Toward a Longitudinal, Multi-Dimensional Class Model

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Summary

A longitudinal analytical framework, one that sees class as a process over time and not a fixed attribute, is proposed as a means to redirect class analysis and revive a theoretical debate that has gone stale. Class analysis implies an inherently dynamic perspective. However, quantitative studies of class that go beyond static analyses of cross-sections are rare. Three dimensions of class may be identified in previous work on the effects of class: 1) class as market situation, 2) class as social status, and 3) class as position in the relations of production. A longitudinal multi-dimensional model would allow each of these aspects of class to independently influence the life course over time. Hierarchical Linear Modeling (HLM) techniques are used to estimate a model of this type. Thirteen years of individual income data from the German Socio-Economic Panel (GSOEP) are used to illustrate the application of this framework. The estimate results indicate that each of the three dimensions significantly affects income trajectories over time, but they do so in different ways.

1. Introduction

A survey of recent sociological literature on social class gives new meaning to the term "class struggle." At times a war of attrition and in other instances a pitched battle, opposing sides in the class debate remain unable to resolve fundamental differences. However, as Grusky and Sørensen (1998) argue, there is little to be gained in further defense or critique of existing variants of class analysis. Instead, the goal ought to be to rebuild a class framework that can redirect future research. The aim of this paper is to offer such a framework, based on explicit recognition of the fact that class phenomena manifest themselves in multiple dimensions over time. The goal is to combine the strengths of different approaches, rather than to define any one as superior or inferior.

Adequately capturing the multi-faceted character of class phenomena requires a multi-dimensional modeling framework. The multi-dimensional class model developed in this paper is operationalized through a hierarchical linear model of earned income over time.[1] Class membership, as defined through several class schemes, is used to model income trajectories, which are recorded as continuous measures at multiple time points.

The paper proceeds as follows. The next section identifies key analytical concepts and describes the multi-dimensional class model. The third section describes the data and variables used to test the model, while the third section presents the results obtained when a multi-dimensional class model of income determination is estimated using longitudinal data from the German Socio-Economic Panel (GSOEP). The final section discusses the implications of the findings.

2. Specifying a Longitudinal, Multi-Dimensional Class Model

Along with the critical voices of those who eschew class analysis of any ilk, arguments against specific theories of class are commonly raised by those who favor a different approach to class. Rather than entering this fray, the model developed here borrows from each of the three primary approaches to class: 1) class as market situation, 2) class as social status, 3) class as position in the relations of production. Based on these three dimensions of class, a class-based model of income determination implies a particular profile to the individual at the center of the process, as well as to the social structure where this process is played out. At the center of the process is an individual actor, who is very much a market agent. The individual's earnings over time are in part a return to an investment to human capital. Each individual's stock in human capital is acquired through and signaled by education and training as well as prior work experience. The return to human capital over time includes gradual and continuous positive and negative changes in the rate of return. However, there may also be sudden gains or losses, discontinuities that come with voluntary or involuntary job shifts.

Beyond this element of class, where the actor's class position coincides with market position, the individual also possesses a stock of social and cultural capital that figures in the process of income determination. Largely handed down through the family, class membership in this regard is the primary vehicle for the reproduction of social and cultural advantage and disadvantage. As status attainment researchers have convincingly shown, it has an obvious influence, channeling individuals toward certain educational and occupational tracks. Moreover, it may have other effects that persist over time beyond the influence of family status background on the portfolio of human capital one acquires. In narrow economic terms, knowing the right people and having the right tastes are likely to have income benefits as well.

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[1] The term hierarchical linear models corresponds to models given a variety of names in other disciplines, including: multi-level linear models, mixed-effects models, random-effects models, random-coefficient regression models and covariance components models (Bryk and Raudenbusch 1992).

Finally, individuals with particular stocks of human, social, and cultural capital also occupy class positions with regard to the productive process. These class positions confer property, organizational, and skill assets that place class members in relations of exploitation with members of other classes: to exploit the labor power of individuals in other class positions or to have their labor power exploited based on their class position.

