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# Popularity

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# Non-technical summary

# POPULARITY

What makes you popular among your high-school peers? And what are the economic gains from popularity later in life? We investigate these questions using survey data on high school friendship relations collected from male respondents to the Wisconsin Longitudinal Study (WLS), who were asked to report the names of up to three best friends from their senior class in high school. These friendship nominations allow us to distinguish students on the basis of the number of friendship nominations they give, which we term the *out-degree* of friendship, and the number of friendship nominations they receive, termed the *in-degree*. Some students receive many friendship nominations, reflecting their high social standing and popularity among schoolmates, while others receive few. Some nominate few others as friends, possibly reflecting a lack of initiative to participate socially; others display gregariousness – a high out-degree, reflecting a strong desire to be socially active and accepted.

One of the biggest obstacles to research on social networks is that it is rarely possible to observe the complete network – as in the WLS, which only sampled one-third of the relevant school population. However, an advantage of the WLS is that it is a long-term study that also observed individuals' economic success in the labor market 35 years after high school. We develop a new method for dealing with data from partially-observed social networks, both to understand the nature of such networks in school and the longer-term consequences of early social engagement.

We find evidence that the early family environment, school composition and school size play a significant role in shaping friendship networks. In particular, close maternal and sibling relationships have a strong positive effect on the in-degree and out-degree of friendship. Adolescents educated in larger and more homogenous schools also had significantly higher friendship levels.

We then analyze the effect of the in-degree and out-degree of friendship on adult economic success as measured by each individual's level of earnings some 35 years later. While the out-degree (gregariousness) has no effect, we find a positive effect for in-degree (popularity). One additional friendship nomination in high school is associated with a 2 percent higher wage 35 years later. This is roughly equivalent to almost half the gain from an extra year of education. Shifting somebody from the bottom fifth to the top fifth of the school popularity distribution – in other words, turning a social reject into a star – would be predicted to yield him a 10 percent wage advantage. This work emphasizes the critical importance of the early development of social skills alongside cognitive and productive skills as a basis for economic success in adult life.

# POPULARITY*

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**Abstract**

What makes you popular among your high-school peers? And what are the labor market returns to popularity? We investigate these questions using an objective measure of popularity derived from sociometric theory: the number of friendship nominations received from schoolmates. We provide novel evidence that early family environment, school composition and school size play a significant role in determining popularity. We show that the estimated wage return to one additional nomination is about 2 percent *the popularity premium*. This amounts to roughly 40 percent of the return to one more year of education.

**JEL Classification**: A14, I21, J31

**Keywords**: friendship ties, non-cognitive abilities, social capital, earnings

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# 1 Introduction

Until recently, intelligence was considered to be the major determinant of success in life, e.g., Herrnstein and Murray [1994]. Even if the literature is still in its infancy, there is now mounting evidence of the importance of socioemotional skills – personality traits, motivation, self-control and persistence – for a variety of social and economic outcomes, e.g., Bowles et al. [2002], Heckman et al. [2006], Borghans et al. [2008] and Segal [2008]. There is also emerging evidence that early childhood interventions work primarily through the development of noncognitive traits, e.g., Heckman et al. [2007].

Measurements of these traits are still under development and there is no consensus on them as there is on IQ tests. One strand of literature uses scales constructed from reports of parents, teachers and the individuals themselves. These are relatively easy and inexpensive to gather, but might suffer from potential shortcomings. For example, Pepler and Craig [1998] notice that parents ratings could be both more positively and more negatively biased than teachers ratings.[1] On the other hand, teachers' ratings can be influenced by their perceptions of children's behavior and anyway they are limited to the behavior they observed, e.g., Rosenthal and Jacobsen [1968]. Recent research also finds evidence that standard measures of personality traits are plagued by non-classical measurement error, e.g., Cunha et al.[2009]. Another strand of literature uses, instead, various measures of participation in high school athletics and membership of organization to proxy for social skills, e.g., Barron et al. [2000], Glaeser et al. [2002], Postlewaite and Silverman [2005] and Kuhn and Weinberger [2005]. Usually, it is assumed that these measures are error-free proxies of underlying traits relevant for later life success: no allowance is made for measurement error and unobserved

[1] Fergusson and Horwood [1987] found that depressed mothers tend to rate their children more negatively than non-depressed mothers.

heterogeneity.[2]

We attempt to overcome some of these difficulties by drawing on methods from social network analysis, see, for example, Burt [1976], Borgatti and Everett [1992], Coleman [1961], Wasserman and Faust [1994]. Our basic idea is to derive from the observed school friendship network sociometric measures as proxies of individuals' relational attributes and to analyse their determinants and their effects on adult outcomes. Researchers in the sociometric tradition have found that sociometric proxies of social skills are correlated with the lack of unpleasant behavior and the possession of prosocial qualities. In addition, there are significant differences in the characteristics associated with sociometric proxies of social skills and perceived social skills (either by the self or by the peers).[3]

We use detailed information on high school friendship relations collected from respondents to the Wisconsin Longitudinal Study (WLS), who were asked to report the names of up to three best friends from their senior class in high school. Friendship nominations are by nature directed and this leads to an important conceptual distinction. When Paul nominates John as his friend, Paul reveals his affection towards John while, by receiving a claim of friendship, John is socially approved by Paul. We can then distinguish students on the basis of the number of friendship nominations they give, which we term the *out-degree* of friendship, and the number of friendship nominations they receive, termed the *in-degree*. Some students will receive many friendship nominations, reflecting their high social standing and popularity among schoolmates, while others will receive few. Similarly, some students will nominate few others as friends, which may reflect lack of initiative to participate and interact socially. On other other hand, a high out-degree might reflect a strong desire to be socially accepted.

[2]An exception is Stevenson [2003], which uses the enactment of title IX of the Educational Amendment of 1972 as a source of exogenous variation in the opportunities of participation.

[3]For example, Parkhurst and Hopmeyer [1998] show that socially skilled students who are not high in the perceived popularity are characterized by peers as kind and trustworthy, not as dominants or aggressive.

The precise definition of a reference group is one of the strengths of our approach, contrary to many papers in the literature of social interactions which are more agnostic in this regard. Two aspects are worth emphasizing. First, the focus on the last school year implies that the observed differences across students in their network location capture the outcome of a differentiation process. Secondly, the focus on the senior class strengthens the power of our measures of adolescent social standing. Adolescents have been exposed to interactions in different contexts, from mathematics classes to athletics and extracurricular activities. This implies that the pool of individuals who can be nominated is much larger than in cases where the boundaries are restricted to a particular class.

We also provide a methodological contribution. One of the biggest obstacles to research on social networks is that it is rarely possible to have a complete description of the network together with information on long term individuals' economic outcomes. This is true of the WLS, which is a 1-in-3 sample of the relevant school population. For each sampled individual we observe the out-degree fully (subject to the censoring limit of three nominations) but have partial observability of the in-degree, since nominations have only be received by schoolmates also included in the WLS sample. Thus, the observed in-degree differs from the true in-degree by a non-positive measurement error, which has a complicated distribution not independent of the true in-degree. We develop a pseudo-likelihood-based approach to dealing with this problem which takes account of the sampled nature of the network data. The basic idea of our approach is to simultaneously estimate the outcome of interest together with the friendship formation process, modeled as the probability that a student would be nominated by a randomly-selected member of his class (in-degree probability), and the probability that a randomly-selected class member would be nominated by him (out-degree probability). Our method can, in principle, be applied to other datasets generated by non-exhaustive sampling from networks.

