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Childhood Intelligence, Family Background, and Gender as Drivers of Socioeconomic Success: The Mediating Role of Education

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What drives socioeconomic success within a society? This study analyzes how late childhood intelligence, parental socioeconomic background, and gender relate to multiple dimensions of adult socioeconomic success (i.e., education, occupational status, and income). A particular focus is placed on education, which is considered as both an indicator of socioeconomic success and a mediator of the relationships with the other dimensions. Randomly sampled participants (N = 5,292) in a German prospective longitudinal study were assessed for the first time at age 12 years in 1991 and for the last time as adults in 2009–10. Comparison of the effects of childhood intelligence and parental socioeconomic background revealed childhood intelligence to be the more powerful predictor of the 3 dimensions of later adult socioeconomic success. Education was the strongest predictor of both later adult occupational status and later adult income, and mediated most of the effects of childhood intelligence and parental socioeconomic background on later adult occupational status and later adult income. A gender income gap was apparent, with men reporting higher income, even when childhood factors and education were controlled. Education barely mediated any gender differences, but family-related structural factors (i.e., working part time and having children) explained much of the gender gap in income.

Keywords: childhood intelligence, parental socioeconomic background, gender, education, socioeconomic success

How do individuals achieve socioeconomic success? To what extent is it "inherited"? A substantial body of research highlights the robust relationships between parents' and children's socioeconomic success—typically defined in terms of educational attainment, occupational status and prestige, and income (Strenze, 2007). In a meta-analysis, Strenze (2007) found a mean correlation of r = .30 between parental socioeconomic background and children's occupational status, and a weaker correlation of r = .15 for children's income. Parental socioeconomic background may influence children's socioeconomic success directly (e.g., when socioeconomically advantaged parents use their influence to find job openings for their children) or indirectly by affecting the children's decisions and behavior (e.g., when the same children decide to stay on in education to improve their chances of getting a good job).

At the same time, there is evidence that cognitive ability—in particular, intelligence—may be the key factor for socioeconomic

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attainment in adulthood (Gottfredson, 2003; Jencks, 1979; Nyborg & Jensen, 2001). Strenze's (2007) meta-analysis suggested that childhood and adolescent intelligence is one of the strongest predictors of adult socioeconomic success, with correlations of r = .41 with occupational status and r = .22 with income. Again, cognitive abilities may influence socioeconomic success directly (e.g., when more intelligent individuals perform better in job interviews and ultimately in their jobs) or more indirectly via the qualifications obtained (e.g., when the same individuals acquire further education, and are thus more likely to be selected for higher positions).

As these examples indicate, the influences of intelligence and social background on socioeconomic success may be partly or entirely mediated by education. Although seen as a substantive dimension of "socioeconomic success" in its own right, education is also a necessary condition for other dimensions of socioeconomic success, such as occupational status and income (Strenze, 2007). Research underlines the importance of education as "human capital"; its primary function is to equip individuals with the skills and knowledge needed to succeed in adult life and, in particular, on the labor market (G. S. Becker, 1964; Mincer, 1974; for an overview, see Psacharopoulos & Patrinos, 2004). It has also been argued that education systems and their qualification frameworks function as "filters" (Spence, 1973) controlling access to the job market in modern societies. Both these lines of research stress both the productive function of education and the key function it may have in mediating the effects of parental background or childhood intelligence; indeed, the precise functions of education are still hotly debated (see, e.g., Caplan, 2018).

By quantifying these absolute and relative effects, studies can provide insights into the functioning of an (education) system as a whole, rather than focusing on isolated segments, as is typically the case. In this study, we contribute to the literature by examining data from Germany, where research quantifying the longitudinal effects of parental background, late childhood intelligence, and gender on socioeconomic success (i.e., education, occupational status, and income) is scarce. Before presenting our data and analyses, we consider the role of systemic contextual factors, the variability of these factors, and the relevance of gender within this context.

Contextual Variations

Relationships between childhood intelligence, parental background, and indicators of socioeconomic success vary across cultural contexts. For example, Sorjonen, Hemmingsson, Lundin, Falkstedt, and Melin (2012) found that parental background had stronger effects on educational attainment in the United Kingdom than in Sweden. The effects of parental background on other dimensions of socioeconomic success were also much lower in Sweden, and more strongly mediated by education than in the United Kingdom (see also Bukodi, Erikson, & Goldthorpe, 2014; Deary et al., 2005; Schoon, 2008; von Stumm, Macintyre, Batty, Clark, & Deary, 2010). The U.S. situation seems to be similar to the U.K. one, with most studies suggesting that parental socioeconomic background has strong direct effects on educational attainment, occupational status, and income (e.g., Judge, Klinger, & Simon, 2010; Rumberger, 2010; Scullin, Peters, Williams, & Ceci, 2000; Spengler, Damian, & Roberts, 2018; Zax & Rees, 2002).

One reason for these contextual variations is the interaction between genes and environments. The relationship between parents and offspring is structured by various types of Gene × Environment correlations (passive, evocative, or active)—in other words, characteristics of the family environment are in part produced by the (shared) genetic endowment of parents and their children (see, e.g., Plomin, DeFries, Knopik, & Neiderhiser, 2013). Most importantly, how strongly intelligence is determined by genes may depend on parental socioeconomic status (SES), although this interaction seems to be context specific. Tucker-Drob and Bates (2016) showed that the so-called Gene × SES interaction—the phenomenon that intelligence is heritable in high-SES families but less so in low-SES families—varies by culture: The interaction was salient in the United States but not in western European countries or Australia. We would therefore assume that the phenotypic relations between the corresponding factors also vary by context, as is indeed suggested by cross-national comparative research (e.g., Chmielewski & Reardon, 2016).

Another reason for such contextual variations is that education systems differ in their structures and functioning. As Bol and van de Werfhorst (2013) have highlighted, structural features such as the degree of tracking at secondary level (e.g., number of school types; within-school ability-grouping measures), the structure and specificity of vocational training (e.g., curriculum based or not), and the formalization of qualifications affect the fluency of transition to the job market and the duration of job search (see also Allmendinger, 1989). At the upper secondary level, factors such as the flexibility to correct earlier decisions and the cost of tertiary education also play a role (Weiss, 2013). These structural features are highly intertwined: More differentiated and tracked systems are also more specific in the vocational training and certification offered (see the analyses of Bol & van de Werfhorst, 2013). They can, to some extent, be expected to have different and contrasting effects: More structured and tracked systems are likely to produce closer links between parental socioeconomic background and educational attainment. In early tracking systems, for example, parents have more influence on school transition decisions, which strengthens the effects of parental background (see also, Chmielewski & Reardon, 2016). At the same time, the link between education and children's future socioeconomic success is stronger in these more structured systems, which should cause parental influence to decrease. Filter or signal theories highlight the relevance of human capital and education as the formal gateway to socioeconomic success in modern societies. Before making a hire, an employer cannot be certain of an applicant's skills and cognitive abilities. Herein lies the importance of formal educational qualifications: They are the signals indicating a candidate's skills and abilities and, by extension, productivity (although other "indices" may also serve as filters, e.g., gender, social, and ethnic origin; Spence, 1973). To what extent human capital and educational qualifications function as signals for placement on the job market varies depending on factors including how formally structured the education system is (e.g., whether or not vocational training follows a standardized curriculum). Sorjonen et al. (2012) found a stronger relationship between education and professional success in Sweden than in countries with less formally structured education, such as the United Kingdom, where vocational training, in particular, is less standardized than in Sweden. In addition, they found that the effect of cognitive ability on socioeconomic success

was entirely mediated by education in Sweden but not in the United Kingdom (Sorjonen et al., 2012). These results imply that the relationship between education and other indicators of socioeconomic success narrows when cognitive ability is more closely related to human capital and educational qualifications, and when those qualifications are better interpretable by potential employers than in less structured systems (see also Weiss, 2013).

