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# Status Attainment as a Competitive Process

## A Theoretical and Empirical Study on the Implications of Boudon's Status Attainment Model

by Rense Corten, Ineke Maas *and* Chris Snijders

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### 1. Introduction

Status attainment in the tradition of Blau and Duncan [1967] is typically modelled as an individual-level process. Occupational status, the classic variable of interest, is modelled as an individual outcome that is determined by other individual characteristics such as social origin, education, and gender. An implicit assumption of this approach is that individuals can acquire status positions (i.e., jobs) independently from one another. This is of course a simplification. In most cases jobs are scarce and individuals compete for them, making status attainment a process in which individuals are *interdependent*. Only a handful of theoretical models [Boudon 1974; Thurow 1975; Sørensen 1977] take these interdependencies into account. The mainstream of status attainment research “almost completely fails to make the micro-to-macro transition” [Coleman 1987, 163].

Boudon was the first to come up with an interdependent model in this context. He constructed a labor market model using a mechanism of job competition where the most highly educated individuals are the first in line to get to the best status positions. Loosely based on numerical examples of fictitious cohorts, Boudon concluded that if the educational system expands, then the inequality of educational opportunity might steadily decline, but this is *not* necessarily followed by a decrease of the inequality of status opportunity.

In this study, we aim at contributing to an approach to status attainment in which the status attainment process is explicitly modelled as a competitive process of job allocation mainly based on educational credentials. We take Boudon's [1974] theory as a starting point, and extend the model in several directions as has been suggested informally in the literature. Next, we deduce hypotheses by simulating the model for varying values of the input parameters. Finally, we test our hypotheses on empirical data. Despite the attention that Boudon's theory has received at the time of publication, adequate empirical tests of the theory are still lacking, exactly because the implications of the theory are difficult to spell out informally or just based on a casually chosen handful of examples. This study fills that gap.

Our research questions are the following:

*Research question 1:* what are the implications of Boudon's model with respect to the relation between the inequality of educational opportunity (IEO) and the inequality of status opportunity (ISO).

*Research question 2:* how can Boudon's ISO model be improved to generate new predictions on the determinants of ISO?

The answers to questions 1 and 2, as derived by computer simulation, come in the form of hypotheses that will subsequently be tested empirically.

Our third research question is:

*Research question 3:* to what extent are the hypotheses that follow from Boudon's (extended) model corroborated when tested against empirical data on status attainment?

## **2. Boudon's Theory of Social Stratification**

Boudon's theory consists of two separate models; one on how social origin determines the educational level, and a second on how education leads to social destination (status).<sup>1</sup> We only consider the second part of this theory, Boudon's *inequality of status opportunity model* (ISO). This model starts from the assumption that society is stratified in a number of status levels, and that there is a certain degree of educational inequality between the strata. The general idea is that, at any time-point, a cohort of people will be looking for a job, and the members of this cohort can be ordered according to their social origin and attained educational level. Individuals compete for jobs of different status levels in a society in which the allocation of status positions is mainly based on educational achievement: a meritocracy [cf. Young 1958]. We

<sup>1</sup> For detailed discussions of the first model see Corten [2004], Fararo and Kosaka [1976] and Raub [1984].

further clarify the model's mechanism by a numerical example, closely resembling the example from Boudon [1974, 146-152].

Table 1 shows a fictitious distribution of 100,000 people over three levels of social background and six educational levels. This fictitious distribution represents a given degree of educational inequality by background status. In this example there are 10,000 individuals with the highest status level, 30,000 with the middle status level, and 60,000 with the lowest status level.

TAB. 1. *Educational Attainment by Social Origin: Fictitious Data After Boudon [1974: 146]*

		Educational level							
		High	6	5	4	3	2	1	Low
Social origin*	3	1967	905	618	1735	2775	2000	10000	
	2	1020	1188	1074	4191	10827	11700	30000	
	1	318	624	714	3918	18432	35994	60000	
Low		3305	2717	2406	9844	32034	49694	100000	

Boudon assumes that the distribution of status positions is fixed over time, so that the individuals in Table 1 compete over the same numbers of status positions. We now step through Boudon's rules of interdependence at the micro-level to arrive at Table 2, the distribution of achieved social status by educational attainment.

TAB. 2. *Achieved Social Status by Educational Attainment: Fictitious Data After Boudon [1974: 147]*

		Social status				
		High	3	2	1	Low
Educational level	6	2314	694	297	3305	
	5	1902	571	245	2717	
	4	1684	505	217	2406	
	3	2870	4882	2092	9844	
	2	861	16344	14829	32034	
	1	369	7005	42320	49694	
	Low	10000	30000	60000	100000	

Consider the 10,000 open high status positions. In our example there are 3305 individuals with the highest educational level available for these 10,000 positions. Boudon now applies the “meritocratic parameter” (70% in his example) to the 3,305 high level candidates and gives 2,314 (=70% of 3,305) a position at the highest status level. This leaves 991 highly educated candidates and 7,587 high status positions. The remaining high status positions are then distributed among those with a level 5 education, according to the same procedure. There are 2,717 individuals at the second highest educational level, for 7,587 jobs. Boudon gives 1,902 (=70% of these 2,717) a job at the highest status level. When we continue this process and turn to the candidates with educational level 3, there are only 4,100 positions at the highest status level left while there are 9,838 candidates in this educational class. Applying the meritocratic parameter would imply that 70% of 9,838 candidates get a job at the highest level, but there are no longer that many highest status level jobs available. Therefore, whenever the number candidates is larger than the number of positions, Boudon applies the meritocratic parameter to the number of positions, instead of to the number of candidates, so that now 70% of 4,100 = 2,872 positions go to candidates with an educational level of 3. Using this recipe, we can distribute all status positions and completely fill out Table 2. As an interesting aside, note the unintended inconsistency in Boudon’s distributional mechanism: in some cases it is ill defined. To see this, consider a toy example with only two levels of education and status. Suppose there are 100 individuals with a high status background, of which 60 have a high education. Furthermore suppose there are 20 individuals with a low status background, of which 10 have a high education. We first give 49 highly educated (=70% of 70) a high status job. We now have 51 (=100-49) high status jobs left, but we have only 50 lower educated and Boudon’s mechanism comes to a grinding halt. It is likewise possible that there are not enough lowest status jobs for the remaining individuals at a given educational level. Boudon apparently has not noticed this problem; nor has it, to our knowledge, been noted in any other related study. We will not discuss this problem in detail here but in the subsequent simulations we take its possible occurrence into account.