We now give an overview of the main results. We consider three main determinants of friendship nomination. The first set refers to the child's early family environment. In line with earlier research on the effects of early family life on long-term cognitive and behavioral outcomes (Repetti et al. [2002]), our results show that students who have experienced positive interactions in their family are more likely to receive and sponsor friendship nominations.

The second set of determinants we consider is the proportion of classmates who share similar characteristics with the respondent. There is now large evidence documenting a strong tendency of various types of individuals to associate with others who are similar to themselves, a phenomenon that Lazersfeld and Merton [1954] termed *homophily*. Homophily has since been documented across a wide range of characteristics, such as age, race, gender, religion and occupations, e.g., Fong and Isajiw [2000], Baerveldrs et al. [2004], Moody [2001] and McPherson et al. [2001]. Type-sensitive preferences and matching bias are the two main mechanisms used to explain these patterns, see Currarini et al. [2008]. We use indicators of common nationality, family background and friends' characteristics to capture preferences-based homophily. We find that adolescents in more homogenous groups are significantly more likely to receive and sponsor friendship nominations.

The last set of determinants we consider are meant to capture the respondent's relative position among schoolmates. Interestingly, we find that relatively older and smarter students are more popular, while relative family income status plays a minor role.

We then analyze the effect of in-degree and out-degree of friendship on adult economic success as measured by the wage. We think of the in-degree as a natural measure of 'popularity', while the out-degree could be interpreted as 'gregariousness' (or, less charitably, sycophancy). While the out-degree has no effect, we find a positive effect of in-degree. One additional friendship nomination in high school is associated with a 2 percent higher wage 35

years later. Popularity as captured by an additional friendship nomination is equivalent to roughly 40 percent of the return to one more year of education. This holds after accounting for a wide range of observables – family background, school quality, cognitive ability, human capital, and adult social capital– and for unobserved residual heterogeneity.

But why would the in-degree of friendship in high school matter for subsequent economic attainment? We argue that the number of friendship nominations received is a natural measure of popularity: it captures the extent to which a student is accepted by his schoolmates, which is related to his ability to make positive personal and social adjustments. During secondary school, a social differentiation process takes hold that gradually breaks up the individual's initial fixation on "generation-superiors" such as parents, the class teacher from elementary school and other significant adults. In this new reference system students come to occupy differentiated positions within the group as an immediate consequence of their own interpersonal behavior (which may have been shaped by their childhood experience) and of what others consider appropriate conduct.[4] Large parts of an individual's role performance when adult, as an employee in a team of co-workers for example, will also be in association with status-equals or near-equals. By that time, an individual needs to have understood the "rules of the game", how to gain acceptance and social support from colleagues, whom to trust and when to reciprocate. Thus, social interactions within the group of classmates provide the bridge to the adult world as they train individual personalities to be socially adequate for the successful performance of their adult roles.[5]

[4]In a study of Illinois high schools, Coleman (1961) finds that students identify themselves as belonging to social categories such as nerds, jocks, leading crowd and others. Students tend to differentiate themselves along two major dimensions: 'cognitive achievement' as measured by grades, and 'social approval' as reflected in leadership roles in extracurricular student activities and participation in high school athletics. See Akerlof and Kranton (2002) on "Identity and Schooling" for a review and economic interpretation of the sociological literature on education.

[5]This view of the school class as an agency of socialization was emphasized by Talcott Parsons [1959] in his seminal essay "The school class as a social system".

The remainder of the paper is organized as follows. We describe the data and the econometric methodology in section 2 and we present the results in section 3. We conclude in section 4 discussing possible policy implications of our findings.

# 2 Data and Econometric Methodology

### Friendship Relations in the WLS

The WLS is a random, one-third sample of all seniors in Wisconsin high schools in 1957 ($n$=10,317). Survey data were collected from the original respondents or their parents in 1957, 1964, 1975, 1993 and 2004, and from a selected sibling in 1977, 1994 and 2005. The data provide rich information on socio-economic background, mental ability, educational attainment, family formation, and labor market history.[6] The WLS sample is broadly representative of white, non-Hispanic American men and women who have completed at least a high school education. For more detailed information on the WLS see Sewell et al. (2001) and the references therein.

Our main variables of interest are adolescent friendship ties and adult earnings. We measure the former from responses to the 1975 Telephone Questionnaire, where respondents were asked to report the names of up to three same-sex best friends from their senior class in high school. Student $i$ is recorded as having a tie with student $j$ if $i$ claims his friendship to $j$. We do not have information about the strength of the friendship relations, which are therefore *dichotomous*: either a relation exists or it does not. Relations are also *directed*: $i$ may claim friendship to $j$, but the reverse is not necessarily true. These asymmetries allow us to distinguish students on the basis of friendship nominations made, which we term

[6]See Table A1 in the appendix for detailed information on the variables we use, and the wave and the survey instrument they are collected in.

the *out-degree* of friendship, and the number of friendship nominations received, termed the *in-degree* of friendship.

The WLS design imposes several restrictions. First, students are asked to report names of friends within the same school and grade. This raises the so-called *boundary specification problem*, e.g., Laumann et al. [1983]. Previous empirical studies suggest that this is not a severe problem in the context of adolescent friendship networks. For example, Ennett and Bauman [2000] consider friendship networks among ninth graders in North Carolina in 1980. Each student was asked to nominate up to three best friends, without restriction to friends from school. In their sample of roughly 1,100 students, 95 percent of friendship links were within the same school. However, the boundary issue may be important for students in single-sex schools and we return to this in section 3.1 below.

Second, by questionnaire design the number of possible friendship nominations is censored at three.[7] Moreover, due to random sampling, we only have partial observability of the nominations received by the sampled students. While we observe all the ties sponsored by sample members towards individuals both inside and outside the sample (the out-degree of friendship), we miss the information on claims of friendship towards sampled members, which would have been made by classmates who were not sampled in the WLS. Thus, the observed in-degree differs from the true in-degree by a measurement error taking non-positive values, with a complicated distribution not independent of the true in-degree. Our estimation strategy, described below, addresses all these issues.

For the construction of the observed in-degree, $\tilde{k}_i$, and out-degree, $m_i$, we use information on 4,330 male respondents to the 1975 questionnaire who provided names of their best friends in 1957. The average number of individuals observed per graduating class is close to 170 students, ranging from a minimum of 6 to a maximum of 482. Table 1 below displays

[7] See Holland and Leinhard [1973] for a discussion of the right-censoring by vertex degree introduced by this fixed-choice design.

summary statistics on the distribution of the observed in-degree and out-degree. Despite the limitations imposed by the WLS design, we still see substantial variation in both measures. The mode of the in-degree distribution is 0, while that of the out-degree distribution is 3. Roughly 15 percent of the respondents give only one name, 30 percent report two, and 44 percent nominate three friends; 11 percent of the respondents do not report any friend and roughly 41 percent of ties are reciprocated. This distribution of out-degree of friendship is consistent with previous studies, which do not use retrospective information. For example, in Ennett and Bauman [2000] the corresponding sample proportions nominating one, two and three best friends are 17 percent, 32 percent and 41 percent respectively, and 57 percent of friendship nominations are not reciprocated.