Yet one of the limitations of this research is geographical. With a few exceptions (e.g., Büchner, Smits, & van der Velden, 2012; Dubow, Huesmann, Boxer, Pulkkinen, & Kokko, 2006; Spengler et al., 2015), most evidence stems from the United States (e.g., Judge et al., 2010; Scullin et al., 2000; Spengler et al., 2018) or the United Kingdom (e.g., Cheng & Furnham, 2012; Deary et al., 2005; Johnson, Brett, & Deary, 2010; von Stumm et al., 2010). Relatively little is known about the respective relationships in other countries (for an overview, see Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Strenze, 2007). To our knowledge, only one study has looked at Germany: The *Lebensverläufe ins frühe Erwachsenenalter* study (Life Courses Into Young Adulthood; Fend, Berger, & Grob, 2009) followed a cohort of students in the German state of Hesse from adolescence to adulthood. The results indicated that adolescent intelligence was a marginally stronger predictor of educational attainment than parental socioeconomic background (Fend, 2009b). The respective predictions are not directly comparable, as they were reported as unstandardized effects (Fend, 2009b); however, both parental background and adolescent intelligence remained statistically significant predictors in joint predictions. In further analyses on the same dataset, Georg (2009) found that the effects of both factors in predicting adult SES diminished when education was controlled. A small effect of social background remained for men only (see the next section for details). The results for income are more difficult to interpret, but suggest that both parental background and intelligence were relevant in the direct prediction of income, at least (Fend, 2009a).

In sum, although the interplay between intelligence, parental background, and socioeconomic success is likely to differ across countries, research has thus far focused on the Anglo American context. The data available for other countries, including Germany, are scarce and unsystematic.

The Role of Gender

Another limitation concerns the role of gender. The "classic" studies drew on exclusively male U.S. or U.K. samples of military service personnel (see Strenze, 2007). Less is known about how findings generalize to women. Socioeconomic success still seems to be gendered in most countries (e.g., Hanushek, Schwerdt, Wiederhold, & Woessmann, 2015). Although women started to participate more strongly in further education in the 1970s, and their educational attainment has now overtaken that of men in some domains (Buchmann & DiPrete, 2006), gender differences in labor market success persist. Women still earn less than their male coworkers and are less likely to reach high-status positions (Buchmann & DiPrete, 2006; Reimer & Steinmetz, 2011; Schoon & Polek, 2011).

This paradox is not yet fully understood. Various explanations have been proposed. Structural explanations, drawing in particular on human capital theory, suggest that differences in human capital may contribute to the earning differential (G. S. Becker, 1964): Although women and men may be similarly trained on an absolute level, specific gender profiles in the educational and professional paths taken may account for (some of) the socioeconomic and income gap—for example, women choosing less well-paid professions than men. This "horizontal" stratification process may put women at a disadvantage in terms of socioeconomic success—and income in particular (Eccles, 1994; Gottfredson & Lapan, 1997; Reimer & Steinmetz, 2011). Indeed, women tend to be overrepresented in low-income, low-prestige professions, such as health care and the humanities, whereas men are overrepresented in most science, technology, engineering, and mathematis fields (Bundesagentur für Arbeit, 2016; Busch, 2013). Relatedly, women are more likely to take career breaks and to work part time, mainly due to childcare commitments (i.e., traditional distributions of family work), with direct effects on their income and acquisition of further professional skills that, in turn, negatively impact their long-term promotion prospects (Busch, 2013; Ziefle, 2004).

The understanding of how men and women attain socioeconomic success and to what extent they (may) differ in this regard is also incomplete. Some studies suggest that the overall predictability of career success is similar and that there are, if at all, only slight gender differences in the extent to which childhood factors mediate adult socioeconomic success (Heckman, Stixrud, & Urzua, 2006; Rumberger, 2010; Schoon, 2008). The classic study by Sewell, Hauser, and Wolf (1980) suggested that men's occupational status was slightly better predicted by childhood factors. These differences diminished when only women without children were included in the analyses, implying that job-extraneous factors, such as child-related aspects, (negatively) affected women's career trajectories and their predictability relative to men's. A more recent study (Büchner et al., 2012) showed that socioeconomic success as operationalized by educational attainment was better predicted in men than in women. Yet later occupational status and income were generally better predicted in women than in men, with the direct effects of cognitive abilities and schooling being larger for women than for men.

For Germany, Georg's (2009) results suggest some further gender differences in the pattern of effects predicting education and adult occupational status. Beyond the result that parental background only predicted occupational status in men, Georg found that women were about as likely as men to finish general education, but that women received less vocational training and were less likely to go to university and pursue careers in better paid professions. This differential effect was most salient at the point that university graduates entered the labor market. Simultaneously, the study suggested that intelligence predicted education slightly better in men than in women. Findings for income paint a different picture, however: The analyses of Fend (2009a) based on the same dataset did not allow the relative importance of parental background, childhood intelligence, and education in predicting income to be directly quantified; however, at least the bivariate correlations of these factors with income appeared to be entirely comparable. Whether that finding extends to multivariate regressions remains an open question. Additionally, neither study tested statistically for differential effects between men and women.

The Present Study

Drawing on German longitudinal data spanning the period from late childhood to adulthood, we pursue four main issues: First, we estimate the absolute and relative effects of intelligence, parental background, and gender. Second, we explore to what extent education functions not only as an outcome measure of socioeconomic success, but also as a mediator of other dimensions of socioeconomic success—and to what extent direct effects of intelligence, parental background, and gender persist once we control for education. Third, we explore the role of gender as a moderator of the relationships between the other variables. Fourth, we explore to what extent gender effects, in particular, change when we control for variables related to horizontal stratification and parenting.

Drawing on the theoretical and empirical findings outlined above, we predicted that the continuous background variables of late childhood intelligence and parental socioeconomic background would correlate most strongly with education, less strongly with adult occupational status, and least strongly with income at age 30. Whether intelligence or parental background is the better absolute predictor of socioeconomic success in adulthood was treated as an open question; however, from previous (internationally comparative) work, we expected intelligence to be the better predictor, and the two factors to share some variance but also to have some unique effects. Drawing on human capital and filter theories, in particular, we hypothesized that education would be a central mediator of the effects of both intelligence and parental socioeconomic background. As Germany has a highly structured education system (especially for vocational qualifications; see, e.g., Bol & van de Werfhorst, 2013), we expected to observe results similar to those reported for other countries with more formally structured education systems, such as Sweden (Sorjonen et al., 2012; Weiss, 2013) and Luxembourg (Spengler et al., 2015). Specifically, we expected a large part of both effects to be mediated, and direct effects to be small (see also Georg, 2009), but whether these background factors remained predictive after control for education, as is typical for countries such as the United Kingdom and the United States, was treated as an open question.

We expected to find only small gender differences in the level of education, but men to be at an advantage in terms of occupational status and income (e.g., Buchmann & DiPrete, 2006). We also expected the absolute predictability of occupational status and income to be higher in men, as women are more affected by extraneous factors, although the evidence is mixed. Additionally, we expected to find that gender differences on the absolute level were partly explained when we controlled for the domain of professional activity. To explore whether extraneous factors were relevant in explaining gender differences in main effects or/and predictability, we controlled for whether participants worked full or part time and whether they had children. We expected all three aspects to help to explain differences between men and women, especially the gender-related main effects.

Method

Sample

The sample was taken from the longitudinal large-scale *Bildungsverläufe und psychosoziale Entwicklung im Jugendalter und jungen Erwachsenenalter* study (BIJU; Educational Careers and Psychosocial Development in Adolescence and Young Adulthood; Baumert et al., 1996). The study was initiated by the Max Planck Institute for Human Development in fall 1991 with a sample of students entering seventh grade. Seven waves of the study have since been conducted, the last in 2009–10 (see Table 1). Here, we use data from Wave 1 (fall of 1991) and Wave 2 (early 1992) as predictor variables, and data from Wave 7 as outcome variables.