By combining Table 1 and Table 2 one can -still under the assumption that social origin does not play a role in the distribution of jobs- calculate a mobility table (see Table 3).

TAB. 3. *Achieved Social Status by Social Origin: Fictitious Data After Boudon [1974: 152]*

		Social status				
		High	3	2	1	Low
Social origin	3	3038	3291	3671	10000	
	2	3897	9941	16162	30000	
	1	3064	16768	40167	60000	
Low		10000	30000	60000	100000	

Boudon then analyses the outcomes of the model for several distributions of educational attainment across strata, using examples in which the amount of inequality of educational opportunity (IEO) steadily decreases. Boudon's most striking conclusion is that while in his examples IEO declines over cohorts (as measured by disparity ratios) and school attendance increases, social mobility (and hence ISO) does not seem to be influenced by this process. Moreover, the changes in ISO that occur do not seem to follow a systematic pattern and even when IEO is high, there still is a considerable amount of mobility. In order to have a model that can account for a direct effect of origin on status (as is usually found in empirical research), Boudon furthermore introduces "dominance effects." These effects model that the distribution of jobs also depends on social origin, although education remains the most important factor. According to his own writing, Boudon's general conclusions are robust against the addition of dominance effects.

### 2.1. *Criticism, Theoretical Extensions and Empirical Tests of Boudon's Model*

Boudon's model provoked much criticism and debate, such as a devastating review by Hauser [1976], a symposium in *Social Science Information* and several other studies devoted to Boudon's book. We briefly review and comment on this discussion, as well as on related empirical work.

We first consider an argument against Boudon's theory that we feel is less convincing, namely Boudon's artificial method of distributing jobs, especially the "meritocratic parameter." This has been much criticized [e.g. in *ibidem*] for being unrealistic and hard to understand intuitively. It is however possible to interpret the meritocratic parameter simply as the probability for a given actor to obtain the highest still available status position. For the case where the number of jobs is larger than the number of candidates the interpretation is straightforward: if there are 150 po-

sitions for 100 candidates and the meritocratic parameter is 70%, then the probability for any of the actors from this group to get a job is 0.7. When there are more candidates than positions matters are less clear. Suppose there are 200 candidates for 150 positions. In this case the probability of getting a job would be at most 150/200, even if education would be a 100% guarantee for getting a job. If a given level of education only provides a 70% chance for getting a position, the probability of obtaining a position would become  $70\% \times (150/200) = 52.5\%$ . This implies that 105 ( $=200 \times 70\% \times 150/200$ ) candidates will get their desired positions, which is easily seen to be the same number that results when the meritocratic parameter is applied directly to the number of positions. Thus although Boudon's procedure for the meritocratic distribution of positions is certainly a strong simplification, it does provide a consistent model of a competitive process in which the meritocratic parameter reflects the probability of success as depending on education.

The aspect of Boudon's study that attracted most criticism was that it was unclear to what extent the conclusions depended on Boudon's particular numerical examples [*ibidem*; Sørensen 1976]. Moreover, several aspects of the model other than the use of the meritocratic parameter were attacked as unrealistic, such as the assumption that the social class structure is stable over time. Modernization theory claims that in modern societies the relative number of higher status positions gradually increases as a result of an increasing need for skilled labor [Treiman 1970]. The intuition of many was that if the number of high status positions increases over time, declining IEO will have a stronger effect on ISO than in Boudon's examples, so that his conclusion would no longer be valid (see also Grusky 1983 for some empirical support for this idea).

The only study known to us that is theoretically concerned with the ISO model is the study by Müller-Benedict [1999], who applies computer simulation techniques to examine the behaviour of the ISO-model. This method, similar to the method of simulation that will be used here, consists of varying the parameters of the model over a relatively large range of possible values simultaneously, and evaluating the sensitivity of the outcomes to these variations. In his simulation Müller-Benedict varies three parameters of the ISO model: the level of IEO, the level of meritocracy and the level of dominance. The distribution of available status positions is still assumed to be stable over time. The analysis of the model without dominance shows that Boudon's important conclusion that the level of IEO does not substantially influence mobility does not hold generally: although ISO indeed remains more or less constant in the range of IEO that Boudon considered, it does decline when educational inequality is lower. Furthermore, the analysis shows that ISO increases when the level of meritocracy increases. Including dominance effects reveals a much more complex pattern.

More meritocracy still leads to less mobility, but the relation between educational inequality and mobility now roughly shows a U-shaped pattern, with many exceptions in between.

Our analysis differs from Müller-Benedict's in a number of ways. First, Müller-Benedict assumes the level of dominance to be equal to the level of meritocracy. We feel that this assumption is unnecessarily restrictive and theoretically unfounded. Instead, we vary dominance and meritocracy independently in order to examine their effects separately. Second, Müller-Benedict assumes a stable distribution of status positions, as in Boudon's original model. Addressing the concerns motivated by modernization theory mentioned above, we allow the distribution of status positions change over time. Finally, we test the predictions of the model more thoroughly, as we elaborate below.

The number of empirical applications of Boudon's theory is relatively small, and most studies necessarily limit themselves to testing Boudon's more general conclusion. Also, most studies focused on Boudon's model on how status determines education and not on how education determines future status. In more specific tests of Boudon's theory, moderate support for the theory was found by Andorka [1976] and Müller-Benedict [1999], while Delmotte and Despriet [1984] conclude that education really is a source of mobility and therefore reject Boudon's theory. Although the methods used and the conclusions found in these studies markedly differ, nearly all the empirical studies have one thing in common. They all take Boudon's overall conclusions to be *the* implications of his model, and test whether these empirically hold. These conclusions however simply represent the bold generalization of the results of Boudon's handful of numerical examples.