Hierarchical linear modeling techniques (Bryk and Raudenbusch 1992) provide a framework to separate out different moments of the income determination process — the dynamics of market processes; the individual-level effects of human, cultural, and social capital; and the impact of relationships to the means of production as an effect shared by similarly situated individuals — and separately consider the effects of each over time.

Though the basic notation is similar, the dynamic character of a longitudinal, multi-dimensional class model of income trajectories stands in sharp contrast to a traditional cross-sectional income model. A cross-sectional, multi-dimensional class model of income for J individuals may be written as follows:

[1] $Y_j = \text{ß}_0 + \text{ß}_1 MC_j + \text{ß}_2 PC_j + \text{ß}_3 SC_j + e_j$

   Y_j is the income of individual j;

   ß_0 is the intercept for all individuals;

   $\text{ß}_1 MC_j$ represents the effects of class as market situation;

   $\text{ß}_2 PC_j$ represents the effects of class as a position in the relations of production;

   $\text{ß}_3 SC_j$ represents the effects of class as social background; and

   e_j is an error term that captures the deviation of income of person j from the model.

Moving to a longitudinal perspective, one may assume there are $i = 1,\ldots, I$ observations of Y earnings, nested within $j = 1,\ldots, J$ individuals (i.e., multiple observations of each individual's incomes over time). Then, one may specify a multi-equation model where the intercepts and slopes of income over time (equation [2]) are estimated as outcomes of individual characteristics (equations [3] and [4]). The single equation at the first level may be written as:

[2] $Y_{ij} = \text{ß}_{0j} + \text{ß}_{1j} DUR_{ij} + e_{ij}$

   Y_{ij} are the earnings at time i of individual j;

   ß_{0j} is the intercept in an income equation for individual j;

   $\text{ß}_{1j} DUR_{ij}$ is the slope of the income equation for individual j, indicating predicted change in income between observations; and

   e_{ij} is a Level-1 error term that captures the deviation of observed income of person j at time i from predicted income for individual j at time i.

Then, at the second level, two equations treat the means and slopes as outcomes. Measures of the different dimensions of class serve as predictors in these two equations:

[3] $\text{ß}_{0j} = \mu_{00} + \mu_{01} MC_j + \mu_{02} PC_j + \mu_{03} SC_j + u_{0j}$

[4] $\text{ß}_{1j} = \mu_{10} + \mu_{11} MC_j + \mu_{12} PC_j + \mu_{13} SC_j + u_{1j}$

Finally, to more adequately reflect the market aspect of income determination, job change indicators are added to equation [2].

[2a] $Y_{ij} = \text{ß}_{0j} + \text{ß}_{1j} DUR_{ij} + \text{ß}_{2j} VOL_{ij} + \text{ß}_{3j} INVOL_{ij} + e_{ij}$

These new terms indicate whether or not respondent j experienced a voluntary or involuntary job shift in year i. The mean magnitude of these effects is then estimated at level two by adding two further equations:

[5] $\text{ß}_{2j} = \mu_{20}$

[6] $\text{ß}_{3j} = \mu_{30}$

The parameters estimated at the second level (equations [3] through [6]) are efforts to determine the extent to which income trajectories systematically vary with class as position, class as social background, and class as market situation.

3. Data and Variables

The GSOEP is a nationally representative, panel study that was started in 1984 with a sample of approximately 16,000 individuals in 5,021 households. The analyses presented here are restricted to the 7,054 West German sample members who were employed full-time at the time of at least one interview during the 1984-95 observation period. Of this group, 20 percent (1,409 cases) were employed full time in all twelve years and over half (55.1 percent) were observed in six or more years.

Class as market situation

Labor market experience and post-secondary education and training are used as the main measures of an individual's market situation. Experience is measured as the number of years between the time the individual completed his or her education and the first year of observed income during the panel period.[2] The highest level of com-

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[2] In addition, duration (DUR) is a component of the level one model that estimates an income equation for each individual. This variable is a counter of the number of years of observed earnings and serves as the base for the slope effects for the predictor variables at level two.

pleted post-secondary education upon entering full-time employment serves as the other principal indicator of market situation. Individuals with apprenticeship training act as the reference category, and separate income effects are estimated for individuals who have completed a school based form of vocational education, individuals with training in the allied health professions, those with formal civil service training, graduates of technical schools, university and technical college graduates, and a miscellaneous category of other forms of post-secondary education, as well as those with no post-secondary vocational education. As noted above, voluntary and involuntary job changes are also included as direct and immediate measures of market situation.