The 1991 sample was a stratified random sample of $N = 212$ schools, stratified by state and school type, with two classes being randomly drawn within each school (i.e., two-stage sampling). The study took place in four German states: Mecklenburg–West Pomerania, North Rhine–Westphalia, Saxony–Anhalt, and, from Wave 2 onward, eastern and western Berlin. Wave 2 consisted of $N = 8{,}043$ student participants, and there were $N = 5{,}386$ in Wave 4, at the end of 10th grade (see Table 1). There was oversampling in college-track schools, with all 12th-grade students being included from Wave 5 onward, extending the sample to $N = 8{,}061$ students.[1] In Wave 7, $N = 5{,}292$ valid addresses were available for the final data assessment, and $N = 4{,}130$ individuals responded.

As is typical in longitudinal studies, participation declined over the years and there was a concomitant increase in sample selectivity. Table 2 gives details, comparing for each wave the groups of students who participated/did not participate in Wave 7. Attrition was higher in the early waves, mainly due to dropout of students who had finished their 9 years of compulsory education, repeated a class, or changed schools. The students who dropped out thus represent a negative selection of the student population, with effect sizes of $d = 0.40$ for cognitive ability and $d = 0.22$ for parental socioeconomic background (i.e., father's occupational status). The longitudinal selectivity of the oversampled students at upper secondary level was lower (see results for Wave 5 in Table 2). There was some indication of differences in cognitive ability (e.g., in mathematics achievement, $d = 0.16$), but differences in parental background measures were not significant (e.g., $d = 0.004$ for father's occupational status). Overall, selectivity in these indicators was comparable to that reported in similar longitudinal studies (e.g., Damian, Su, Shanahan, Trautwein, & Roberts, 2015; Spengler et al., 2015, 2018). Table 3 summarizes the demographics of the final sample. Women are typically more likely to respond; here, too, they were overrepresented, at 60.2% of the final sample. Men represented a marginally more positively selected sample (e.g., reporting higher parental socioeconomic background).

In Wave 1–4 (and Wave 5 for upper secondary students), participants were assessed in the classroom context. Waves 6 and 7 (and Wave 5 for participants who had left general education) were conducted as postal surveys. Before commencing the study, written informed consent was obtained from all the participants and their parents. The BIJU study was carried out in accordance with the ethical guidelines for research with human participants as proposed by the American Psychological Association. All of the study materials and procedures were approved by the responsible

[1] Students from the original class-based sample were comparable to the later oversampled group, as the original classes were randomly drawn within each school. Sampling weights were used to account for the differing sizes of the oversampled groups.

Table 1
Summary of Sample Participation From 1991 to 2009–2010

Year of assessment	Wave	Grade	Sample (total, *N*)	Assessed in Wave 7 (*N*)
1991	1	7	5,944	1,317
1992	2	7	8,043	1,783
1995	4	10	5,386	2,308
1997	5	12/voc. training/job[a]	8,061	3,615
2009–2010	7 (eligible)[b]	/	5,292	4,130

[a] In 12th grade, in vocational training, or in the labor market. [b] Eligible if contact addresses were available.

ministries of education, and by the ethics committee of the Max Planck Institute for Human Development, Berlin, Germany. A more detailed description of the study is given in Baumert et al. (1996).

Measures

Outcome variables: Socioeconomic success indicators.

Occupational status. Self-reports on participants' occupational status were obtained in Wave 7. Unemployed participants reported their last occupation. We used the International Standard Classification of Occupations (ISCO 2008; International Labor Office, 2012) to code the occupations. These codes were converted into Treiman's (1977) occupational prestige scores.

Income. Wave 7 self-reports on current income (in euros) served as a second indicator of socioeconomic success. We used a logarithmic transformation of income as it normalizes the distributional shape, makes the analyses more robust against outliers, and facilitates interpretability and comparability to related studies (see, e.g., Strenze, 2007).

Education. Wave 7 self-reports of general and tertiary (vocational/university) education served both as a third outcome dimension of adult socioeconomic success and as the central mediator of occupational status and income. We used the Comparative Analysis of Social Mobility in Industrial Nations classification scheme (König, Lüttinger, & Müller, 1988) to code both general and tertiary education; this approach also permits a transformation into years of education (Blossfeld, 1993). Additionally, we used the grade point average (GPA) of the highest qualification in general and tertiary education, respectively, to test the importance of qualitative differences in educational qualification in predicting the other socioeconomic success outcomes.

Predictor variables.

Childhood intelligence. We used four indicators of late childhood intelligence as measured in seventh grade at Waves 1 and 2: the Figural and Verbal Analogies subscales of the *Kognitiver Fähigkeitstest* (KFT 4–13+; Heller, Schoen-Gaedike, & Weinlaeder, 1985), a slightly adapted German version of Thorndike's Cognitive Abilities Test (Thorndike & Hagen, 1971), and the numerical and spatial intelligence subtests of Amthauer's (1955) Intelligence Structure Test (IST). Both tests—especially the four subdimensions implemented here—are still in regular use in Germany (Amthauer, Brocke, Liepmann, & Beauducel, 2001; Heller & Perleth, 2000; Liepmann, Beauducel, Brocke, & Amthauer, 2007). Although the tests have recently been renormed, this is of minor importance for the present study, as no reference to current norms was necessary. The four subdimensions varied in reliability: Cronbach's $\alpha = .91$ for the figural KFT test, which is supposedly also the purest measure of *g*; Cronbach's $\alpha = .82$ for the verbal KFT test; Cronbach's $\alpha = .68$ and .74 for the spatial IST component (Versions A and B, respectively); and Cronbach's $\alpha = .90$ for the numerical IST component (each with Kuder–Richardson Formula 20). The four variables were used as indicators of a latent intelligence factor (see Statistical Analyses).

Parental socioeconomic background. Parental socioeconomic background was operationalized via indicators of both SES and educational qualification. Students reported their parents' oc-

Table 2
Longitudinal Sample Selectivity: Comparing for Each Wave the Groups of Students Who Participated or Did Not Participate in Wave 7

		Overall			Not in Wave 7[a]			In Wave 7[b]						
Construct	Wave	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*F*	(*df*)	*p*	*d*
Cognitive ability														
Figural intelligence														
1991	1	5,160	.36	1.72	3,955	.20	1.72	1,205	.89	1.64	150.5	(1,5158)	<.001	.40
1995	4	4,842	2.05	1.38	2,707	1.85	1.44	2,135	2.30	1.26	124.5	(1,4840)	<.001	.32
Mathematics														
1997	5	6,522	2.23	.91	3,923	2.17	.94	2,599	2.32	.87	40.2	(1,6520)	<.001	.16
Parental socioeconomic background measures														
Father's occupational status[c]														
1992	2	6,559	44.60	12.96	4,680	43.85	12.76	1,522	46.66	13.21	54.8	(1,6200)	<.001	.22
1997	5	5,989	50.23	13.78	3,131	50.21	13.65	2,851	50.26	50.23	.0	(1,5980)	.885	.004

[a] Students participating in the respective wave who did not participate in Wave 7. [b] Students participating in the respective wave who also participated in Wave 7. [c] Treiman index.