In our opinion, the proper way to test Boudon's theory is to first derive more general predictions regarding the relation between IEO and ISO as dependent on the other parameters of the model. This produces precise predictions on the relations between the "inputs" of the process (IEO, meritocracy, etc.) and the "outputs:" ISO. We tackle this issue by computer simulation. While Boudon's IEO model has been analysed more formally [Fararo and Kosaka, 1976; Raub, 1984] we are not aware of any attempts at a formal treatment of the ISO model (even though Fararo and Kosaka [1976] hint at such an analysis). In general, the non-linear nature of the interdependencies complicate a formal treatment of the model.



### 3. The Simulation

#### 3.1. Design

We conduct a computer simulation in which we repeat Boudon's numerical example for a large range of parameters and subsequently relate the inequality of status opportunity to the input parameters. The simulations include Boudon's base model as well as several extensions. For the base model we follow Boudon's set-up closely: in each simulation round we start with a cohort of 10,000 individuals of whom 1,000 have a high status social background, 3,000 have a medium status social background and 6,000 are from the lowest social background. Moreover, individuals are assumed to have an educational level that varies between 2 and 8, so that there is a certain amount of educational inequality. The distribution of available status positions is the same as the distribution of social origin. The individuals are then distributed among the available status positions according to Boudon's meritocratic principle in which only education matters, and the corresponding ISO levels are calculated. We repeat the base model 600 times, varying IEO<sup>2</sup> and the size of the meritocracy parameter.

For the version in which also dominance effects play a role we use one parameter for dominance and one for meritocracy. The distributional mechanism then works as follows. To distribute jobs at each status level, candidates are ordered according to education (as in Boudon's base model). Within educational classes however, candidates are ordered to social origin, in the sense that those from a higher social background will be placed in front of the lobar queue. We then simply follow Boudon's meritocratic distribution rule. The dominance parameter determines the extent to which social origin plays a role in the ordering of the lobar queue. If dominance is zero, the ordering of candidates within educational classes is completely random and not related to social origin. If dominance is one, the ordering of candidates within educational classes is perfectly according to origin. The size of the dominance effect can be interpreted as the extent to which employers can observe and value social origin.<sup>3</sup> All 600 base models are repeated for 11 levels of dominance, resulting in 6,600 simulation runs.

<sup>2</sup> In fact the way in which education is allocated to persons is based on Boudon's model for IEO, which we do not discuss in detail here. Primary and secondary effects of stratification, educational expansion, and the number of educational levels, varying between 2 and 8, determine the amount of IEO in this model [Corten, 2004].

<sup>3</sup> Note that our implementation deviates from earlier applications by Boudon and Müller-Benedict, for good reasons. Boudon assigned "dominance-parameters" to every cell in the origin-by-education table, which leads to a large number of parameters. Müller-Benedict's implementation of dominance uses a single parameter to order job candidates first by education and then by social origin, which makes that the two effects cannot be varied independently.

A key theoretical extension of Boudon's original theory is our inclusion of "modernization effects," that is, changes in the status distribution towards relatively more high status positions. We distinguish five levels of this occupational expansion, resulting in  $5 \times 6,600 = 33,000$  simulation runs.<sup>4</sup>

### 3.2. *Inputs and Output of the Simulation*

The output of a simulation run is supposed to represent the inequality of status opportunity (ISO) but inequality can be expressed in many ways. One of the most common ways is the *odds ratio*. Müller-Benedict, for example, uses this measure in his simulation study on Boudon's model to express IEO. Boudon's measure of IEO, the *disparity ratio* (the ratio of the probabilities of reaching a certain educational level between social classes), is closely related to the odds ratio. One of the reasons for using odds ratios is that they are relatively easy to calculate and to interpret. A disadvantage is that they are sensitive to outliers: a low frequency in one of the cells of a table that is used to calculate an odds' ratio can result in an extremely high value. Moreover, if only one odds ratio is used, the resulting measure of inequality is necessarily incomplete because it only takes into account the frequencies in some cells of the mobility table. To create a more accurate picture of inequality a series of odds ratios would have to be used, but this would make the derivation of hypotheses very complex. Because the simulation is based on "individual" data, however, it is possible to calculate a more precise measure for ISO: the regression coefficient of status on social origin for each combination of parameter values. These coefficients can then be used as the dependent variable in the analysis of the simulation data (where one observation represents one such a combination), expressing the level of ISO.<sup>5</sup> Across all simulation runs, ISO varies from 0 to 0.63 with a mean of 0.39 (Table 4).

In order to derive testable hypotheses, the output of the simulations (ISO) will be related to the input parameters. Some of the parameters need to be transformed in order to produce a single variable for each construct. One of the main input variables, the level of IEO, can be calculated as the regression coefficient of education on social origin, similarly to the calculation of ISO. However, there is one complication. Because the number of educational levels is varied between cohorts (see footnote 3), the scale of the variable "education" also changes, influencing the regression coefficient of education on origin. To solve this problem, we use the *standardized* regression

<sup>4</sup> The simulations were run in Stata. The code is available from the first author upon request.

<sup>5</sup> We did run our analyses with different measures, including odd's ratios and the percentage of immobile people. This does not have substantive effects on our results.

coefficient of education on origin, which does not depend on the scale of the variable “education.” IEO ranges from 0.09 to 0.54.

The choice of other input variables is more straightforward. For meritocracy, we can just use the value of the meritocratic parameter as used in the simulation. We distinguish five levels ranging from 0.5 to 1.

To vary the amount of occupational expansion in the simulations, we increased the number of positions at the highest level with a certain number, and reduced the number of positions at the lowest level with the same number. The variable occupational expansion is defined as the change in the proportion of status positions on the highest level. If, for example, the number of people with the highest social origin is 10% of the total cohort, and the percentage of destinations at the highest level is 15%, then we say that occupational expansion is 0.05 or 5 percent points. Five levels are distinguished (between 0 and 0.24).