Class as social status

Dahrendorf's (1967) class scheme provides the basic logic for categorizing individuals according to this dimension of social class. Retrospective data concerning each respondent's household at age 16 is used to assign individuals to specific classes. Two of Dahrendorf's classes, the elite and the underclass, are poorly captured in a nationally represented sample such as the GSOEP and are not included in the analysis. On the other hand, an analytical interest in income trajectories suggests that Dahrendorf's scheme be modified, to distinguish two other effects that derive from class as social status. The first modification is to divide individuals with a service

Table 1

Dimensions of German class structure 1985 – 1995. (West German and resident alien GSOEP respondents employed full-time)

	1985	1990	1995
Class as market situation			
Apprenticeship training	42.6	45.5	43.6
Vocational school	8.1	6.2	6.1
Health care school	1.9	2.1	2.6
Technical school	7.7	6.7	5.3
Civil service school	5.2	4.6	5.2
Other vocational education	3.0	2.6	2.8
University education	13.6	13.3	14.5
No vocational education	17.9	21.0	19.9
	100.0%	100.0%	100.0%
Class as social status			
Working class	44.0	42.8	41.7
Working class elite	6.1	5.6	6.4
False middle class	11.7	13.1	14.6
Old middle class	16.3	15.2	12.7
Service class	9.8	10.3	11.3
Service class elite	2.8	3.4	4.0
Foreigner	9.3	9.7	9.4
	100.0%	100.0%	100.0%
Class as position in relations of production			
Low (S) Low(O) assets	12.7	13.4	13.2
Medium(S) Low(O) assets	37.9	40.2	38.7
High(S) Low(O) assets	18.0	18.6	19.8
High(S) Med(O) assets	8.1	6.9	6.3
High(S) High(O) assets	12.6	10.7	12.6
Property assets	9.4	7.9	6.4
	100.0%	100.0%	100.0%
Estimated full-time workers (thousands)	17,251	19,797	16,367
N of cases	4 569	4 346	3 512

Weighted using GSOEP cross-sectional weights for 1985, 1990 and 1995 respectively.

Source: Author's calculations.

class background into two groups, based on whether or not one of their parents had received a degree from a university or technical college. Dahrendorf characterized the service class as travelling the same road, but also recognized that this road was "… barricaded at several points by nearly insurmountable barriers." An elite university education ranks among the highest of these hurdles, so presumably the life chances of individuals — more specifically, here, their income trajectories — will vary based on the segment of the service class to which their parents belonged. Secondly, Dahrendorf's class scheme is modified to explicitly recognize the distinct class position occupied by foreigners in Germany. Dahrendorf's class typology was originally devised in 1965 and largely overlooks the foreign "guest workers." Since then, however, the resident alien population in Germany has taken on very different dimensions. During the time period in question, foreign workers made up approximately 10 percent of the full-time labor force. Many of these workers were educated, and even born, in Germany, but by virtue of their social background occupy very different class positions. A young person of Turkish descent with a German apprenticeship degree may have the same human capital as a German peer and, nonetheless, possess a very different stock of cultural and social capital.

Class as position in relations of production

Self-reported occupational position (*berufliche Stellung*) serves as the basis for operationalizing class in this sense. Based on Wright's (1997) distinction between property, skill, and organizational assets, six classes, in terms of position relative to production, could be identified with the GSOEP data. The first group is workers with low skill and low organization assets. In the analyses presented in this paper the low skill, low organization assets class serves as the reference group. The second group is workers with medium skill and low organization assets. The third group is workers with high skill and low organization assets. The fourth group consists of workers with high skill and medium organization assets. The fifth group includes workers with high skill and high organization assets. Finally, the sixth class includes all business owners and self-employed professionals. This is not a complete replication of Wright's categories; however, this approximation is sufficient for analyses of the separate earnings effects of property, skill, and organizational assets.