Table 3
Descriptive Statistics for Demographic and Outcome Variables: Overall and by Gender

Construct	Overall	Men (39.8%)	Women (60.2%)
Adult occupational status[a]	46.6 (12.8)	47.1 (12.9)	46.3 (12.5)
Income[b]	7.7 (.6)	7.9 (.6)	7.5 (.6)
Education (in years)[c]	14.7 (3.0)	14.9 (3.0)	14.5 (2.9)
General education (in years)	11.5 (1.5)	11.6 (14.3)	11.5 (1.5)
Tertiary education			
No vocational qualification, *n* (%)	164 (4.3)	69 (4.9)	95 (3.9)
Apprenticeship qualification, *n* (%)	2,046 (53.2)	616 (43.7)	1,425 (58.6)
Advanced vocational qualification, *n* (%)	357 (9.3)	162 (11.5)	195 (8.0)
College/university degree, *n* (%)	1,171 (30.5)	518 (36.7)	652 (26.8)
Doctoral degree, *n* (%)	108 (2.8)	45 (3.2)	63 (2.6)
Available, *n* (%)	3,845 (100)	1,410 (100)	2,430 (100.0)
Parental indicators			
Father's occupational status[a]	42.4 (11.9)	42.8 (12.2)	42.1 (12.0)
Mother's occupational status[a]	42.6 (11.7)	43.9 (11.4)	41.9 (11.5)
Number of college degrees in family	.6 (.8)	.6 (.8)	.5 (.8)

Note. Weighted sample (N = 5,246). Data presented as M (SD) except where otherwise indicated.
[a] Treiman index. [b] Logarithmic transformation of income. [c] Years of education, both general and tertiary.

cupations, which were coded according to the ISCO 88 classification (International Labour Organization, 1990). The ISCO codes for each parent were converted into Treiman's (1977) occupational prestige scores. Students were also asked to state their parents' highest educational qualification. The mother's and the father's qualification was used separately. For each indicator, we referred to student reports from the first four waves: If the data were missing at Waves 1–3, we used data from Wave 4. We also used two indicators of parental education. One variable coded whether parents had qualified for higher education (gained the "Abitur"); the second, whether they had graduated from university. Here, both parents' reports were combined, coded from 0 (no Abitur/university degree in the family) up to 2 (both parents have Abitur/a university degree). We used these four variables as indicators of a latent factor of parental socioeconomic background (see Statistical Analyses).

Gender. Data on students' gender were pooled across all waves, coded as a dummy variable (with 1 = female; 0 = male).

Control variables.

Professional sector. We used the official classification system (*Klassifikation der Berufe*) of the German Federal Employment Agency (Bundesagentur für Arbeit, 2011) to specify the professional sector of participants' occupations. The *Klassifikation der Berufe* coding is based on the ISCO categorization scheme, but has the advantage that professions are organized hierarchically by sector. We used this approach to control for professional sector without controlling for occupational status at the same time. The 10 sectors distinguished were coded as dummy variables. As rather few individuals were categorized to the military and agricultural sectors, we pooled the two into one category to achieve a sufficient class size ($N > 50$).

Working part time and having children. To operationalize working part or full time, we used participants' reports on how many hours they worked, as well as a dummy variable indicating whether their working time was regulated at all. Furthermore, we controlled for whether or not participants had children, using this information as a dummy variable (for additional analyses limited to individuals without children, see Table A2 in the Appendix).

State. Finally, to account for regional differences in employment and income, we controlled for German state of origin in all regression models.

Statistical Analyses

First, we established the latent measurement models for our two continuous independent variables: late childhood intelligence and parental socioeconomic background. As both latent variables were measured by four indicators, we inspected each latent factor separately as well as in a combined model. We used the absolute fit criteria root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TLI), and standardized root mean square residual (SRMR), as they allow model fit and model parsimony to be interpreted independent of sample size; a model can be considered to have a good fit with RMSEA < .08, CFI > .95, TLI > .95, SRMR < .08 (Byrne, 2012). The latent models for intelligence and parental background yielded satisfactory model fit for the overall model, with RMSEA = .022, CFI = .967, TLI = .952, and SRMR = .038. The multigroup model for men and women also fit the data well. Imposing strict measurement invariance to establish the same metric across groups of latent indicators (Byrne, 2012; Meredith, 1993) yielded a good model fit, with RMSEA = .022, CFI = .955, TLI = .957, and SRMR = .053.

Second, we conducted correlational and regression analyses to determine the absolute predictive performance of late childhood intelligence, parental socioeconomic background, and gender. We tested to what extent each factor predicted (a) adult socioeconomic success independent of education and (b) adult occupational status and income with control for education. Furthermore, we conducted path analyses to determine the direct and indirect effects of each factor via education (see Figure 1). We estimated bias-corrected confidence intervals for the parameter estimates (with bootstrapping) to test the statistical significance of direct and indirect effects on the outcome variables. This approach accounts for the nonnormality of mediation effects, providing a good balance of Type I

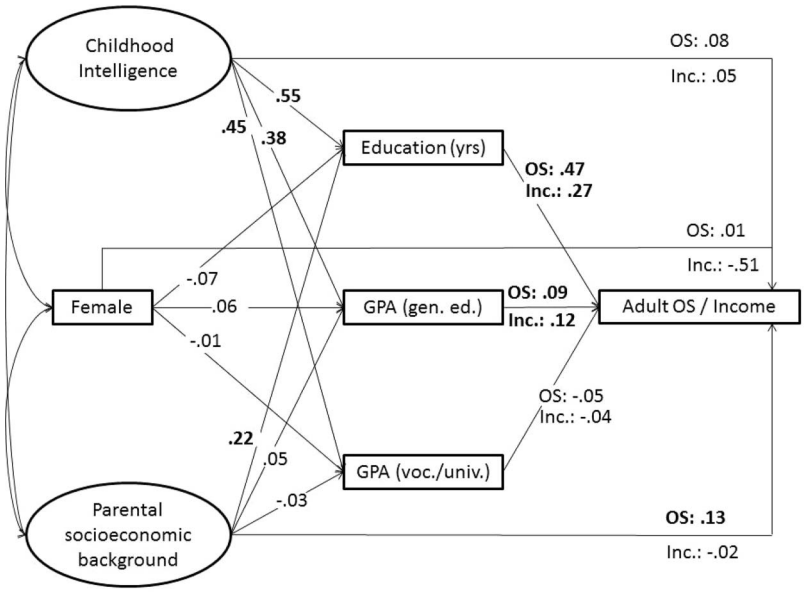

Figure 1. Overall results of path model for adult occupational status (OS, upper coefficients) and income (Inc., lower coefficients). Measurement model of latent factors of childhood intelligence and parental socioeconomic background as well as dummy variables controlling for state are not shown in the figure. Education (yrs) = years of education, both general and tertiary; GPA (gen. ed.) = grade point average of the highest qualification attained in general education; GPA (voc./univ.) = grade point of the highest qualification attained in tertiary education.

error and test power (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Third, we repeated all previous analyses but with gender as a grouping variable to test for gender differences in absolute and mediated effects. Differences in parameters were directly tested using the parameter constraints option in Mplus (Muthén & Muthén, 1998–2013). Fourth, we repeated the analyses with additional control for professional sector, working part time, and having children, testing whether results remained stable overall and across gender. To control for regional differences, we included state of origin in all regression analyses.

Standard errors were bootstrapped in all models, with a jackknife procedure suited for the clustered data structure, which is an implemented standard in Mplus (Muthén & Muthén, 1998–2013). We used a frequency weight to account for the differing probabilities that individuals would be sampled according to the general two-stage sampling procedure and the oversampling in college-track schools. To account for missing data, we used a model based on the full information maximum likelihood approach.

Results

Correlations Between Constructs

First, we examined the zero-order correlations, probing for absolute relationships between variables. As expected, late childhood intelligence correlated highly with all three indicators of adult socioeconomic success: education, $r = .61$, adult occupational status, $r = .42$, and income, $r = .28$ (see Table 4). Likewise, parental socioeconomic background correlated substantially with education, $r = .43$, adult occupational status, $r = .43$, and income, $r = .15$. Similarly, education in terms of the GPA of the highest qualification in general/tertiary education correlated positively with childhood intelligence, parental socioeconomic background, and the other indicators of socioeconomic success. All correlations were statistically significant. Gender correlated weakly (though statistically significantly) with education, $r = -.04$; it did not correlate with adult occupational status, $r = -.02$. However, a significant correlation with income, $r = -.14$, indicated that women earned less than men. The pattern of correlations was consistent with our expectations and held similarly for both female and male participants (see Table 4); none of the bivariate correlations differed statistically significantly across gender.