To indicate the amount of dominance, we use the value of the simulation parameter that governs the extent to which the “employers” in the program can discriminate on social origin (see above). If dominance is 0, social origin plays no role in the ordering of candidates; if dominance is 1 they are (within educational classes) perfectly ordered by social origin.

TAB. 4. *Parameters and Variables in the Simulation*

Variable	Mean	Std. Dev.	Min	Max	Step
ISO	0.386	0.121	0.000	0.628	–
IEO	0.341	0.096	0.085	0.535	–
Meritocracy	0.750	0.171	0.500	1	0.1
Dominance	0.500	0.316	0	1	0.1
Occupational expansion	0.120	0.085	0	0.240	0.06

### 3.3. *Simulation Results*

The following section discusses the results of the analysis of the data generated by the simulation. These data consist of inputs and output of 33,000 different simulation runs. The relations between inputs and outputs can be investigated using regular statistical methods like regression analysis, where one simulation run constitutes one observation. Note that the results of these analyses provide (theoretical) answers to the research questions and should be (and are) formulated as hypotheses: they sum-

marize the relations between the output of the model and the inputs as a consequence of the model design.

Model 1 in Table 5 shows the result of a regression model with ISO (the regression coefficient of status on social origin) as the dependent variable and IEO and meritocracy as independent variables. This equals the base version of Boudon's model. The results show that IEO has a positive effect on ISO, as does meritocracy. In line with Müller-Benedict [1999], these findings show that Boudon's conclusion that changes in IEO have little effect on ISO does not generally hold. The positive effect of meritocracy on ISO is also in line with Müller-Benedict's study. In model 2, the effect of dominance is also taken into account. The effect of dominance on ISO is positive, as one would expect. The effect of meritocracy (to be interpreted as the effect for average levels of dominance) remains positive but drops considerably. In model 3, we introduce the effect of occupational expansion. In line with common intuitions, this effect is negative: if relatively more high status positions become available, status inequality decreases.

In model 4 we examine how the effects of IEO, meritocracy, dominance and occupational expansion influence each other by adding interaction effects. To facilitate interpretation the meritocracy variable has been centred around 0.7, so that the main effects of IEO, dominance, and occupational expansion now refer to the situation in which meritocracy is 0.7 (this is a convenient value because it is the value used by Boudon and is also close to the mean of the variable). Similarly, IEO has been centred around its mean (0.34), so that the main effects of the other variables refer to situations of average IEO. Note that all variables now have total effects that consist of four parts: a main effect plus three parts that are dependent on the values of the other three variables. For instance, the total effect of IEO is now  $0.707 - 0.775 * \text{occupational expansion} + 0.842 * \text{meritocracy}(\text{centred}) - 0.373 * \text{dominance}$ . The main effect of 0.707 is the effect of IEO when dominance and occupational expansion are zero and meritocracy is 0.7.

Model 4 shows that there are clear interaction effects between most independent variables. In fact, the only case in which there is *no* interaction is for dominance by occupational expansion. For the remaining variables, we see a rather complex pattern of interacting effects. Let's start with the more straightforward cases. There is a positive interaction effect between IEO and meritocracy, which means that the effect of meritocracy becomes stronger when IEO increases (and vice versa). Considering that meritocracy is the extent to which selection on educational attainment takes place, this is not surprising. Second, we see a negative interaction between meritocracy and dominance. This is also in line with first intuitions: when selection on origin plays a larger role, the effect of selection on education becomes weaker. Third, we see a neg-

ative interaction effect between IEO and dominance. Again, it is not very surprising that the effect of educational inequality becomes smaller when also direct effects of social origin (i.e. dominance) start to play a role.

TAB. 5. *Regression Models with ISO as the Dependent Variable (Simulated Data)*

	Model 1		Model 2		Model 3		Model 4	
Variable	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Variable	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
IEO	0.774	(0.012)	0.505	(0.008)	0.469	(0.004)	0.707	(0.006)
Meritocracy	0.340	(0.007)	0.009	(0.004)	0.045	(0.002)	0.366	(0.004)
Dominance			0.271	(0.002)	0.288	(0.001)	0.325	(0.001)
Occupational expansion					-0.109	0.004	-0.127	(0.006)
IEO*Meritocracy							0.842	(0.016)
Merit*Dominance							-0.731	(0.005)
IEO*Dominance							-0.373	(0.008)
IEO*Occ. expansion							-0.775	(0.032)
Meritocracy*Occ. exp.							0.369	(0.018)
Dominance*Occ. exp.							-0.001	(0.010)
Constant	-0.289	(0.007)	0.065	(0.004)	0.061	(0.002)	-0.260	(0.004)
N	600		6600		33000		33000	
R <sup>2</sup>	0.918		0.735		0.718		0.851	

The interaction effects with occupational expansion are more difficult to understand. There is a rather strong interaction effect between IEO and occupational expansion. At a meritocratic level of 0.7, the effect of occupational expansion is negative for average levels of IEO, but becomes positive when IEO becomes smaller than 0.18. The size of the total effect of occupational expansion however is also dependent on the level of the meritocratic parameter: the higher the level of meritocracy, the higher the total effect of occupational expansion. Therefore, the higher meritocracy, the higher the value of IEO for which the effect of occupational expansion becomes negative. The interpretation of these effects could be as follows. In situations with a high level of meritocracy, a relatively low level of IEO, and few high

status positions, there are many candidates from a high background who cannot get a high status position because there is a lot of competition from the lower classes. When the number of available high status positions increases, the candidates with a high background have a higher probability of maintaining their status despite a relatively low level of education, and thus ISO increases. In situations with a high level of IEO however, candidates with a high social background are already relatively sure of a high status position. An increase in the number of high status positions would then allow more candidates with a lower status background into high status positions, and ISO would decrease. The positive interaction effect between meritocracy and occupational expansion would reflect that a higher level of meritocracy causes a stronger competition, which increases the positive effect of the distribution as described above.

