.*


Oliver Klünt, Matthias Müller und Heiko Rauhut: *Das Verlangen nach Überwachen und Strafen in der Leipziger Bevölkerung.*


Christian Seyde: *Beiträge und Sanktionen in Kollektivgutsituationen: Ein faktorieller Survey.*


Roger Berger und Rupert Hammer: *Links oder rechts; das ist hier die Frage. Eine spieltheoretische Analyse von Elfmeterschüssen mit Bundesligadaten.*

Stefan Pfau: *Experimentelle Untersuchungen zum sozialen Aus tausch: Prüfung von Lösungs肯zepten der kooperativen Spieltheorie.*

Roger Berger und Julia Zimmermann: *Das Problem der Transaktionsbewertung bei Internetauktionen: Eine Analyse des Bewertungssystems von eBay Deutschland unter Berücksichtigung der Freitext kommentare.*


Thilo Fehmel: *Unintendierte Annäherung? Theorie und Empirie sozialpolitischer Konvergenz in Europa.*

Jenny Preunkert: *Die Eurokrise - Konsequenzen der defizitären Institutionalisierung der gemeinsamen Währung.*


Roger Berger: *Do Train Actors Learn Strategic Behaviour or Are They Selected into Their Positions? Empirical Evidence from Penalty Kicking.*

Kurt Mühler: *Einstellung zur Videoüberwachung als Habitation.*

Nr. 64 (12/14)

Nr. 65 (02/15)
Kurt Mühler: Der Einfluss von Medienrezeption auf personale und soziale Kriminalitätsfurcht.

Nr. 66 (02/15)

Nr. 67 (04/15)
Holger Lengfeld, Sara Schmidt und Julia Häuberer: Is there a European solidarity? Attitudes towards fiscal assistance for debt-ridden European Union member states.

Nr. 68 (02/16)
Kurt Mühler: Zum Einfluss der Wahrnehmung von Unordnung auf das Sicherheitsempfinden.

Nr. 69 (02/17)
Kurt Mühler: Senkt Viktimisierung das Sicherheitsempfinden (nicht)?

Nr. 70 (03/17)
Kurt Mühler: Religiosität und häusliche Arbeitsteilung.

Nr. 71 (04/17)

Nr. 72 (08/17)
Ivo Windrich: Zur Messung speziesistischer Einstellungen.

Nr. 73 (08/17)

Nr. 74 (09/17)
Roger Berger und Thomas Gautschi: Drogenkonsum als rationale Wahl.

Nr. 75 (02/2017)
Jürgen Gerhards; Holger Lengfeld; Zsófia Ignácz; Florian Kley und Maximilian Priem: How Strong Is European Solidarity? Preliminary Results from a Survey Conducted in 13 Member States of the EU.