Predicting Socioeconomic Success in Adulthood: Overall Patterns

Probing for unique and shared effects, we next tested the conjoint power of late childhood intelligence, parental socioeconomic background, and gender to predict the outcome measures (see Table 5, Model 1). All three outcome variables were predicted by the combined model of childhood intelligence and parental socioeconomic background, with $R^2 = 43\%$ for education, $R^2 = 23\%$ for adult occupational status, and $R^2 = 15\%$ for income. As in the zero-order correlations, intelligence and parental socioeconomic background—but not gender—predicted education and adult occupational status. Income was predicted by intelligence and gender, but not by parental socioeconomic background. The effect of

Table 4
Bivariate Correlations Between Constructs for the Overall Sample and Separately for Men and Women

Construct	Number	Overall							Men							Women						
		1	2	3	4	5	6	7	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Gender (1 = female)	1																					
Childhood intelligence	2	−.02							**.39**	**.61**	**.39**	**.34**	**.40**	**.31**								
Parental socioeconomic background	3	**−.04**	**.40**							**.46**	**.13**	**.19**	**.38**	**.11**	**.36**							
Education, years[a]	4	**−.04**	**.61**	**.43**							**.28**	**.39**	**.61**	**.36**	**.62**	**.41**						
GPA gen. ed.[b]	5	.01	**.37**	**.22**	**.23**							**.37**	**.31**	**.26**	**.36**	**.28**	**.20**					
GPA voc./univ.[c]	6	−.01	**.34**	**.20**	**.38**	**.30**							**.31**	**.26**	**.34**	**.21**	**.37**	**.26**				
Adult occupational status[d]	7	−.02	**.42**	**.43**	**.57**	**.25**	**.21**							**.31**	**.41**	**.38**	**.55**	**.26**	**.16**			
Income[e]	8	**−.14**	**.28**	**.15**	**.36**	**.19**	**.17**	**.33**							**.25**	**.15**	**.36**	**.19**	**.13**	**.35**		

Note. GPA = grade point average; gen. ed. = general education; voc./univ. = vocational/university. Coefficients in boldface are statistically different from 0 with $p < .05$.
[a] Both general and tertiary. [b] GPA of the highest qualification attained in general education. [c] GPA of the highest qualification attained in tertiary education. [d] Treiman index. [e] Logarithmic transformation of income.

gender, in particular, was highly statistically significant and substantial.

Next, we investigated to what extent quantitative and qualitative differences in education (a) predicted adult occupational status and income and (b) mediated the effects of intelligence, parental socioeconomic background, and gender. As Model 2 in Table 5 shows, when education in years was included in the prediction, the amount of variance explained increased for both occupational status, from $R^2 = 23\%$ to $R^2 = 36\%$, and income, from $R^2 = 15\%$ to $R^2 = 20\%$. When GPA was additionally included (see Model 3 of Table 5), the amount of variance explained increased only slightly, from $R^2 = 36\%$ to $R^2 = 37\%$ for adult occupational status, and from $R^2 = 20\%$ to $R^2 = 21\%$ for income. The effect of intelligence was now entirely mediated by education. A direct effect of parental SES persisted for adult occupational status. For income, the effect of intelligence was no longer statistically sig-

Table 5
Multivariate Regressions of Education, Adult Occupational Status, and Income on Childhood Intelligence, Parental Socioeconomic Background, and Gender (Model 1) and Additionally Education (in Years [Model 2] vs. Grade Point Average [GPA; Model 3])

Construct	Model 1			Model 2			Model 3		
		95% CI			95% CI			95% CI	
	b∗	Lower	Upper	*b*∗	Lower	Upper	*b*∗	Lower	Upper
Education regressed on									
Childhood intelligence	**.51**	.43	.59						
Parental socioeconomic background	**.23**	.17	.31						
Gender (1 = female)	−.07	−.15	.03						
R^2	.43								
Adult occupational status[a] regressed on									
Childhood intelligence	**.32**	.26	.40	**.10**	.02	.17	.08	−.02	.21
Parental socioeconomic background	**.24**	.16	.30	**.13**	.06	.20	**.13**	.05	.18
Gender (1 = female)	−.01	−.11	.09	.02	−.07	.10	.01	−.08	.07
Education, years[b]				**.46**	.40	.52	**.47**	.41	.53
GPA gen. ed.[c]							**.09**	.05	.13
GPA voc./univ.[d]							−.05	−.13	.01
R^2	.23			.36			.37		
Income[e] regressed on									
Childhood intelligence	**.24**	.16	.33	**.12**	.03	.23	.05	−.07	.16
Parental socioeconomic background	.05	−.04	.15	−.02	−.10	.08	−.02	−.10	.08
Gender (1 = female)	**−.51**	−.61	−.42	**−.50**	−.60	−.41	**−.51**	−.06	−.42
Education, years[b]				**.26**	.18	.33	**.27**	.18	.36
GPA gen. ed.[c]							**.12**	.05	.18
GPA voc./univ.[d]							.00	−.06	.07
R^2	.15			.20			.21		

Note. *b*∗ = fully standardized for continuous predictors (*y*-standardized for dummy-variable predictors); CI = confidence interval; gen. ed. = general education; voc./univ. = vocational/university. Coefficients in boldface are statistically different from 0 with $p < .05$.
[a] Treiman index. [b] Both general and tertiary. [c] GPA of the highest qualification attained in general education. [d] GPA of the highest qualification attained in tertiary education. [e] Logarithmic transformation of income.

nificant and that of parental socioeconomic background remained nonsignificant. In all models, the effects of gender remained virtually unchanged when we controlled for quantitative and qualitative differences in education: gender still predicted income but not adult occupational status (see also Figure 1).

In sum, education played a key role in mediating all or most of the effects of childhood intelligence and parental socioeconomic background on the other dimensions of adult socioeconomic success (i.e., occupational status and income). In contrast, the role of education in gender effects was rather limited (see also Table A1 in the Appendix).

Predicting Socioeconomic Success in Adulthood: Gender as a Moderator

We further explored the gender specificity of these findings. The effects of intelligence and parental socioeconomic background were generally comparable between genders (see Table 6). However, some differences were discernible, especially in the prediction of adult occupational status with control for education: education was a more important predictor of adult occupational status in men, $b^* = 0.54$, than in women, $b^* = 0.41$ (Diff = 0.13; $SE = 0.06$; $p = .05$; Table 6, Model 2; similarly, Model 3). Overall, adult occupational status was better predicted in men, $R^2 = 41\%$, than in women, $R^2 = 34\%$. Additionally, education mediated the effect of intelligence on adult occupational status in men; the effect was no longer statistically significant when we controlled for education in years (or GPA). In women, in contrast, intelligence remained a statistically significant predictor of adult occupational status. For income, without control for education, intelligence was the only predictor of importance in both genders. With control for education, education in years and GPA of general education were statistically significant. Furthermore, the models consistently indicated a higher explained variance for men than women, both with and without control for education. Overall, the findings for men and women were similar, although there was some support for the idea that childhood intelligence, parental background, and education predict adult occupational status and income more strongly in men than in women.

Predicting Socioeconomic Success in Adulthood: Controlling for Professional Sector, Working Part Time, and Having Children

Finally, we tested the role of professional sector, working part time, and having children in predicting adult occupational status and income. Table 7 presents the overall results, with the additional controls being successively entered into the equation. Regarding the predictive power of intelligence and parental socioeconomic background, the results remained entirely comparable to those without the control variables (Models 1–3). The same applied when education was entered as an additional predictor of

Table 6
Multivariate Regressions of Education, Adult Occupational Status, and Income on Childhood Intelligence, Parental Socioeconomic Background, and Gender (Model 1) and of Adult Occupational Status and Income (Logarithmic) on Childhood Intelligence, Parental Socioeconomic Background, Gender, and Additionally Education (in Years [Model 2] vs. Grade Point Average [GPA; Model 3]), Separately for Men and Women

Construct	Men			Women		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Education regressed on						
Childhood intelligence	**.50**			**.54**		
Parental socioeconomic background	**.27**			**.22**		
R^2	.44			.42		
Adult occupational status[a] regressed on						
Childhood intelligence	**.31**	.04	.02	**.34**	**.14**	**.13**
Parental socioeconomic background	**.25**	**.11**	**.11**	**.24**	**.14**	**.13**
Education, years[b]		***.54***	**.52**		***.41***	**.44**
GPA gen. ed.[c]			.05			**.11**
GPA voc./univ.[d]			*.06*			***−.12***
R^2	.24	.41	.41	.23	.34	.36
Income[e] regressed on						
Childhood intelligence	**.31**	.17	.12	**.24**	.12	.02
Parental socioeconomic background	.02	−.04	−.03	.07	.00	−.01
Education, years[b]		**.26**	**.23**		**.28**	**.31**
GPA gen. ed.[c]			.08			**.14**
GPA voc./univ.[d]			.06			−.03
R^2	.14	.17	.18	.07	.13	.15

Note. All reported coefficients are b^* for fully standardized continuous predictors, *y*-standardized for dummy-variable predictors. gen. ed. = general education; voc./univ. = vocational/university. Coefficients in boldface are statistically different from 0 with $p < .05$. Coefficients in italics are statistically different between genders with $p < .05$.