Income

The GSOEP includes a number of income measures, household as well as individual. A detailed income calendar asks respondents about gross monthly income from eleven different sources; however, respondents are only asked to provide a single average amount for each type. In addition, as part of the employment section of the ques-

tionnaire, employed persons are asked to provide their gross and net income from employment in the previous month. This latter measure represents a better point estimate of current earnings. Given the relatively high German tax rate and social welfare contributions, net income was chosen as a better measure of the return to work; however gross earnings yield similar results for the income models estimated below.

4. Estimated Results for a Longitudinal, Multi-Dimensional Class Model

A cross-sectional snapshot of the three main analytical dimensions of the German class structure is presented in Table 1. In large part, these results indicate a period of relative stability in the German class structure.[3] Once Germany's postwar economic miracle took off, the demand for labor was quite strong and unemployment was regularly quite low. Beginning with the 1973 oil embargo, cyclical patterns of unemployment rates with peaks of increasing amplitude came to characterize the demand for labor. In Table 1 we see a peak in employment in 1990, a trend which is consistent with short-term prosperity immediately following German reunification. The increased proportion of employed persons in 1990 with no post-secondary vocational education or training (Table 1, upper panel) is consistent with the expansion of employment in a time of relative prosperity, but even these shifts are quite small. Similarly, these cross-sections indicate changes in the class structure concerning class as position in relation to production or as social status, in terms of family background, that are substantively quite small.

Table 2 describes the data set of pooled individual income observations that serve as the basis for estimation of the longitudinal multi-dimensional class model. The analysis rests on 53,631 observations based on the income trajectories of 7,054 individuals. In any given year, between 3,294 and 4,579 individual observations are recorded. The pooling procedure introduces a lack of independence between observations, as the unobserved attributes of an individual in one year are likely to be correlated with the unobserved attributes of this same individual in other years. Tests of significance for the coef-

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[3] It should be emphasized that a period of relative stability in class structure along these dimensions is not inconsistent, at least in the short run, with a period marked by other types of economic restructuring. During this time there appears to have been a notable shift in employment from blue-collar to white-collar jobs (Witte 1999). This reorganization of production technology is of little import for the perception of class as position in relation to production, where the emphasis is on the asset power of skill and organization position regardless of whether it involves blue-collar or white-collar employment.

Table 2

Pooled individual income observations[1] of West German and resident alien GSOEP respondents employed full-time 1984–1996

	Number of observations	Mean monthly net income	Percent with voluntary job change	Percent with involuntary job change
1984–1996	53,631	2,386	5.5	2.5
1984	4,216	1,967	n.a.[2]	n.a.[2]
1985	4,394	1,995	4.3	2.6
1986	4,523	2,071	6.2	3.5
1987	4,579	2,093	7.0	3.6
1988	4,323	2,162	7.1	3.4
1989	4,340	2,228	7.2	3.0
1990	4,289	2,366	9.3	4.4
1991	4,233	2,471	6.5	1.8
1992	4,117	2,564	6.0	1.7
1993	4,004	2,736	5.5	1.9
1994	3,776	2,810	3.4	1.9
1995	3,543	2,923	3.9	2.1
1996	3,294	2,993	4.2	2.3

[1] The pooled income analysis is based on 53,631 income observations from 7,054 individuals who were employed full-time at least twice during the period 1984-96 (1,025 persons contribute 13 observations, 585 persons contribute 12 observations, 444 persons contribute 11 observations, 407 persons contribute 10 observations, 453 persons contribute 9 observations, 521 persons contribute 8 observations, 523 persons contribute 7 observations, 561 persons contribute 6 observations, 645 persons contribute 5 observations, 693 persons contribute 4 observations, 669 persons contribute 3 observations and 528 persons contribute 2 observations)

[2] Not applicable due to left-censoring regarding voluntary/involuntary nature of job change.

Source: Author's calculations.

ficients are based on robust standard errors that correct for the bias introduced by the pooling procedure.

The analyses presented in Table 3 treat income determination as a dynamic process, rather than static outcome. Based on the HLM (fixed effects) modeling approach, the influence of human capital, class as position, and class as socio-economic background are decomposed into intercept and slope effects. That is, over a given time period, this framework represents distinct effects of each set of factors on income at the level of income at the outset of the observation period (intercept effects) as well as the influence of these factors on change in income throughout the observation period (slope effects). Represented in this way, the empirical evidence is considered in a fashion that shows different dimensions of class to be complementary rather than competing.