We then estimate the determinants in-degree and out-degree of friendship in a simultaneous econometric model of friendship networks and wage determination. We use wage information from 2,879 full-time male employees for whom we observe adult earnings in 1992. We now proceed to describe our modeling strategy.

**Table 1** In-degree and out-degree distributions

| No. of | *In-degree* | | *Out-degree* | |
|---|---|---|---|---|
| nominations | $n$ | Sample % | $n$ | Sample % |
| 0 | 2,598 | 60.00 | 483 | 11.15 |
| 1 | 1,191 | 27.51 | 644 | 14.87 |
| 2 | 398 | 9.19 | 1,275 | 29.45 |
| 3 | 106 | 2.45 | 1,928 | 44.53 |
| 4 | 29 | 0.67 | - | - |
| 5 | 6 | 0.14 | - | - |
| 6 | 2 | 0.05 | - | - |

### An Econometric Model of Early Friendship and Adult Economic Success

Let $\mathcal{N}$ be a school class in our data set with size $N$, and let $\mathcal{S} \subset \mathcal{N}$ be the sampled group in class $\mathcal{N}$ and assume it has size $n = |\mathcal{S}|$. We make the basic assumption that the actual class

is a random sample from a superpopulation of individuals who might potentially have been in that class.

A male individual $i \in \mathcal{S}$ is described uniquely by a vector of observable variables $\mathbf{x}_i$ and an unobservable $u_i$. Let $\pi(\mathbf{x}_i, u_i)$ be the probability that another male classmate, drawn at random, would, if interviewed, nominate person $i$ as one of his three best friends. Similarly, let $\lambda(\mathbf{x}_i, u_i)$ be the probability that another class member, drawn at random, would be regarded by person $i$ as a friend (whether in the top three or not). Then, $\pi(\mathbf{x}_i, u_i)$ and $\lambda(\mathbf{x}_i, u_i)$ describe the in-degree and out-degree probability of friendship for a person with characteristics $(\mathbf{x}_i, u_i)$, respectively.

Next, define $k_i$ as the total number of class members who would, if selected for interview, nominate student $i$ as a friend, while $\tilde{k}_i$ is the number of such people who appear in the selected sample. So, $\tilde{k}_i$ is the observed in-degree, $k_i$ is the "true" in-degree of friendship of individual $i$ and, since $k_i \geq \tilde{k}_i$, there is an inherent downward bias in the crude in-degree measure, $\tilde{k}_i$. Let $m_i$ be the number of people that the individual $i$ thinks of as friends. Under the assumption that the actual class group is a random sample from a superpopulation of individuals who might potentially have been in that group we have that $k_i$ and $m_i$ have binomial $[N-1, \pi(\mathbf{x}_i, u_i)]$ and $[N-1, \lambda(\mathbf{x}_i, u_i)]$ distributions, respectively.

Since the sampling of WLS participants is random, $\tilde{k}_i$ has a hypergeometric $[N-1, n-1, k_i]$ distribution conditional on $k_i$ and the joint distribution of $(k_i, m_i, \tilde{k}_i)$ is therefore:

$$f(k_i, m_i, \tilde{k}_i | \mathbf{x}_i, u_i) = \binom{N-1}{k_i} \pi(\mathbf{x}_i, u_i)^k [1 - \pi(\mathbf{x}_i, u_i)]^{N-1-k}$$

$$\times \binom{N-1}{m} \lambda(\mathbf{x}_i, u_i)^m [1 - \lambda(\mathbf{x}_i, u_i)]^{N-1-m} \binom{k_i}{\tilde{k}_i} \binom{N-1-k_i}{n-1-\tilde{k}_i} / \binom{N-1}{n-1}$$

Ultimately, we would like to understand the effect of differences in adolescent social standings on subsequent adult economic success, allowing for the possibility of spurious

correlation induced by the persistent unobservable factor, $u_i$. To do this, we assume that the subsequently-observed earnings variable, $w_i$, has a conditional Gaussian density, with linear mean function:

$$\mu(\mathbf{z}_i, u_i, m_i, k_i) = \beta_0 + \mathbf{z}_i\boldsymbol{\beta}_1 + \beta_2 u_i + \beta_3 m_i + \beta_4 k_i$$

The conditional wage distribution is then:

$$f(w_i|\mathbf{z}_i, u_i, m_i, k_i) = \sigma^{-1}\phi\left(\frac{w_i - \mu(\mathbf{z}_i, u_i, m_i, k_i)}{\sigma}\right),$$

where $\mathbf{z}_i$ is a set of observed covariates, possibly incorporating some elements of $\mathbf{x}_i$, $\sigma^2$ is the residual variance and $\phi(.)$ represents the N(0,1) density.

We use a maximum likelihood approach, based on the following likelihood expression:

$$P(m_i, \tilde{k}_i, w_i|\mathbf{x}_i, \mathbf{z}_i) = \quad E_u\left[\sum_{k_i=\tilde{k}_i}^{N-1} f(k_i, m_i, \tilde{k}_i|\mathbf{x}_i, u) f(w_i|\mathbf{z}_i, u, m_i, k_i)\right] \quad \text{if } m_i < 3$$

$$E_u\left[\sum_{k_i=\tilde{k}_i}^{N-1}\sum_{m=3}^{N-1} f(k_i, m_i, \tilde{k}_i|\mathbf{x}_i, u) f(w_i|\mathbf{z}_i, u, m_i, k_i)\right] \quad \text{if } m_i \geq 3 \qquad (1)$$

where $E_u$ denotes an expectation with respect to a known distribution for the unobserved effect $u$. We assume a Gaussian density for $u$. Thus the likelihood function has the form of a single or double summation within an integral and we use Hermite quadrature for the integration step.

The expression (1) is the marginal likelihood for a single individual $i$. A pseudo-likelihood function for the full sample of $I$ individuals is constructed as:

$$L = \prod_{i=1}^{I} P(m_i, \tilde{k}_i, w_i|\mathbf{x}_i, \mathbf{z}_i).$$

This is not a full likelihood function, since it does not reflect the stochastic dependence between the individuals sampled within the same class and therefore does not generate asymptotically efficient estimates. However, the score vector has zero expectation at the

true parameter values, so the pseudo-maximum likelihood estimates are consistent, subject to the requirement of identifiability. Standard errors and test statistics are derived from an asymptotic approximation to the covariance matrix, which adjusts for within-class clustering of the sample.