[a] Treiman index. [b] Both general and tertiary. [c] GPA of the highest qualification attained in general education. [d] GPA of the highest qualification attained in tertiary education. [e] Logarithmic transformation of income.

Table 7
Multivariate Regressions of Adult Occupational Status and Income on Childhood Intelligence, Parental Socioeconomic Background, and Gender, Controlling Additionally for Professional Sector, Working Hours, and Having Children (Models 1–3) and Education (in Years [Models 4–6] vs. Grade Point Average [GPA, Models 7–9])

Construct	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Adult occupational status[a] regressed on									
Childhood intelligence	**.26**	**.26**	**.25**	.07	.07	.07	.06	.06	.06
Parental socioeconomic background	**.22**	**.22**	**.22**	**.13**	**.13**	**.13**	**.12**	**.12**	**.13**
Gender (1 = female)	**−.15**	**−.14**	**−.13**	−.07	−.07	−.07	−.08	−.07	−.07
Education, years[b]				**.44**	**.44**	**.44**	**.44**	**.44**	**.44**
GPA gen. ed.[c]							**.08**	**.08**	**.08**
GPA voc./univ.[d]							−.05	−.05	−.05
Controls									
Professional sector	+	+	+	+	+	+	+	+	+
Part time		+	+		+	+		+	+
Children (yes/no)			+			+			+
R^2	.25	.26	.26	.37	.37	.37	.38	.38	.38
Income[e] regressed on									
Childhood intelligence	**.21**	**.18**	**.18**	**.11**	.08	.09	.04	.00	.01
Parental socioeconomic background	.05	.08	.08	−.01	.02	.02	−.02	.02	.02
Gender (1 = female)	**−.48**	**−.32**	**−.31**	**−.46**	**−.30**	**−.30**	**−.46**	**−.30**	**−.29**
Education, years[b]				**.25**	**.24**	**.23**	**.26**	**.24**	**.23**
GPA gen. ed.[c]							**.12**	**.12**	**.12**
GPA voc./univ.[d]							.01	.06	.06
Controls									
Professional sector	+	+	+	+	+	+	+	+	+
Part time		+	+		+	+		+	+
Children (yes/no)			+			+			+
R^2	.15	.32	.32	.19	.36	.36	.20	.37	.38

Note. All reported coefficients are b^* for fully standardized continuous predictors, *y*-standardized for dummy-variable predictors. gen. ed. = general education; voc./univ. = vocational/university. + indicates that the predictor was included as a control variable. Coefficients in boldface are statistically different from 0 with $p < .05$. Models 4–6 additionally controlled for education in years; Models 7–9 additionally controlled for GPA.
[a] Treiman index. [b] Both general and tertiary. [c] GPA of the highest qualification attained in general education. [d] GPA of the highest qualification attained in tertiary education. [e] Logarithmic transformation of income.

adult occupational status and income (Models 4–6 and Models 7–9).

In contrast, the results for gender changed in important ways: When controlling for professional sector, we found a statistically negative effect of being female in predicting adult occupational status (Table 7, Models 1–3), which was not found in the models without controls. Yet this effect was again only statistically significant without control for education (Models 4–6 and Models 7–9). The pattern of results for income was very different. Here, entering the controls for professional sector did not change the gender effects, but adding the family related controls (i.e., working part time and having children) reduced the negative effect for women, from $b^* = -0.48$ to $b^* = -0.32/-0.31$. It also substantially increased the prediction of income, from $R^2 = 15\%$ to $R^2 = 32\%$ (similar patterns emerged with control for education; see Table 7, Models 4–6 and Models 7–9).

The separate multigroup regressions for men and women confirmed this pattern, adding further interesting details (see Table 8). For both genders, parameters for all three predictors of adult occupational status and income remained virtually unchanged. In contrast, the explained variance in income increased from $R^2 = 16\%$ to $R^2 = 42\%$ in the models controlling for working part time and having children, but only for women not for men (see Table 8, Models 4–6 and Models 7–9). Women's income was even better predicted with control for these characteristics.

In sum, controlling for the structural factors of professional sector, working part time, and having children barely impacted the effects of intelligence and parental socioeconomic background, but it did impact the effect of gender. In particular, the gender income gap decreased when we controlled for working part time and having children.

Discussion

In this study, we used data from a German longitudinal study to compare the importance of late childhood intelligence, family background, and gender as predictors of socioeconomic success (education, occupational status, and income). We addressed these questions on various levels: We used correlational analyses to estimate the absolute relevance of individual characteristics and family background, and multivariate analyses to gauge whether these effects were direct or confounded/mediated by education. In a nutshell, education played a central role in mediating most or even all of the effects of childhood intelligence and parental socioeconomic background on adult socioeconomic success, but its role in gender effects was rather limited.

Education as the "Great Mediator"

In terms of the total effects of the continuous predictors, childhood intelligence showed the highest correlation with education, followed by adult occupational status, and then income—a pattern similar to that emerging from Strenze's (2007) meta-analysis (see also Marks, 2015). The same pattern emerged for parental socio-

Table 8

Multivariate Regressions of Adult Occupational Status and Income on Childhood Intelligence and Parental Socioeconomic Background, Separately for Men and Women, Controlling Additionally for Professional Sector, Working Hours, and Having Children (Models 1–3) and for Education (in Years [Models 4–6] vs. Grade Point Average [GPA; Models 7–9])

	Men									Women								
Construct	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Adult occupational status[a] regressed on																		
Childhood intelligence	**.27**	**.27**	**.28**	.04	.04	.03	.02	.03	.03	**.27**	**.27**	**.26**	.09	.09	.10	**.13**	.09	.09
Parental socioeconomic background	**.19**	**.18**	**.18**	.09	.09	.09	**.11**	.09	.09	**.25**	**.25**	**.25**	**.15**	**.15**	**.16**	**.13**	**.14**	.14
Education, years[b]				**.49**	**.49**	**.51**	**.52**	**.47**	**.47**				**.41**	**.41**	**.41**	**.44**	**.43**	**.43**
GPA gen. ed.[c]							.05	.05	.04							**.11**	**.10**	**.10**
GPA voc./univ.[d]							.06	.04	.04							**−.12**	**−.11**	**−.11**
Controls																		
Professional sector	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Part time		+	+		+	+		+	+		+	+		+	+		+	+
Children (yes/no)			+			+			+			+			+			+
R^2	.27	.28	.28	.40	.41	.41	.41	.41	.41	.24	.24	.25	.35	.35	.35	.36	.37	.37
Income[e] regressed on																		
Childhood intelligence	**.28**	**.28**	**.28**	.10	.06	.15	.11	.09	.06	**.20**	**.15**	**.13**	.10	.06	.06	.01	−.04	−.05
Parental socioeconomic background	0	−.01	−.01	.01	.07	−.06	−.03	−.04	−.04	.08	**.14**	**.13**	.01	.07	.08	.00	.07	.07
Education, years[b]				**.27**	**.23**	**.27**	**.22**	**.24**	**.26**				**.27**	**.23**	**.21**	**.30**	**.25**	**.24**
GPA gen. ed.[c]							**.09**	**.11**	**.11**							**.13**	**.12**	**.12**
GPA voc./univ.[d]							.07	.09	.09							−.02	.29	.03
Controls																		
Professional sector	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Part time		+	+		+	+		+	+		+	+		+	+		+	+
Children (yes/no)			+			+			+			+			+			+
R^2	.14	.19	.19	.14	.23	.24	.19	.25	.25	.09	.37	.37	.14	.40	.40	.16	.42	.42

Note. All reported coefficients are b^* for fully standardized continuous predictors, *y*-standardized for dummy-variable predictors. gen. ed. = general education; voc./univ. = vocational/university. + indicates that the predictor was included as a control variable. Coefficients in boldface are statistically different from 0 with $p < .05$. Models 4–6 additionally controlled for education in years; Models 7–9 additionally controlled for GPA.