The upper panel of Table 3 describes the estimated intercept effects in this model of the income determination process. Again, significant intercept effects indicate systematic differences in the observed level of income at the start of the observation period. For example, the significant negative coefficient for women means, all other things equal, that women earned less than men at the start of the observation period. Likewise, the positive significant coefficient attached to the measure of labor market experience indicates that, controlling for other factors, individuals with more labor force experience earn more

than those with less labor market experience. Turning to other measures of human capital, the coefficients representing the effects of different levels of post-secondary education present a plausible and familiar picture. Apprenticeship training serves as the reference category. Relative to apprenticeship training, positive intercept effects are found for post-secondary vocational school, technical school, civil service school, and university degrees. The largest effects are found for the latter category, which includes degrees from technical colleges as well as traditional German universities. A clear negative intercept effect is found for individuals with no post-secondary education or training, while negative yet insignificant effects are recorded for training in the allied health professions and the miscellaneous group of "other forms" of post-secondary degrees.

Turning to the intercept effects associated with class position — with individuals in positions with low levels of skill assets, organizational assets, and property serving as the reference category — Table 3 indicates that individuals who occupy positions with more assets are generally at an advantage, with the exception of persons with high levels of vocational education and low levels of organizational assets. Most extreme, in contrast to persons with low levels of skill and organizational assets, are those with both high levels of skill and organizational assets; this group earns an estimated 1033 DM more each month than the reference group.

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Table 3

Multi-dimensional class model of earnings' trajectories of full-time employed West Germans and resident aliens (GSOEP 1984–1996). Restricted maximum likelihood estimation of fixed effects with robust standard errors.

	Coefficient	Intercept effects Standard Error	T-ratio	Coefficient	Slope effects Standard Error	T-ratio
Intercept	1404.04	25.87	54.27**	210.87	6.45	32.67**
Female	−485.71	17.71	−27.42**	−61.26	4.37	−14.01**
Work experience	19.19	0.83	23.25**	−4.12	0.20	−20.68**
Post-secondary vocational education – apprenticeship training (reference category)						
Vocational school	150.85	42.72	3.53**	1.02	9.73	0.10
Health care school	−3.77	65.05	−0.06	1.21	17.21	0.07
Technical school	217.85	49.50	4.40**	3.27	9.35	0.35
Civil service school	290.02	51.45	5.64**	−4.19	7.79	−0.54
Other voc. education	−69.64	42.75	−1.63	−2.36	14.67	−0.16
University education	492.83	54.93	8.97**	76.85	13.28	5.79**
No vocational education	−156.10	22.08	−7.07**	4.24	5.40	0.78
Class assets: skill (S), organizational(O) and property – Low(S) Low(O) assets (reference category)						
Medium(S) Low(O)	172.46	16.03	10.76**	−6.00	4.06	−1.48
High(S) Low(O)	45.08	23.85	1.89	−4.44	6.73	−0.66
High(S) Med(O)	489.11	40.76	12.00**	−5.53	8.27	−0.67
High(S) High(O)	1033.31	62.52	16.53**	35.93	13.78	2.61**
Property	659.06	73.45	8.97**	−22.43	17.01	−1.32
Class background: Working class (reference category)						
Working elite	104.89	45.92	2.28*	22.37	10.16	2.20*
False middle	2.26	32.82	0.07	15.06	8.31	1.81
Old middle	4.65	38.72	0.12	22.65	10.36	2.19*
Service	27.29	40.65	0.67	25.07	8.59	2.92**
Service elite	86.61	81.71	1.06	69.56	18.75	3.71**
Foreigner	−4.17	22.37	−0.19	−14.11	5.45	−2.59**
Job change: no job change (reference category)						
Voluntary				66.85	14.50	4.61**
Involuntary				−62.04	16.17	−3.84**

Source: Author's calculations.