The finding that the effect of IEO becomes weaker if occupational expansion increases casts new light on the idea that the stability of status inequality as predicted by Boudon is caused by the rigidity of the job structure. In fact, our simulations show the opposite. The negative interaction effect indicates that the effect of declining IEO would even become smaller if relatively more high status positions become available. Moreover, the finding that a change in the status distribution towards more high status jobs can under certain circumstances lead to a higher level of ISO, suggests that trends in ISO could be the result of a complex interplay of factors. The results above suggest that, in theory, ISO could remain stable *because* the relative number of high status positions increases. Namely, when IEO decreases but at the same time (or perhaps even as a result of the change in IEO) the proportion of high status positions increases, these two trends could – under certain circumstances – offset each other’s effects, resulting in a stable level of ISO. A further decline of IEO would then lead to a stronger effect of the distribution change, etc. Thus the two processes of a decline in IEO and a change towards more high status positions would, according to this model, lead to a quite complex development of ISO.

The differences of the effects of meritocracy, IEO and occupational expansion for different levels of dominance can be illustrated graphically by estimating separate regression models for different levels of dominance, and by plotting the effect sizes of the different variables against dominance. Figure 1 shows the value of the main effects of meritocracy, IEO and occupational expansion on ISO, for different values of dominance. It shows, once again, that the effects of meritocracy and IEO decrease when dominance becomes stronger, while the effect of occupational expansion is hardly influenced. The figure also shows that there appears to be some kind

of floor effect in this: for dominance values larger than 0.7, the main effects remain stable.<sup>6</sup>

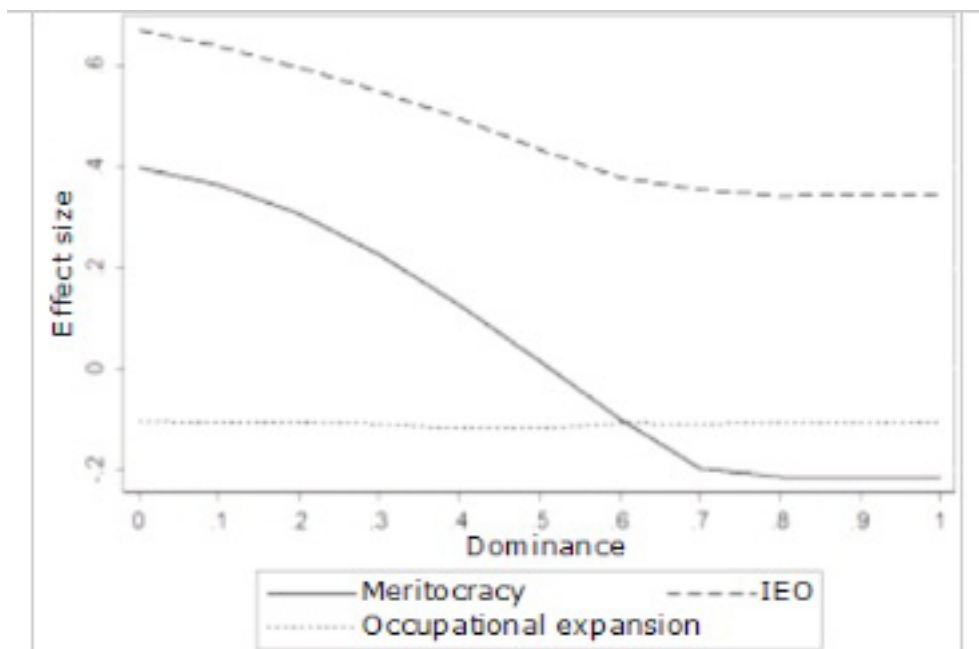


FIG. 1. Effect Size as Dependent on Dominance

Source: Authors' Elaboration

The simulation results allow us to formulate hypotheses on the effects of IEO, meritocracy, dominance and occupational expansion on ISO. Some of these hypotheses are similar to those from previous studies, others however are new.

First, we formulate hypotheses on the effects of meritocracy and IEO. These are similar to the hypotheses previously formulated by Müller-Benedict [*ibidem*].

*Hypothesis 1:* The higher IEO, the higher ISO

*Hypothesis 2:* The higher the level of meritocracy, the higher ISO

*Hypothesis 3:* The higher the level of meritocracy, the stronger the positive effect of IEO on ISO and vice versa.

Secondly, we formulate hypotheses on the effect of dominance. As we assume that dominance and meritocracy can vary independently, our hypotheses are different from those by Müller-Benedict who assumes that meritocracy and dominance are equal.

*Hypothesis 4:* The stronger dominance, the higher ISO

<sup>6</sup> We also analyzed variations of the model with more status levels and different starting distributions. This changes results only slightly.

*Hypothesis 5:* The stronger dominance, the weaker the positive effect of IEO on ISO

*Hypothesis 6:* The stronger dominance, the weaker the positive effect of meritocracy on ISO

Hypotheses 4 to 6 are rather straightforward and do not contradict common intuitions.

It is important to note, though, that in our case they follow logically from the assumptions of our model. Our hypotheses on occupational expansion however are somewhat more counter-intuitive:

*Hypothesis 7:* When the level of meritocracy is high and IEO is low, an increase in the proportion of high status positions has a positive effect on ISO. When meritocracy is low and IEO is high, the effect of an increase of the proportion of high status jobs is negative.

*Hypothesis 8:* The larger an increase in the proportion of high status positions, the weaker the positive effect of IEO on ISO

These two hypotheses reflect both sides of the interaction effect between IEO and occupational expansion, and the interaction effect of occupational expansion and meritocracy.