In this model, identification comes from two sources. The first is the specific binomial and hypergeometric distributional forms entailed by the sampling structure. Unusually, these specific distributional forms are dictated by the sampling structure and are not an arbitrary convenient approximation. The second source of identifying information is the exclusion from the wage equation of covariates which appear in the friendship part of the model. These exclusion restrictions have both theoretical and empirical plausibility. Notice that they are not formally necessary for identification, since we have *a priori* information on the distributional form of observed in-degree and out-degree. Nevertheless, they sharpen identification considerably and can be tested. We return to this in the section below.

# 3 Results

We present estimates for three specifications of the wage equation, all including the in-degree $k$ and out-degree $m$ as wage determinants. All three variants of the model use the same vector, $\mathbf{x}$, of covariates for the in-degree and out-degree equations, but use different sets of covariates, $\mathbf{z}$, in the wage equation. In the first specification, the vector $\mathbf{z}$ only includes measures of family background, school quality and location; the second specification introduces additional measures for cognitive ability and human capital, while the final specification includes covariates reflecting adult social capital, marital status and job search methods.

We first discuss the results for the determinants of the in-degree and out-degree of friendship, in terms of the marginal effects presented in Table 2. We then discuss the results for

wages, which are presented in Table 3. Full parameter estimates are given in Appendix Table A2.

## 3.1 In-degree and Out-degree of friendships

We summarise the results on the friendship part of the model by means of marginal effects of variations in $\mathbf{x}$ on the mean of the predicted in-degree and out-degree calculated over all sampled individuals:

$$M_{out} = n^{-1} \sum_{i=1}^{n} \frac{\partial \left[ N\pi(\mathbf{x}_i, u = 0) \right]}{\partial \mathbf{x}_i} \; ; \quad M_{in} = n^{-1} \sum_{i=1}^{n} \frac{\partial \left[ N\lambda(\mathbf{x}_i, u = 0) \right]}{\partial \mathbf{x}_i}.$$

Since the estimates are largely unaffected by the specification of the wage equation, in Table 2 we only present the results calculated using parameter estimates for the full version of the complete model.

We consider three groups of variables which are potentially important for the formation of friendship ties and therefore for the location of a student in the friendship network. The first group relates to the respondent's childhood family environment, as proxied by only-child status, the quality of the sibling relationship and the closeness of the mother-child relationship. Overall, the estimates show that a warmer family environment during childhood is associated with a significantly higher degree of adolescent social engagement. The strongest of these effects are the positive impact of a close maternal relationship on the friendship in-degree and out-degree, and the negative impact of a poor sibling relationship on the out-degree. This remarks the importance of the early family environment on subsequent adolescent social life. We also find some evidence that siblings and friends are substitutes, since only children have a higher out-degree probability (suggesting that they look for external social contacts), whereas there is no effect on the in-degree.

The second group of variables that we consider relates to the characteristics of the respondent and his family with respect to the class norm: class-mean deviations of the students' IQ, year of birth and family income.[8] We find that high school students with above average IQ are more likely to nominate others and to be popular in turn. This comes as no surprise, as relative high ability students might both be more attractive as peers and better understand the opportunities arising from social interactions. Remarkably, belonging to a relatively wealthier family does not make a student more popular among his peers, whereas it significantly increases his out-degree, while there is some evidence that being relatively younger is associated with a reduction in the in-degree.[9]

[8]The IQ measure is the Henmon-Nelson standardized test score. All class averages are calculated over all the sampled males within the grade cohort of the respondent's school.

[9]This last finding is consistent with recent evidence on the effect of relative age on school leadership, see Dhuey and Lipscomb [2008].

**Table 2** Marginal effects on expected out-degree and in-degree from the full model of friendship structure and wages

| Covariate | Out-degree | | In-degree | |
|---|---|---|---|---|
| | Effect | Std.err. | Effect | Std.err. |
| *Respondent's location and size of school* | | | | |
| Rural area | 1.672*** | 0.162 | 1.602*** | 0.299 |
| Small town | 1.418*** | 0.167 | 1.551*** | 0.266 |
| Large town | 0.219*** | 0.105 | 0.004 | 0.074 |
| Graduating Class size | 0.018*** | 0.001 | 0.022*** | 0.001 |
| *Respondent's childhood family ties* | | | | |
| Mother's affection | 0.374*** | 0.081 | 0.799*** | 0.170 |
| Only child | 0.164*** | 0.059 | 0.211 | 0.231 |
| Aggressive sibling | -0.680*** | 0.121 | -0.043 | 0.042 |
| *Respondent's characteristics relative to class norm* | | | | |
| Deviation from mean IQ | 0.166*** | 0.069 | 0.387*** | 0.080 |
| Deviation from mean year of birth | 0.205*** | 0.050 | -0.269* | 0.138 |
| Deviation from mean income | 0.028** | 0.013 | 0.036 | 0.027 |
| *Respondents' school composition: Homophily*[1] | | | | |
| Proportion males in class | 0.126 | 0.229 | -4.325*** | 0.672 |
| Parental origin | 1.393*** | 0.125 | 2.499*** | 0.240 |
| Religion | 0.512*** | 0.195 | 0.311 | 0.409 |
| Father high school educated | 0.714*** | 0.091 | 1.495*** | 0.318 |
| Father college educated | -0.454** | 0.214 | -1.055*** | 0.226 |
| Mother high school educated | 0.490*** | 0.091 | 0.589** | 0.288 |
| Mother college educated | 1.267*** | 0.242 | 0.312 | 0.422 |
| Father managerial/professional | 1.090*** | 0.342 | 2.177*** | 0.500 |
| Mother managerial/professional | 2.638*** | 0.731 | -0.379 | 1.227 |
| Job plans | 0.201 | 0.160 | 1.176*** | 0.369 |
| College plans | 0.991*** | 0.205 | 1.496*** | 0.382 |
| Individual effect | 1.416*** | 0.091 | 2.391*** | 0.130 |

[1] Homophily covariates with respect to a given characteristic are constructed as a dummy for the child himself possessing that characteristic × the proportion of the class also possessing it.

Statistical significance: * = 10%; ** = 5%; *** = 1%

The final group of variables are meant to capture preferences for homophily: that friendship ties tend to be formed among individuals who share similar attributes. We construct a variety of homophily indicators by defining the type of a respondent with respect to his parents' attributes (such as national origin, religion and occupation) and his own attitudes (such as whether he shares schoolmates' plans to go to college or to find a job). Each of

these variables has the same structure. For individual $i$ in class $c$:

$$X_{ic} = \xi_{ic}\left[N_c^{-1}\sum_{j=1}^{N_c}\xi_{jc}\right]$$

where $X_{ic}$ is the constructed covariate, $\xi_{ic}$ is a dummy variable recording whether individual $i$ has the characteristic in question and $N_c$ is class size. We find that most of these variables are positively associated with in-degree and out-degree of friendship. For example, if a student belongs to a school where everybody has the same national origin his expected in-degree and out-degree are raised by 2.5 and 1.4 friends respectively. If only 50% of the class is of the same origin, these effects will be halved. Other large homophily effects include parental occupation.

The influence of the gender composition of the class on the expected in-degree is large: moving from an equally-mixed to a single-sex school reduces the in-degree by 2.16. This may be related to the network boundary issue. A student in a male-only class, who has a demand for female social contacts, must necessarily look outside his school class for such contacts, bringing with it some substitution of external friends for school friends. For most of the sample, this gender-mix effect is very small: only 5 percent of the sampled students are in single-sex classes and, for the remainder, there is little deviation from the median 50-50 mix.