[a] Treiman index. [b] Both general and tertiary. [c] GPA of the highest qualification attained in general education. [d] GPA of the highest qualification attained in tertiary education. [e] Logarithmic transformation of income.

economic background, but the correlation for each indicator was lower. However, education was the predictor most closely correlated with both adult occupational status and income. The results thus support Schoon's (2008) conclusion that "time spent in full-time education is the strongest predictor of adult social position" (p. 79) for Germany as well. The multivariate regressions revealed that childhood intelligence and parental socioeconomic background both predicted all three outcomes, even when we controlled for the other predictors. Childhood intelligence was again the most important predictor. Yet most of the effects of childhood intelligence and parental socioeconomic background on adult occupational status and income proved to be mediated by education (both quantity and quality). Only direct parental background effects on adult occupational status remained statistically significant. Income seemed to be entirely independent of family background when we controlled for intelligence and/or education. These effects persisted when we controlled for professional sector, working part time, or having children, which implies that family background is related to whether an individual aspires to a more prestigious position, but not so much to how well the position pays.

Comparing these German results with previous studies conducted elsewhere highlights several points. Overall, the power of various indicators of childhood intelligence and parental socioeconomic background to predict adult socioeconomic success was similar to that seen in other countries (Sorjonen et al., 2012; Strenze, 2007). However, our more detailed investigations of direct and meditated effects emphasized two aspects. First, when both predictors were entered simultaneously in the regression, the direct effect of parental socioeconomic background in predicting education was lower (at $b = .23$) than that of childhood intelligence (at $b = .51$). This finding seems comparable to that of the *Lebensverläufe ins frühe Erwachsenenalter* study (Fend, 2009a, 2009b; Georg, 2009), as far as direct comparisons are possible. It also appears fairly comparable to the pattern of effects observed in other European countries, such as Sweden and Luxembourg, but less so to that seen in the United Kingdom or the United States, where parental background typically seems to be more important than intelligence (Deary et al., 2005; Dubow et al., 2006; Judge et al., 2010; Schoon, 2008; Sorjonen et al., 2012; Spengler et al., 2015). Second, education played a central role in predicting adult occupational status and income in the German sample; it mediated most, if not all, of the effects of parental socioeconomic background and intelligence. Again, these results are more similar to those reported for Sweden and Luxembourg than for the United Kingdom or the United States, where the indirect paths via education are substantially smaller and, in particular, the direct effects of parental background are larger.

Overall, it seems that both education and the role of cognitive functioning for education play a more important role in these continental European countries than in the United Kingdom or the United States. One speculation is that this difference is rooted in a more structured, standardized system of general and vocational education (e.g., degree of school autonomy, standardization of curricula, dual vocational training) in continental Europe (Bol & van de Werfhorst, 2013; Chmielewski & Reardon, 2016; Weiss, 2013). Our analyses are consistent with the reasoning that more formally structured systems strengthen the role of education in predicting further dimensions of socioeconomic success, with the result that childhood intelligence is more important than parental socioeconomic background. Notably, although the patterns of effects observed in Sweden, Luxembourg, and Germany appear similar, the respective education systems also differ in some key features—primarily, the tracking structures implemented at secondary level. Germany and Luxembourg are examples of strong explicit tracking, whereas Sweden uses less between-school tracking, and is thus more similar to the United States and the United Kingdom in this respect (see Bol & van de Werfhorst, 2013). However, the discussion of tracking structures in the majority of (internationally comparative) studies currently focuses on between-school tracking—probably because it is more easily accessible to researchers. Yet it has been shown that within-school tracking functions in a similar way in shaping student outcomes (e.g., Hattie, 2002) and with respect to the effects of parental background (e.g., course and career choices; Schnabel, Alfed, Eccles, Köller, & Baumert, 2002), but very differently when it comes to psychosocial outcomes (Chmielewski, Dumont, & Trautwein, 2013). The relative contribution of vocational and university training structures to long-term socioeconomic success remains an interesting question: Analyses from Switzerland suggest that the effects of vocational training may even reverse the effects of general and university education, at least on income (Backes-Gellner & Geel, 2014).

Gender Differences and Education

The functioning of gender in predicting adult socioeconomic success seems to be entirely different from that of the other two background factors. The pattern of results emerging for gender was exactly the opposite to that for parental socioeconomic background: Gender did not substantially predict either education or occupational status, but it did substantially predict income (in line with international patterns; see Buchmann & DiPrete, 2006): Women earned significantly less than men, even when we controlled for all other factors, including education. Additionally, education did not mediate the effect of gender on income. The results suggest fairly similar paths in both genders—also consistent with some of the literature (e.g., Heckman et al., 2006; McClendon, 1976). Georg (2009) found similar paths for men and women, although the lack of conjoint and standardized results and statistical information on inference for the effects between genders means that these results must be interpreted with caution.

Gender-specific differences in effects also emerged when we controlled for professional sector and family related aspects. Horizontal stratification seemed to play a role here: Analyses controlling for professional sector suggested that women seem to work in less high-status positions. That effect again disappeared when education was entered into the equations. This finding is also in line with the general pattern that women obtain higher levels of general education (e.g., more women qualify for higher education) but men have more tertiary and university education (Autorengruppe Bildungsberichterstattung, 2016)—a pattern also evident in our sample (see also Table 3). Let us use the example of doctoral qualifications to illustrate this pattern: Men tend to pursue careers in fields with a higher absolute proportion of doctorates (e.g., medicine, law); at the same time, the share of doctorates within each profession is higher for men than for women (see also Jahn, Jaksztat, & Reimer, 2016; Radmann, Neumann, Becker, & Maaz, 2017). These findings support the hypothesis of a horizontal strat-

ification process (see also Eccles, 1994; Gottfredson & Lapan, 1997; Reimer & Steinmetz, 2011).

There was also some support for the hypothesis that socioeconomic success was better predicted in men than in women. Women were more affected by job-extraneous factors, making their career attainment less predictable (Sewell et al., 1980; Ziefle, 2004). First, men's occupational status seemed to be better predicted than women's. Second, controlling for working part time and having children reduced gender differences. In particular, the income gap was substantially reduced (as in Sewell et al., 1980, even more so when the analysis was limited to individuals without children; see Table A2 in the Appendix). Further gender-specific analyses showed that these effects related mainly to women: there was much less change in the predictions of men's occupational status and income when these variables were included.

In sum, on the one hand, it appears that part of the gender income gap is left unexplained. To what extent is it a result of active discrimination, with well-paid positions not being offered to women ("glass ceiling")? To what extent is it due to more subtle, ambivalent factors, such as women being less demanding than men in their pay negotiations? Further research is needed to disentangle these aspects. On the other hand, a substantial part of the gender income gap seems to be related to structural factors, especially working part time and having children. A practical policy implication is the need for measures to address this effect. For example, there has to be a provision for women (or rather all individuals) who work part time for family and childcare reasons to return to a full-time position without detrimental long-term effects on their salary.