## 4. Testing the Hypotheses

### 4.1. Data and Methods

Data to test our hypotheses with are not easy to find. We use the *International Social Mobility and Politics File* (ISMFP) [Nieuwebeerta and Ganzeboom 1996] to perform a first test of the hypotheses. This dataset contains a large number of surveys from 16 different countries over a long period of time (1956–1991) and provides information on respondents' occupational status, social background, education, and basic demographic characteristics. We selected all observations with valid scores on all dependent and independent variables, and who started their first job after 1945. We group individuals into cohorts who entered the labor market in a certain country in the same year. This results in a dataset of 43,931 individuals in 196 cohorts from seven countries: Australia, the United Kingdom, Germany, Italy, the Netherlands, Norway and the USA. Details on the structure of the data are provided in Table 6.



TAB. 6. *Overview of the Data*

Country	N	N (cohorts)	Mean cohort size	Earliest cohort	Latest cohort
Australia	6849	38	180.24	1950	1987
UK	1417	13	109.00	1971	1983
Germany	12306	38	323.84	1950	1987
Italy	3422	36	95.06	1947	1982
Netherlands	3234	17	190.24	1969	1985
Norway	954	13	73.38	1972	1984
USA	15749	41	384.12	1945	1985

Because our hypotheses describe macro level relations, we adopt a multilevel approach. In our regression models, ISO is modelled as the effect of father's occupational status on the respondent's occupational status. The variables of the simulation model (IEO, meritocracy, dominance, and occupational expansion) are modelled as properties of a cohort that moderate the effect of respondents' fathers' occupational status on respondents' status. Interaction effects between cohort-level variables appear in the regression models as three-way interaction terms. This is illustrated in Figure 2, using only IEO and meritocracy as an example. The thick arrows represent relations on which we have hypotheses. To statistically account for the multi-level structure of the data, we estimate a random intercept and a random coefficient of father's status, thus allowing ISO to vary between cohorts [Snijders and Bosker, 1999].

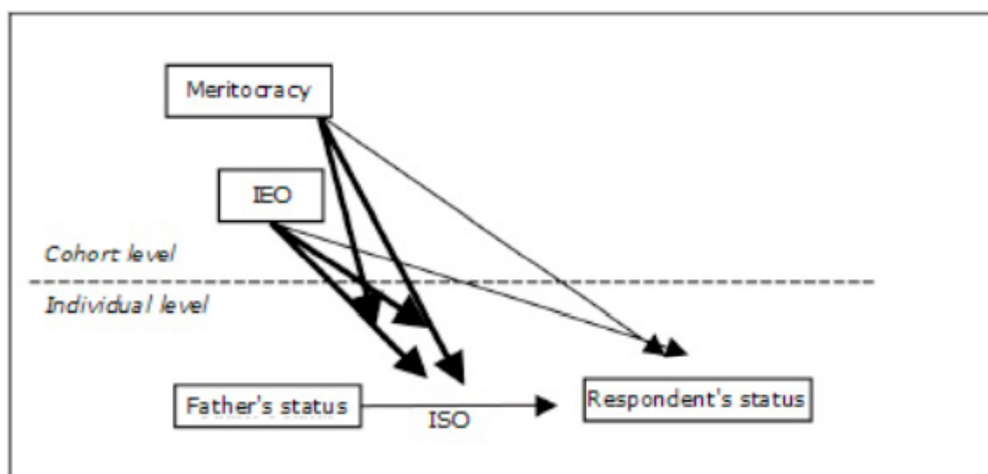


FIG. 2. Structure of the regression models, with meritocracy and IEO as an example

Source: Authors' elaboration

#### 4.2. Measures

In analogy with the simulation analyses, the data will be analysed by studying ISO outcomes for labor market cohorts. The year of labor market entry was reconstructed by adding four years and the number of years the respondent spent in school to his or her year of birth.

To estimate *ISO*, we use information on the status of the respondent's current or last job and on the status of his father's job during respondent's adolescence, both measured with the International Social Economic Index (ISEI) [Ganzeboom, de Graaf, Treiman, and de Leeuw 1992]. Because the theoretical model that underlies the simulation ignores career effects, the hypotheses relate to the respondents' first job after they left the educational system. Ideally, we would thus use data on the respondent's first job, but because first jobs are not generally available in the data, we took career effects into account by using age as a control variable.

In the simulation, *IEO* was the standardized coefficient of level of education on social origin. Similarly, we obtain a cohort-level measure of IEO by estimating the standardized regression coefficient of years spent in school on father's status in each cohort.<sup>7</sup>

<sup>7</sup> To account for differences in accuracy of the estimated regression coefficients caused by differences in cohort sizes, we experimented with weighting the data using the inverse standard errors of these estimates. This does not affect the results. The analyses reported here are therefore unweighted.

*Meritocracy* refers to the value employers attach to education when choosing between applicants. Wolbers [1998] estimated this value by using log-linear models (on the same data), and found that it correlates strongest with the level of unemployment in a given period. In times when unemployment is high, employers apply a stricter selection on education than when labor is scarce. Therefore we use the level of unemployment during the year of entry of each labor cohort as an indicator for meritocracy (sources: OECD and Bureaus of Statistics).

In the simulation analyses *dominance* is a parameter that indicates to what extent employers order applicants for jobs not only on education but also on social origin. It is usually assumed that especially among self-employed social origin is an important selection criterion. The percentage of the labor force that is self-employed would therefore be an indicator of dominance. We estimated the percentages using information on the employment status of the fathers of the respondents (at respondent age 15). The percentage of self-employed in 1950 is then estimated using all information on employment status of the fathers of respondents who were 15 in that year. The year-to-year variation in these estimated percentages is decreased by taking a five-year moving average.

*Occupational expansion* is defined as an upward shift of the occupational structure. In the simulation this was measured by subtracting the percentage of high status jobs of fathers from the percentage of high status jobs among their children. With the data at hand, this would be very complicated because respondents are measured at different stages in their career, whereas their fathers are measured at approximately the same stage in their career. We therefore use the linear regression coefficient of job status of the respondents on year of survey as an indicator of the amount of upward change in the occupational structure. Note that this measure varies between countries but not between labor market cohorts within countries.

In constructing of interaction effects, all variables were centred around their means. Table 7 provides descriptives of the cohort-level independent variables.