On the other hand, the intercept effects tied to different levels of class as social background are in large measure insignificant. In fact, using individuals with a working class social background as a reference group, only those persons with an elite working class background have statistically significantly higher net monthly earnings at the start of the observation period. Moreover, in substantive terms the predicted difference, at 104 DM per month, is relatively small. In every other case, respondents who grew up in households that fall into Dahrendorf's other class categories (the service class, the false middle class, and the old middle class) or in non-German households reported monthly earnings that were virtually identical to those of working class respondents.

The lower panel in Table 3, which contains the slope effects of the same set, reveals other aspects of the process of income determination. The significant negative coefficient for women indicates that earnings of women grew at a slower rate than those of men. The estimated coefficient for labor force experience is also negative and significant. In a fixed effects model of income change, the slope effect of experience is functionally equivalent to a quadratic term for experience squared in a standard cross-sectional income equation, i.e., both represent the diminishing marginal returns to experience over time.

Most importantly, the slope effects describing the relationship between the different dimensions of class and income change are quite different from the intercept effects. Compared to individuals with apprenticeship training, a significant coefficient is only found for persons with a university degree. The incomes earned by these individuals grew at a faster rate than the incomes of those who had completed an apprenticeship. In all other cases, including those persons with no post-secondary education or training, the estimated slopes do not systematically vary. As a result, the initial differences in income according to education, which the intercept effects represent, remain un-

changed. The significant, positive slope effect for a university degree may be plausibly interpreted, from a human capital perspective, as a necessary incentive to compensate for the opportunity costs of an extended university education.

Similarly, looking at class position, a significant effect is only found for those individuals with the highest levels of skill and organizational assets. The income advantage of these individuals at the start of the observation period — represented by the substantively large and statistically significant intercept effect — also increases over time. The lack of a statistically significant effect for each of the other types of class positions implies that in all other cases the initial observed differences in income ordering remain unchanged. For example, the initial estimated difference in income between individuals with high skill and medium organization assets and those with low skill and low organization assets neither increases nor decreases over time.

However, considering class as social background, where individuals with a working class background serve as the reference category, a number of significant effects are present. Individuals who were raised in families that belong to Dahrendorf's service class experienced significantly greater increases in income over time than individuals from working class families. This effect holds regardless of the level of education in the family of origin. A similar positive and significant effect is found for individuals brought up in the old middle class. However, the slope effect for individuals with origins in Dahrendorf's false middle class is not significant, indicating that the income of these individuals increases at the same rate as individuals with a working class background. A significant negative effect, on the other hand, is found for non-Germans who were raised in non-German households in either Germany or another country.

The final two coefficients in the bottom panel of Table 3 represent discontinuities in income trajectories brought about by job changes. Direct and immediate measures of an individual's market standing, both types of changes are statistically significant, though in opposite directions. A positive income change is found for individuals who voluntarily change jobs and a negative change for those who involuntarily change jobs.

5. Conclusions: Class Analysis, Measurement and Modeling

The analytical strategy followed in this paper, based on a longitudinal multi-dimensional class model, introduces a temporal aspect that adequately represents the dynamic quality of class in our complex social world. In the social world, class is a lived experience made up of different moments, not a static outcome. This strategy situates the individual in time and thereby assesses the significance of different dimensions of class for various moments. In the example used to illustrate the model in this paper, the income trajectories of full-time workers in Germany are considered in light of three dimensions of class: class as market situation, class as social status, and class as position in relation to production. Each dimension significantly affects income over time, but they do so in different ways. Class as market situation and class as position in relation to production generally affect the level of income, but not the change in income over time. Class as social status, on the other hand, typically has little effect on the initial income level but does influence the patterns of earnings growth over time.

The extent to which the pattern of results found in Germany are present in other contexts remains an empirical question. The analysis here is not necessarily a common solution; however, the paper does introduce a modeling strategy that lends itself to wide application. Not only different contexts, but different dimensions and different specifications of class may also be introduced within this longitudinal framework. Moreover, the model may be adapted to explore the influence of class on a wide range of outcomes and not simply income trajectories. In addition, the model can be expanded to test for the crosscutting influences of race, gender, and social movements. These models allow consideration of affiliations such as these as alternate explanations, but also as factors that combine and interact with the influence of particular dimensions of class.

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