Beside these three groups of covariates, we have also included variables for the location of the respondents and class size (the number of male students in the school grade). Students living in rural and small towns are more likely to nominate others and to receive nominations. An increase in school size has two conflicting effects on social interactions: on the one hand, it increases the size of the pool of potential friends, on the other, it reduces the probability that any one member of that pool will be chosen as a friend. The net effect of school size therefore depends on which of these two dominates. It turns out that in our sample the marginal effect of school size on expected in-degree and out-degree of friendship is typically positive, despite its negative coefficient in the in-degree and out-degree probabilities (see

Table A2). This observation is consistent with previous studies which show that school size affects the nature of school friendship networks, see, e.g., Hallinan and Smith [1989], Allcott et al. [2007]. We return to this issue and its relation to educational policy in the concluding remarks.

In addition to these observable influences on friendship relations, unobserved heterogeneity also matters. A single individual effect, representing additive unobservable time-invariant individual-specific factors, appears with large and significant coefficients in both the in-degree and out-degree probability functions.[10] The estimates imply that a 1-standard deviation increase in the unobserved factor generates an increase in the expected in-degree and out-degree of 2.4 and 1.4 respectively.

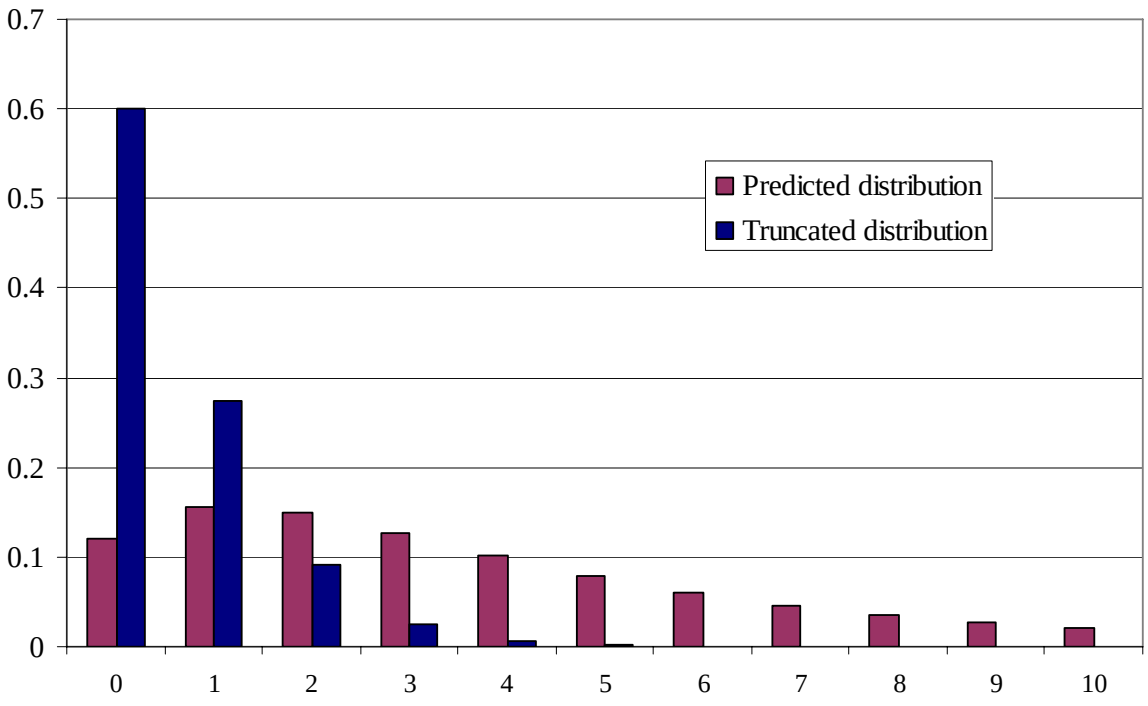


Figure 1: The predicted in-degree distribution and the empirical distribution of in-degree in partially-sampled classes

[10]We also estimated a 2-factor variant of the model, but the second factor was never significant.

Finally, the estimated model implies a much more plausible distribution of in-degree across individuals than the empirical distribution of directly observed inward nominations. Figure 1 shows the sample average of the individual binomial distributions of in-degree predicted by the model, compared with the empirical distribution of in-degree in the partial sample of class networks set out in Table 1 above. It is worth noticing that the predicted in-degree distribution is consistent with the ones reported in previous studies of high-school friendship networks with complete information on the relational data, e.g., Strauss and Pollack [2003].

## 3.2 The Popularity Premium

Our main interest is to establish the impact of in-degree and out-degree of friendship on adult earnings. We are able to measure wages at a relatively advanced age and thus our estimates capture the cumulative effects of differences in relational skills that have materialized over the entire life course. The results are reported in Table 3. We now discuss each of the three sets of variables in the wage model in turn.

*Family Background, School Quality and Location.* In the first specification, the wage equation only includes measures of family background (parental education), high school quality (size of the graduating class, proportion of students taking a language or a math course, and proportion of students with friends planning to go to college), and place of residence in 1992, in addition to in-degree and out-degree. The results are reported in Table 3 column 1. All the estimates have the expected sign and they are highly significant. The number of friendships sponsored by a student has no effect on adult earnings. In contrast, the number of friendship nominations that a student receives from his schoolmates has a sizable effect: the wage premium of an additional friendship nomination is 6 percent.

*Cognitive Ability and Human Capital.* In the second specification, we add proxies for cognitive ability (the Henman-Nelson test of Mental Ability and the grade rank in the high school graduating class) and human capital (years of education) to control for the possibility that our measure of in-degree could act as a proxy of intelligence or achievement.[11] Column 2 in table 3 reports the results of our second specification.[12] As expected, the addition of these controls reduces the estimated coefficient; still, the popularity premium is large and significant at a 5 percent level.

*Marital Status, Job Finding Methods and Adult Social Capital.* In our final specification, we also control for marital status, adult social capital and job finding methods, in order to account for possible channels through which the effect of in-degree might operate.

Indeed, joining a social network is one of the most common forms of social capital investment. These networks cover institutions ranging from labor unions, political clubs, hobby groups and religious associations, and play a role in providing opportunities which may be important for economic success. The empirical work on social capital often uses survey responses about the number of organization or group memberships and the frequency of contacts with friends and family members as proxies for social capital, see, for example, Glaeser et al. [2002], and Durkin [2000]. We follow the literature and include both an index for social participation[13] and two measures for frequency of contacts with friends and relatives. Finally, we include an indicator for whether the job was found through informal contacts (like friends or acquaintances, former co-workers, teachers, relatives) to account for the role played by job ties in job search.[14]

[11] In fact, the positive relationship between social capital and human capital is one of the most robust empirical regularities in the social capital literature, see Helliwell and Putnam [1999].

[12] Note that all our estimates are very similar to the ones reported in Zax and Rees (2002).