TABLE 7. *Cohort-level Variables (N=196)*

Variable	Mean	Std. Dev.	Min.	Max.
IEO	0.31	0.11	0.04	0.54
Meritocracy	4.79	2.82	0.65	14.20
Dominance	16.33	7.19	0.00	30.71
Occupational expansion	0.20	0.15	0.09	0.48

### 4.3. Results

The results of the analyses are summarized in Table 8. Model 1 contains only the effect of father's status on respondent's status (as a random coefficient), controlled for age. The size of this coefficient serves as an indicator of ISO. We find that ISO is overall positive. The significant variance of the effect of father's status shows that this effect differs between cohorts. In the subsequent models we attempt to explain this variation by adding cohort-level variables to the model.

In Model 2, we add main effects of cohort-level variables and interaction effects of these variables with father's status. We focus on the interaction effects in this model because they correspond to the main effects in Model 3 of the simulation analyses (Table 5). In line with the predictions, we find that IEO positively affects the effect of father's status. If the inequality of educational opportunities is higher, so is the inequality of occupational opportunities. Contrary to expectations, however, there is a significantly negative effect of our indicator of dominance on the effect of father's status. In cohorts with a higher percentage of self-employed, ISO is lower than in cohorts with a lower percentage of self-employed. The effects of our indicators of meritocracy and occupational expansion are not significant.

Next, we add three-way interaction effects, which can be interpreted as interaction effects of the cohort-level variables on ISO. We tested these three-way interaction effects one by one, and only report the coefficients and standard errors of the three-way interaction effects in Table 3 (we do not report the coefficients of the other variables nor the random components, because they slightly differ between the estimated models). None of these effects turns out to be significant.

TAB. 8. *Multilevel Regression Models (Empirical Data)*

	Pre- diction	Model 1		Model 2		Model 3-8	
		Coeff.	SE	Coeff.	SE	Coeff.	SE
Constant		18.780**	(0.080)	36.060**	(1.467)		
Father's status		0.259**	(0.006)	0.264**	(0.005)		
Age		0.566**	(0.011)	0.568**	(0.011)		
IEO				-21.260**	(2.344)		
Meritocracy				-0.287**	(0.083)		
Occupational expansion				-8.265**	(2.254)		
Dominance				-0.454**	(0.046)		
Cohort effects; interaction of father's status with:							
IEO	+			0.512**	(0.054)		
Meritocracy	+			-0.002	(0.002)		
Dominance	+			-0.002**	(0.001)		
Occupational expansion	-			0.056	(0.056)		
Interaction cohort effects; interaction of father's status with:							
IEO*meritocracy	+					0.007	(0.017)
Meritocracy*dominance	-					0.000	(0.000)
IEO*dominance	-					-0.001	(0.009)
IEO*occupational expansion	-					0.290	(0.454)
Meritocracy*Occupational expansion	+					0.026	(-0.019)

TAB. 8.

	Pre- diction	Model 1		Model 2		Model 3-8	
		Coeff.	SE	Coeff.	SE	Coeff.	SE
Variance components							
Effect father's status		0.003**	(0.001)	0.000	(0.000)		
Cohorts		26.502	(3.595)	10.120	(1.774)		
Individuals		191.118	(1.295)	191.000	(1.294)		
-2*(LL)		356087		355853			

\*\* =  $p < 0.05$

## 5. Conclusions and Discussion

We started this paper from the contention that the process of status attainment should be understood as a process in which people are interdependent: one's social destination does not only depend on one's own individual characteristics, but also on those of others who are also striving to reach a high position on the status ladder. This view contrasts with the way status attainment has usually been modelled in mainstream status attainment research, where attained status is typically seen as dependent on individual background exclusively.

As a starting point we took the model by Boudon [1974], who modelled the process of status attainment as a competitive process in which both education and social background provide individuals with an advantage in the "lobar queue." We argued that this model, despite the attention it received at the time of publication, has not been tested satisfactorily. The way to test such a model (which was originally formulated as a numerical example) is to relate the outcomes of the model to a large variation of specific model parameters, such that predictions can be derived on the level of Inequality of Status Opportunity (ISO) in different circumstances (the degree of educational inequality, the level of meritocracy, etc.). We did this by means of computer simulation, in which we basically repeated Boudon's original numerical example in a very large number of variations, and explored the effects of different parameter values on the outcomes of the process by statistical analysis of the simulation results. In doing so we improved upon earlier analyses of this kind [e.g. Müller-Benedict 1999].

Moreover, we also extended Boudon's model. One of the assumptions of his theory that was heavily criticized [see Hauser 1976] was that the structure of status position remains stable over time, while modernization theory states that in industrial societies the proportion of higher status positions gradually increases because of the increasing demand for skilled labor. This assumption in particular has been held responsible for Boudon's assertion that ISO can remain stable while IEO decreases. To investigate this issue, we included simulation runs in which the status distribution shifts upwards.

The results from the simulation analyses can be considered as hypotheses. In agreement with the earlier study by Müller-Benedict [1999] we find that Boudon's assertion about the independence of ISO and IEO does not hold; IEO really depends on ISO (H1). Moreover, also in agreement with Müller-Benedict, we find a positive relation between meritocracy and ISO (H2). We derive new, but unsurprising hypotheses on the relation between dominance and ISO, and interaction effects of dominance with IEO and meritocracy (H4-6). A more counter-intuitive result however was found for the effects of occupational expansion, our extension of the model. In contrast to what one might expect, an increase in the proportion of high status positions does not lead to a stronger effect of IEO on ISO, but to a *weaker* effect of IEO (H8). In addition, the effect of occupational expansion itself can in some cases (when meritocracy is high and IEO is low) have a negative effect on ISO: when more jobs at the highest level become available, inequality can increase (H7).