Strengths and Limitations

The main strengths of this study are the population-based nature of the longitudinal data and the substantial sample sizes for both men and women. Most previous studies have drawn on male samples (see Roberts et al., 2007; Strenze, 2007). We tested for both main effects of gender and interaction effects in a multigroup model. Having various indicators for all continuous constructs allowed us to use a latent variable modeling approach. Yet certain limitations warrant discussion. First, the study was conducted in just four of the 16 German federal states (Berlin, Mecklenburg–West Pomerania, North Rhine–Westphalia, and Saxony–Anhalt) and is therefore not representative for Germany as a whole. Whether or not the results can be generalized to the federal level remains an open question that could be addressed with data from the large-scale National Educational Panel Study (NEPS; Blossfeld, Maurice, & Schneider, 2011).

Relatedly, our investigation followed individuals up to their early 30s—a time at which some career development is still to be expected. Longitudinal analyses from other countries suggest that the relative importance of cognitive factors may increase in middle age, while the influence of parental background decreases (see, e.g., for the United States, Ganzach, 2011; Spengler et al., 2018; Zax & Rees, 2002). Note also that our participants were first assessed in late childhood at age 12 years. In future studies it would be interesting to examine younger children, as parental socioeconomic background is known to affect the development of children's intelligence. The pattern of effects in Strenze (2007) suggests that bivariate relations between childhood intelligence assessed after the age of 6 years and socioeconomic success assessed after the age of 30 do not seem to systematically covary with age, but it remains to be tested to what extent multivariate effects may change.

From an epistemological perspective, we aimed to disentangle the effects of late childhood intelligence, parental background, and gender on adult socioeconomic success. However, we cannot specify the ultimate causes of these relations. As elaborated in the behavioral genetics literature, childhood intelligence and parental socioeconomic background (less so, gender) are connected to later socioeconomic success through various forms of Gene × Environment correlations (Plomin et al., 2013). The design we used does not make it possible to separate the genetic versus environmental influences and their interplay, leaving these (ultimate) causal connections an open, but highly relevant question for further research.

As is to be expected, our dataset was affected by sample attrition over the almost 20-year study period. As described, the dropout was to a certain extent differential; participants were a cognitively and socioeconomically positive selection, and more women responded. The selectivity of dropout is comparable to that reported for other large-scale longitudinal studies (e.g., Damian et al., 2015; Schoon, 2008; Spengler et al., 2015; von Stumm et al., 2010). We tested the robustness of our full information maximum likelihood findings using a different imputation approach (MI; Graham, 2009) and different sample selection strategies (i.e., subjects who participated in Wave 7, $N = 4130$; all subjects who participated at least once between Wave 4 and 7, $N = 10{,}906$). Overall, the results converged with those presented here. Nevertheless, it should be kept in mind that although these models relax assumptions (i.e., that missingness is conditionally at random), they cannot rule out the possibility that even these assumptions may be violated and bias parameter estimation. If that is the case, it is likely that our estimates represent the upper bound range of effects. For example, men were less likely to respond, but those who did were a positively selected group. As such, the advantages for men may be smaller than our analyses indicate, as the lower parts of the male distribution were underrepresented, meaning that positive effects were overestimated.

Last but not least, the indicators controlling for professional sector were broad, which may explain the relatively low amount of variance explained, at least when predicting income. For example, we controlled whether respondents worked in the legal sector or the health sector, but further heterogeneity within each sector may also be relevant (e.g., criminal vs. international business law). More-fine grained categorizations may thus be helpful here.

Outlook

The German school system with its strong explicit tracking structure (which is now opening up; see M. Becker, Neumann, & Dumont, 2016) has been criticized as low in distributional justice. Our study provides the first systematic estimate of the distribution of socioeconomic success in Germany, considering the relative contribution of individual variables (intelligence, gender) and parental background variables (parental socioeconomic background and their mediation by education) in predicting further socioeconomic success. The results suggest that the German system is in fact comparable to systems typically considered to be more mer-

itocratic (e.g., Sweden) when it comes to the impact of individual and family background characteristics on socioeconomic success. Our results stress the importance of quantifying such distal but "absolute" effects across the life course: The conclusions may differ from those of studies focusing on single, specific segments, such as social disparities in school transition patterns or academic achievement during compulsory schooling. As highlighted by Bol and van de Werfhorst (2013), specific facets of education systems such as tracking structures in secondary schooling have multiple effects that may counteract each other across the life course. Our results speak for a more differentiated discussion of these issues.

At the same time, analyses of such effects represent a point of departure for exploring in more depth how the basic processes can be further disentangled—for example, by investigating the role that specific sociological and psychological factors play in explaining how education mediates the effects of parental socioeconomic background (e.g., Stephens, Markus, & Phillips, 2014). This is equally important, as especially unexplained indirect effects of family background and gender beyond intelligence and other psychological—behavioral variables and processes represent further potential social disparities and, by extension, violations of the principles of meritocracy and equal opportunities within a society.

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Appendix

Additional Analyses

Table A1
Decomposing the Effects of Childhood Intelligence, Parental Socioeconomic Background, and Gender on Adult Occupational Status and Income via Education (in Years vs. Grade Point Average [GPA])

	Adult occupational status[a]			Income[b]		
		95% CI			95% CI	
Effects	b^*	Lower	Upper	b^*	Lower	Upper
Childhood intelligence						
Total	**.35**	.29	.42	**.26**	.19	.33
Indirect (total)	**.27**	.20	.33	**.20**	.12	.28
Direct	.08	−.02	.17	.06	−.07	.18
Parental socioeconomic background						
Total	**.23**	.15	.30	.05	−.04	.13
Indirect (total)	**.11**	.07	.16	**.07**	.04	.10
Direct	**.13**	.05	.19	−.02	−.11	.07
Gender (1 = female)						
Total	−.02	−.12	.11	**−.53**	−.62	−.43
Indirect (total)	−.03	−.08	.02	−.01	−.05	.02
Direct	.01	−.08	.09	**−.51**	−.60	−.42

Note. b^* = fully standardized for continuous predictors (*y*-standardized for dummy-variable predictors); CI = confidence interval. Coefficients in boldface are statistically different from 0 with $p < .05$.
[a] Treiman index. [b] Logarithmic transformation of income.

(*Appendix continues*)

Table A2

Multivariate Regressions of Adult Occupational Status and Income on Childhood Intelligence, Parental Socioeconomic Background, and Gender, Controlling Additionally for Professional Sector and Working Hours, and for Education (in Years [Model 2] vs. Grade Point Average [GPA; Model 3]), for Individuals Without Children Only

Construct	Model 1	Model 2	Model 3
Adult occupational status[a] regressed on			
Childhood intelligence	**.28**	.06	.05
Parental socioeconomic background	**.26**	**.15**	**.15**
Gender (1 = female)	−.09	−.06	−.06
Education, years[b]		**.47**	**.47**
GPA gen. ed.[c]			**.09**
GPA voc./univ.[d]			−.04
Controls			
Professional sector	+	+	+
Part time	+	+	+
R^2	.30	.42	.43
Income[e] regressed on			
Childhood intelligence	**.27**	**.18**	.08
Parental socioeconomic background	.06	.01	.03
Gender (1 = female)	**−.20**	**−.21**	**−.20**
Education, years[b]		**.20**	**.21**
GPA gen. ed.[c]			**.11**
GPA voc./univ.[d]			.03
Controls			
Professional sector	+	+	+
Part time	+	+	+
R^2	.26	.28	.28

Note. All reported coefficients are b^* for fully standardized continuous predictors, *y*-standardized for dummy-variable predictors. gen. ed. = general education; voc./univ. = vocational/university. + indicates that the predictor was included as a control variable. Coefficients in boldface are statistically different from 0 with $p < .05$. Model 2 additionally controlled for education in years; Model 3 additionally controlled for GPA.
[a] Treiman index. [b] Both general and tertiary. [c] GPA of the highest qualification attained in general education. [d] GPA of the highest qualification attained in tertiary education. [e] Logarithmic transformation of income.

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