[13] In forming this measure, we exclude the subset of organizations with a strong consumption component. See Table A1 for details on the specific organizations included in our measure.

[14] There is now an established literature which shows that connections transmit information about jobs, offsetting some of the informational asymmetries between the supply and demand side of the labor market, see, for example, Granovetter [1974], Montgomery [1991], Rees [1996] and Topa [2000].

The results of this last specification are reported in column 3 of Table 3. We first note that the introduction of these additional variables does not qualitatively alter the estimated impact of cognitive ability, human capital, school quality and family background. Secondly, we confirm existing findings that individuals with higher level of adult social capital and married men have higher wages (see, for the latter, Korenman and Neumark [1991]). We do not find a wage premium for individuals who found their current job via informal channels.

Most importantly, once we condition on this new set of covariates, our conclusions on the wage premium of high school popularity do not change. An additional friendship nomination in high school is worth a (statistically significant) 1.9 percent higher wage 35 years later. This popularity premium is roughly 40 percent of the wage premium of an additional year of education. Shifting somebody from the 20th to the 80th percentile of the predicted degree distribution – making an *isolate* a *pop-star* – yields a 10 percent wage premium, a return consistent with estimates reported in previous studies, e.g., Kuhn and Weinberger [2005] and Postlewait and Silverman [2005].

We make two final remarks. First, the unobserved individual effect which appears in the in-degree and out-degree equations is statistically insignificant in the wage equation. This implies that in-degree and out-degree can be treated as exogenous, conditional on our set of covariates.[15] However, the wage equation cannot be estimated in isolation, since the non-classical measurement error in $\tilde{k}$ must still be dealt with. Indeed, a simple OLS estimation of the wage equation yields similar results apart from the coefficient of the in-degree which is more than double with a magnitude of 4.3 percent and significant at a 1 percent level.[16]

The second remark is about the validity of our exclusion restrictions. Apart from having *ex-ante* theoretical and empirical plausibility, they are also tested *ex-post* and not rejected.

[15]This is also reassuring in view of the retrospective nature of our friendship data. As the friendship information is collected almost twenty years before the wage, this weakens the possibility that the observed positive association between the two might arise from spurious correlations in unobservable.

[16]This result is available upon request to the authors.

A generalized model with unrestricted wage equation yielded a log-likelihood of −11404.18, with an insignificant likelihood ratio statistic of 29.79 (22 degrees of freedom), comparing this unrestricted model with the most general form of the restricted model.

**Table 3** Coefficients in the log-wage equation
(standard errors in parentheses)

| Covariate | (1) | (2) | (3) |
|---|---|---|---|
| *Family background, school quality and location* | | | |
| College-educated father[1] | 0.073*** | 0.02 | 0.038 |
| | (0.02) | (0.039) | (0.024) |
| College-educated mother[1] | 0.148*** | 0.11*** | 0.089*** |
| | (0.02) | (0.04) | (0.021) |
| Graduating Class size | 0.043*** | 0.036*** | 0.038*** |
| | (0.008) | (0.009) | (0.008) |
| Proportion taking math | 0.082*** | 0.028 | 0.026 |
| | (0.026) | (0.027) | (0.027) |
| Proportion taking language | 0.155*** | 0.085 | 0.074 |
| | (0.058) | (0.059) | (0.055) |
| Proportion with college plans | 0.177*** | 0.038 | 0.036 |
| | (0.033) | (0.054) | (0.048) |
| Resident in Wisconsin | -0.278*** | -0.187*** | -0.175*** |
| | (0.017) | (0.020) | (0.012) |
| *Cognitive ability and human capital* | | | |
| IQ | - | 0.085*** | 0.085*** |
| | | (0.010) | (0.009) |
| Grade rank | - | 0.077 | 0.040 |
| | | (0.103) | (0.069) |
| Years of schooling | - | 0.049*** | 0.046*** |
| | | (0.004) | (0.004) |
| *Marital status, job findings methods and adult social capital* | | | |
| Married | - | - | 0.172*** |
| | | | (0.020) |
| Social participation | - | - | 0.336*** |
| | | | (0.047) |
| No. of outings with friends | - | - | 0.707*** |
| | | | (0.075) |
| No. of outings with relatives | - | - | -0.650*** |
| | | | (0.124) |
| Job found through network | - | - | 0.011 |
| | | | (0.018) |
| Individual effect | -0.033* | 0.001 | -0.003 |
| | (0.018) | (0.02) | (0.014) |
| In-degree | 0.066*** | 0.021** | 0.019** |
| | (0.014) | (0.009) | (0.009) |
| Out-degree | -0.019 | -0.002 | -0.001 |
| | (-1.179) | (0.01) | (0.012) |

[1] Differently from Table 2, now these two variables are simply constructed as dummies.

Statistical significance: * = 10%; ** = 5%; *** = 1%

# 4 Concluding Remarks

This paper contributes to the emerging literature on the relevance of non-cognitive traits for achieving economic success in life. We propose to overcome some of the difficulties encountered in the literature on the meaning and the measurement of these traits by focusing on popularity, objectively measured as the number of friendship nominations received from high-school classmates. We exploit the non-reciprocal nature of friendship relations and are able to show that the popularity premium is substantial: one additional friendship nomination received in high-school is associated with about 2 percent higher wages 35 years later. In contrast, there is no evidence of a wage premium associated with the number of friendship nominations the individual makes.

As a by-product of our estimation strategy, we also provide novel evidence on the determinants of popularity. Of particular interest is the role played by early family environment, school composition and school size on adolescent social engagement. While current research merely focuses on the effect of class size on cognitive achievement (e.g., Angrist and Lavy [1999] and Hoxby [2000]), our results suggest that a deeper understanding of the effect of school size and composition on the development of social skills is needed. Policies that focus on promoting integration in schools and on developing social competencies may be a fruitful way of promoting success in life.

Finally, we also provide a methodological contribution. We show how to analyse data from partially sampled social networks with a censored number of possible links. Given the difficulties of sampling complete networks, we expect our method to have wide applicability. While we focus on earnings here, we plan to extend our analysis to investigate the effect of adolescent social standing on other outcomes, such as health and risk behavior.