The elaboration of Boudon's model by simulation allows for empirical testing of its implications for the relations between ISO on the one hand and IEO, meritocracy, dominance and modernization on the other hand. We have tested the hypotheses on data on 196 labor market cohorts from seven countries. Only the hypothesis on the effect of IEO is supported by the data: ISO increases when IEO increases (H1). For the other hypotheses, no support was found. The effect of dominance is in the opposite direction as predicted by the model. Thus, overall, we find little empirical support for Boudon's model.

The use of simulation methods in sociology remains an exception, although its popularity seems to increase over the years (see Halpin [1999] for a review). Our study presents an opportunity to say something about the usefulness of this technique for stratification research in general and that of Boudon's model specifically. Generally, support for the hypotheses as derived from the extension of Boudon's model was weak, to say the least. Nevertheless, the simulations of the extension of the model were necessary to execute a proper empirical test to begin with. On the other hand, the results may not justify a complete dismissal of the theory, as our tests of

the hypotheses were far from perfect. Several problems can be mentioned that leave room for improvement.

In the first place, several of our measures for the concepts used in the model are debatable. This goes especially for the measure for occupational expansion (which now has only seven different values over all cases, and does not vary between years), but also for the measures for dominance and meritocracy. Partly, these problems are caused by the fact that the individuals in the data were observed at different points in their career. This makes it hard to establish the conditions of their entry in the lobar market as postulated in the model. Finding better measures for these concepts will certainly be a good step in improving our test of the theory. Second, the number of cases at the cohort level on which the hypotheses were tested was rather low (196), whereas the hypotheses were derived from a dataset with 33,000 hypothetical cohorts.

Third, the variance on the predictors of ISO was much larger among the simulated cohorts than among the observed cohorts. Both the second and the third problem are not easy to solve. If we could observe all lobar market cohorts between 1945 and 2005, we would still need 550 countries to create a dataset of the same size as the simulated data. It may be instructive to compare our results to similar analyses performed by Rijken [1999], who tries to explain the variance in the direct effect of father's status on the status of his child in 794 cohorts (i.e. specific lobar market cohorts in countries separately for men and women). Rijken's focus is on the effect of state socialism and they indeed find the expected negative effect of this characteristic on the intergenerational transfer of status. In her models, just like in ours, though, occupational expansion does not have an effect and of three characteristics of the educational system, only the mean education of the cohort members is negatively related to the intergenerational transfer of status. This supports our own finding of a negative relation between IEO and ISO, but it also shows how difficult it is to find empirical support for hypotheses on macro differences in ISO.

Besides the direct empirical test of the newly derived hypotheses, though, there are several other implications of the results from the simulations, in line with more general arguments in favour of computational sociology as put forward in Macy and Willer [2002] or Hedström [2005]. First, the simulations provide a theoretical underpinning and explicitness of assumptions as compared to "just" intuitive theorizing. In terms of Wippler and Lindenberg [1987] and in the spirit of Coleman [1987], Boudon's model makes the micro-macro link explicit through "bridge assumptions:" individuals at the micro level are influenced by macro level factors such as the availability of jobs at given educational levels. Moreover, Boudon's way of distributing jobs, and finally a mobility table, provides the "transformation rule:" the way in which individual level outcomes translate into macro-level consequences.



Secondly, simulation makes it possible to derive hypotheses that are formulated quantitatively. In most of sociological theory, hypotheses are formulated in general terms, and postulate relations like “the larger  $x$ , the smaller  $y$ .” In contrast, the simulation model used here generated “hypotheses” that could be formulated as regression equations. That we decided not to do so, had to do with the problem that the quantitative relations resulting from a simulation are not always easily interpreted, when it is not clear what the exact meaning is of the values used. For example, the simulation model used here uses a parameter for meritocracy, but the exact meaning of a “meritocratic parameter” with a value of 70% is unclear. The same goes for dominance and occupational expansion in our analysis. This can make it hard to test quantitative hypotheses generated by a simulation model, but the possibility is interesting.

Nevertheless, a simulation approach demonstrates that it is possible and necessary to operationalize abstract concepts such as meritocracy in terms of concrete processes. While verbal theorizing, in which such concepts also play an important role, often leaves those concepts relatively vaguely defined, implementation in a simulation model forces the modeller to think specify precisely what “importance of selection on achieved characteristics” (i.e., meritocracy) looks like in quantities terms.

Third, we observed that including micro-assumptions about competitiveness of individuals on the job market does not contradict the intuitive main effects of educational inequality and meritocracy (hypotheses 1-3) on status inequality. That is, for these main effects, the inclusion of more complex micro-assumptions does not lead to different macro-hypotheses. Applying the model leads to concrete predictions about the effects of dominance that are harder (hypotheses 4-6) to deduce based on intuitive modelling alone. Moreover, the simulation suggests that the inclusion of competitiveness and restrictions on the job market in the sense of Boudon implies two quite counter-intuitive effects of occupational expansion on the inequality of status opportunity. In the present article we tried to empirically test all these hypotheses at the same time, comparing countries and cohorts. However, future research might focus on one specific hypothesis and search for suitable data e.g. on the level of companies or industrial sectors to shed light on one of the consequences of Boudon’s model.

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## Status Attainment as a Competitive Process

### A Theoretical and Empirical Study on the Implications of Boudon's Status Attainment Model

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**Abstract:** The typical status attainment approach assumes a purely individual-level process, disregarding that individuals are interdependent because status positions are scarce. In line with arguments by Thurow [1975] and Coleman [1987] we reanalyze and extend Boudon's [1974] model in which status attainment is modeled as a competitive process. We use computer simulations to derive testable predictions from this model under different circumstances. In line with previous studies, we find that Boudon's assertion that mobility is not affected by educational inequality does not hold in all circumstances. Furthermore, we extend Boudon's model by allowing the distribution of jobs to shift upwards (in line with modernization arguments), and find that this has complex and counterintuitive effects on status inequality. We test the hypotheses that we derive from the simulation on comparative data. Although not all hypotheses are supported, the results do lend support to the notion that status attainment is indeed a competitive process.

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*Keywords:* Inequality of educational opportunity, status, mobility, labor market, simulation

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