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# Appendix: Additional Tables

**Table A1** Definitions and means of variables

| Variable | Interview year & Survey Instrument | Sample mean |
|---|---|---|
| *Friendship model: location and size of school* | | |
| Rural area | 1957 [SAQ-GR] | 0.190 |
| Small town | 1957 [SAQ-GR] | 0.335 |
| Large town | 1957 [SAQ-GR] | 0.205 |
| Graduating Class size (no. of male students in school grade) | 1957 | 168.5 |
| *Friendship model: childhood family ties* | | |
| Mother's affection[1] | 1993-94 [MS-SSR] | 0.258 |
| Only child | 1975 [PQ-GR] | 0.067 |
| Aggressive sibling[2] | 1993-94 [MS-SSR] | 0.032 |
| Sex sibling[3] | 1993-94 [MS-SSR] | 0.469 |
| *Friendship model: Individual characteristics relative to class norm* | | |
| Deviation from mean IQ | 1957 | 0.096 |
| Deviation from mean year of birth | 1975 | 0.018 |
| Deviation from mean income | 1975 [PQ-GR] | -2.20 |
| *Friendship model: Homophily[4]* | | |
| Proportion males in class | 1957 | 0.525 |
| Same parental origin | 1975 [PQ-GR] | 0.407 |
| Religion | 1975 [PQ-GR] | 0.452 |
| Father high school educated | 1957 [SAQ-GR] | 0.054 |
| Father college educated | 1957 [SAQ-GR] | 0.024 |
| Mother high school educated | 1957 [SAQ-GR] | 0.123 |
| Mother college educated | 1957 [SAQ-GR] | 0.023 |
| Father managerial/professional | 1957 [SAQ-GR] | 0.023 |
| Mother managerial/professional | 1957 [SAQ-GR] | 0.005 |
| Job plans | 1975 [PQ-GR] | 0.247 |
| College plans | 1975 [PQ-GR] | 0.183 |
| *Friendship model: Others* | | |
| Father of German origin[5] | 1975 [PQ-GR] | 0.471 |

Legenda: SAQ-GR: Self-Assessment Questionnaire, Graduate Respondent (1957); PQ-GR: Phone Questionnaire, Graduate Respondent (1975); SSR-MS: Selected Sibling Respondent's Mail Survey (1993-1994).

[1] "Mother's affection" is a dummy variable which takes value 1 if the mother hugged the respondent "some" or "a lot", as reported by the selected sibling.

[2] "Aggressive sibling" is a dummy variable which takes value 1 if the selected sibling reported to "insult, swore at" the respondent "some" or "a lot".

[3] "Sex sibling" is a dummy variable which takes value 1 is the selected respondent's sibling is a male.

[4] Homophily covariates with respect to a given characteristic are constructed as a dummy for the child himself possessing that characteristic × the proportion of the class also possessing it.

[5] "Father of German origin" is defined as a conventional dummy variable

**Table A1 (ctd.)** Definitions and means of variables

| Variable | Interview year & Survey Instrument | Sample mean |
|---|---|---|
| Log hourly wage | 1992-93 [PQ-GR] | 2.897 |
| *Wage model: family background, school quality and location* | | |
| College-educated father | 1957 [SAQ-GR] | 0.104 |
| College-educated mother | 1957 [SAQ-GR] | 0.103 |
| Graduating Class size | 1957 | 168.5 |
| Proportion taking math | 1957 [MQ-PR] | 0.208 |
| Proportion taking language | 1957 [MQ-PR] | 0.071 |
| Proportion of friends with college plans | 1975 [PQ-GR] | 0.367 |
| Resident in Wisconsin | 1992-93 [PQ-GR] | 0.675 |
| *Wage model: cognitive ability and human capital* | | |
| IQ (Henmon-Nelson test score) | 1957 | 0.119 |
| Grade rank | 1957 [SAQ-GR] | 0.358 |
| Years of schooling | 1992-93 [PQ-GR] | 14.18 |
| *Wage model: marital status, job finding methods and adult social capital* | | |
| Married | 1992-93 [PQ-GR] | 0.872 |
| Social participation[1] | 1992-93 [MQ-GR] | 0.114 |
| No. of outings with friends[2] | 1992-93 [MQ-GR] | 0.100 |
| No. of outings with relatives[3] | 1992-93 [MQ-GR] | 0.091 |
| Job found through network | 1992-93 [PQ-GR] | 0.304 |
| *Wage model: Others* | | |
| Deviation from mean year of birth | 1975 | 0.018 |
| Missing social participation[4] | 1992-93 [MQ-GR] | 0.359 |

Legenda: SAQ-GR: Self-Assessment Questionnaire, Graduate Respondent (1957); MQ-PR: Mail Questionnaire, Respondent's Parent, Little's Subsample Survey (1957); PQ-GR: Phone Questionnaire, Graduate Respondent (1975, and 1992-93); MQ-GR: Mail Questionnaire, Graduate Respondent (1992-93).

[1] This variable is constructed as log(index+1)/10, where the index of social participation is constructed as the sum of the scales for involvement with the following organizations: church-connected groups (but not the church itself), veterans' organizations, business or civic groups, parents-teachers associations, community centers, organizations of people of the same nationality, youth groups, professional groups, political clubs or organizations, neighborhood improvement organizations, charity or welfare organizations. Each scale is comprised of the following items: 0 "Not involved", 1 "Very little", 2 "Some", 3 "Quite a bit", 4 "A great deal".

[2] This variable is constructed as log(no. of outings+1)/10. It counts the number of times the respondent has gotten together with friends in the past four weeks.

[3] This variable is constructed as log(no. of outings+1)/10. It counts the number of times the respondent has gotten together with relatives in the past four weeks.

[4] This is a dummy variable which takes value 1 if there is missing response for the "Social participation" variable.

**Table A2** Parameter estimates: in-degree

| Parameter | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Constant | -1.52*** | -1.473*** | -1.47*** |
| | (0.057) | (0.059) | (0.071) |
| *Respondent's location and size of school* | | | |
| Rural area | 0.195*** | 0.211*** | 0.21*** |
| | (0.029) | (0.035) | (0.038) |
| Small Town | 0.163*** | 0.204*** | 0.204*** |
| | (0.03) | (0.033) | (0.034) |
| Large Town | 0.006 | 0.001 | 0.0005 |
| | (0.01) | (0.013) | (0.01) |
| Graduating Class size | -0.258*** | -0.257*** | -0.257*** |
| | (0.012) | (0.013) | (0.013) |
| *Respondent's childhood family ties* | | | |
| Mother's affection | 0.093*** | 0.105*** | 0.105*** |
| | (0.017) | (0.0078) | (0.021) |
| Only child | 0.05* | 0.029* | 0.027 |
| | (0.029) | (0.017) | (0.03) |
| Aggressive sibling | -0.042*** | -0.009 | -0.005 |
| | (0.006) | (0.028) | (0.005) |
| Sex sibling | 0.014 | 0.003 | 0.001 |
| | (0.016) | (0.013) | (0.019) |
| *Respondent's characteristics relative to class norm* | | | |
| Deviation from mean IQ | 0.09*** | 0.05*** | 0.05*** |
| | (0.01) | (0.009) | (0.01) |
| Deviation from mean year of birth | -0.05*** | -0.03*** | -0.03** |
| | (0.008) | (0.008) | (0.018) |
| Deviation from mean income | 0.007** | 0.005 | 0.005 |
| | (0.003) | (0.003) | (0.003) |
| *Respondent's school composition: Homophily* | | | |
| Proportion males in class | -0.465*** | -0.566*** | -0.568*** |
| | (0.069) | (0.054) | (0.085) |
| Parental Origin | 0.339*** | 0.329*** | 0.328*** |
| | (0.018) | (0.014) | (0.028) |
| Religion | 0.033 | 0.04 | 0.04 |
| | (0.039) | (0.046) | (0.05) |
| Father high school educated | 0.209*** | 0.196*** | 0.196*** |
| | (0.039) | (0.012) | (0.041) |
| Father college educated | -0.204* | -0.139*** | -0.138*** |
| | (0.116) | (0.017) | (0.029) |
| Mother high school educated | 0.079*** | 0.075*** | 0.077** |
| | (0.031) | (0.021) | (0.037) |
| Mother college educated | 0.157 | 0.036 | 0.041 |
| | (0.108) | (0.067) | (0.055) |

**Table A2 cont.** Parameter estimates: in-degree

| Parameter | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Father managerial/professional | 0.314*** | 0.295*** | 0.286*** |
| | (0.054) | (0.084) | (0.064) |
| Mother managerial/professional | -0.095 | -0.052*** | -0.051 |
| | (0.093) | (0.015) | (0.161) |
| Job plans | 0.156*** | 0.153*** | 0.154*** |
| | (0.038) | (0.038) | (0.048) |
| College plans | 0.213*** | 0.197*** | 0.196*** |
| | (0.043) | (0.033) | (0.049) |
| *Others* | | | |
| Father of German origin | -0.154*** | -0.161*** | -0.161*** |
| | (0.018) | (0.014) | (0.022) |
| Individual Effect | 0.299*** | 0.314*** | 0.314*** |
| | (0.014) | (0.019) | (0.018) |

**Table A2 cont.** Parameter estimates: out-degree

| Parameter | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Constant | -1.855*** | -1.855*** | -1.855*** |
| | (0.019) | (0.015) | (0.033) |
| *Respondent's location and size of school* | | | |
| Rural area | 0.254*** | 0.253*** | 0.253*** |
| | (0.011) | (0.021) | (0.022) |
| Small Town | 0.215*** | 0.215*** | 0.214*** |
| | (0.014) | (0.019) | (0.023) |
| Large Town | 0.033*** | 0.033** | 0.033** |
| | (0.008) | (0.015) | (0.016) |
| Graduating Class size | -0.234*** | -0.234*** | -0.234*** |
| | (0.011) | (0.011) | (0.012) |
| *Respondent's childhood family ties* | | | |
| Mother's affection | 0.057*** | 0.056*** | 0.056*** |
| | (0.012) | (0.012) | (0.012) |
| Only child | 0.0243** | 0.024 | 0.025*** |
| | (0.011) | (0.020) | (0.008) |
| Aggressive sibling | -0.103*** | -0.103*** | -0.103*** |
| | (0.007) | (0.030) | (0.018) |
| Sex sibling | -0.017 | -0.017 | -0.017 |
| | (0.01) | (0.01) | (0.01) |
| *Respondent's characteristics relative to class norm* | | | |
| Deviation from mean IQ | 0.025** | 0.025** | 0.025** |
| | (0.01) | (0.01) | (0.01) |
| Deviation from mean year of birth | 0.031*** | 0.031*** | 0.031*** |
| | (0.009) | (0.009) | (0.007) |
| Deviation from mean income | 0.004** | 0.004** | 0.004** |
| | (0.0018) | (0.0018) | (0.0019) |
| *Respondent's school composition: Homophily* | | | |
| Proportion males in class | 0.019 | 0.019 | 0.019 |
| | (0.02) | (0.014) | (0.034) |
| Parental Origin | 0.211*** | 0.211*** | 0.211*** |
| | (0.007) | (0.017) | (0.017) |
| Religion | 0.078** | 0.077*** | 0.077*** |
| | (0.017) | (0.018) | (0.029) |
| Father high school educated | 0.108*** | 0.108*** | 0.108*** |
| | (0.008) | (0.005) | (0.013) |
| Father college educated | -0.069*** | -0.068 | -0.068** |
| | (0.024) | (0.049) | (0.032) |
| Mother high school educated | 0.074*** | 0.074*** | 0.074*** |
| | (0.011) | (0.007) | (0.013) |
| Mother college educated | 0.182*** | 0.189*** | 0.192*** |
| | (0.037) | (0.026) | (0.036) |

**Table A2 cont.** Parameter estimates: out-degree

| Parameter | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Father managerial/professional | 0.165*** | 0.164** | 0.165*** |
| | (0.015) | (0.071) | (0.052) |
| Mother managerial/professional | 0.416*** | 0.41*** | 0.399*** |
| | (0.093) | (0.083) | (0.111) |
| Job plans | 0.03** | 0.03* | 0.03 |
| | (0.014) | (0.017) | (0.024) |
| College plans | 0.149*** | 0.149*** | 0.15*** |
| | (0.019) | (0.019) | (0.03) |
| *Others* | | | |
| Father of German origin | -0.071*** | -0.07*** | -0.07*** |
| | (0.01) | (0.01) | (0.01) |
| Individual Effect | 0.216*** | 0.214*** | 0.214*** |
| | (0.012) | (0.014) | (0.012) |

**Table A2 cont.** Parameter estimates: wages

| Parameter | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Constant | 2.696*** | 2.107*** | 1.956*** |
| | (0.026) | (0.078) | (0.058) |
| Deviation from mean year of birth | 0.08*** | 0.008 | 0.008 |
| | (0.012) | (0.016) | (0.017) |
| *Family background, school quality and location* | | | |
| College-educated father | 0.073*** | 0.02 | 0.038 |
| | (0.02) | (0.039) | (0.024) |
| College-educated mother | 0.148*** | 0.11*** | 0.089*** |
| | (0.02) | (0.04) | (0.021) |
| Graduating Class size | 0.043*** | 0.036*** | 0.038*** |
| | (0.008) | (0.009) | (0.008) |
| Proportion taking math | 0.082*** | 0.028 | 0.026 |
| | (0.026) | (0.027) | (0.027) |
| Proportion taking language | 0.155*** | 0.085 | 0.074 |
| | (0.058) | (0.059) | (0.055) |
| Proportion with college plans | 0.177*** | 0.038 | 0.036 |
| | (0.033) | (0.054) | (0.048) |
| Resident in Wisconsin | -0.278*** | -0.187*** | -0.175*** |
| | (0.017) | (0.020) | (0.012) |
| *Ability and human capital* | | | |
| IQ | - | 0.085*** | 0.085*** |
| | | (0.010) | (0.009) |
| Grade rank | - | 0.077 | 0.040 |
| | | (0.103) | (0.069) |
| Years of schooling | - | 0.049*** | 0.046*** |
| | | (0.004) | (0.004) |
| *Marital status and adult social capital* | | | |
| Married | - | - | 0.172*** |
| | | | (0.020) |
| Social participation | - | - | 0.336*** |
| | | | (0.047) |
| Missing Social Participation | - | - | 0.017** |
| | | | (0.008) |
| No. of outings with friends | - | - | 0.707*** |
| | | | (0.075) |
| No. of outings with relatives | - | - | -0.650*** |
| | | | (0.124) |
| Job found through network | - | - | 0.011 |
| | | | (0.018) |
| Individual effect | -0.033* | 0.001 | -0.003 |
| | (0.018) | (0.02) | (0.014) |
| In-degree | 0.066*** | 0.021** | 0.019** |
| | (0.014) | (0.009) | (0.009) |
| Out-degree | -0.019 | -0.002 | -0.001 |
| | (-1.179) | (0.01) | (0.012) |
| Log-likelihood | -11529.8 | -11448.4 | -11419.1 |