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Implications of Middle School Behavior Problems for High School Graduation and Employment Outcomes of Young Adults: Estimation of a Recursive Model
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ABSTRACT

The potentially serious adverse impacts of behavior problems during adolescence on employment outcomes in adulthood provide a key economic rationale for early intervention programs. However, the extent to which lower educational attainment accounts for the total impact of adolescent behavior problems on later employment remains unclear As an initial step in exploring this issue, we specify and estimate a recursive bivariate probit model that 1) relates middle school behavior problems to high school graduation and 2) models later employment in young adulthood as a function of these behavior problems and of high school graduation. Our model thus allows for both a direct effect of behavior problems on later employment as well as an indirect effect that operates via graduation from high school. Our empirical results, based on analysis of data from the NELS, suggest that the direct effects of externalizing behavior problems on later employment are not significant but that these problems have important indirect effects operating through high school graduation.

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1. INTRODUCTION

The impact of children's behavioral or "noncognitive" traits on future labor market outcomes has been of interest for economists and other social scientists (Heckman, Rubinstein, 2001; Bowles, Gintis, Osborne, 2001; Farkas, 2003; Heckman, Stixrud, Urzua, 2006). Previous studies indicates that adolescent behavioral problems, such as persistent rule-breaking, aggressive or antisocial behaviors, low motivation for school, alcohol and illicit substance use, and delinquent acts, are associated with higher unemployment and lower earnings in adulthood (Bowles, Gintis, Osborne, 2001; Cawley, Heckman, Vytlacil, 2001; Kokko, Pulkkinen, 2000; Woodward and Fergusson, 2000). This study adds to the literature by examining the relative importance of direct and indirect relationships between behavioral problems in adolescence and employment status in early adulthood.

The relative importance of the direct versus indirect impacts of behavioral problems on adult employment has possible implications for investment in prevention programs. If negative impacts are primarily due to lower educational attainment, interventions that improve high school graduation rates (or delay discontinuation of education among at risk youths) may have long-term benefits in terms of future employment and earnings. On the other hand, if behavioral problems primarily affect distal labor market outcomes via direct impacts of noncognitive traits and skills, interventions that focus on keeping students in school despite behavioral problems may not substantially improve labor market outcomes. That would require programs that ameliorate behavioral problems, or early intervention programs that prevent development of these problems.

We use data from a nationally representative cohort in 1988 of eighth-grade students who were followed up in 2000, at ages 25 to 28, to model the effects of early adolescent behavior

problems on employment status in early adulthood. Unlike prior studies (e.g., Kokko, Pulkkinen, 2000; Woodward, Fergusson, 2000), our model allows for both direct and indirect effects of behavioral problems in 8th grade (1988) on early adulthood employment; indirect effects operate via the probability of graduating from high school. We estimate model parameters via maximum likelihood estimation of a recursive bivariate probit regression with potentially correlated errors (Greene, 2003, Cameron, Trivedi, 2005). The bivariate probit model explicitly allows for the possibility that educational attainment is endogenous to employment (Heckman, Stixrud, Urzua, 2006).

We obtain coefficient estimates using the unweighted NELS data since unweighted estimators are consistent and more efficient than their weighted counterparts when the stratifying variables are exogenous (Wooldridge, 2002).

Behavioral problems, educational attainment, and employment

Because maladaptive behaviors may cause lower educational attainment, they could indirectly affect employment in adulthood via effects on educational attainment. High schools require a minimal level of compliance with rules that some students cannot achieve or may be unwilling to tolerate, which may explain the negative association of behavioral problems in adolescence with high school completion and college attendance (Fergusson, Horwood, Woodward, 2001; Woodward, Fergusson, 2000; Alexander, Entwisle, Horsey, 1997; Ensminger, Slusarcick, 1992; Ensminger, Lamkin, Jacobson, 1996; Brooks-Gunn, 1993; French, Conrad, 2001). The literature indicates that high school graduation raises earnings and increases the probability of employment (e.g., Geweke, Keane, 2000; Heckman, 2000; Hamburg 1974, Steinberg, Lerner 2004). Thus, an indirect structural relationship between adolescent behavioral problems and employment outcomes in adulthood may be important.

However, most previous empirical work has not examined this structural relationship (e.g., Kokko, Pulkkinen, 2000; Woodward, Fergusson, 2000; Vitaro, Larocque, et al. 2001; Capaldi, Chamberlain, Patterson, 1997; Jimerson, Egeland, et al. 2000; McLeod, J.D., Kaiser, K. 2004). Instead, measures of behavior problems and educational attainment were modeled in the same single equation specification for employment. The resulting estimates thus only reflect direct effects of behavioral traits on employment, with the measure of educational attainment absorbing the indirect effect of behavioral problems on employment outcomes.

Direct effects of behavioral problems on employment may occur because employers' value adherence to norms of conduct in the workplace (Bowles, Gintis and Osborne, 2001). Employers may be less willing to employ individuals with behavioral problems, because maladaptive behavior may interfere with performance or generate higher incidental costs to the employer. Childhood problems are directly related to these effects, because problems adapting to requisite norms of behavior in adulthood typically are evident during childhood (Hofstra, van der Ende, and Verhulst, 2002). However, employers can not usually observe whether potential employees had behavioral problems while at middle or high school. The educational screening hypothesis suggests that employers use education to screen for exogenous ability differences. Thus, they infer some unobservable factors, such as extent of middle-school behavioral problems, from the observable facts of high-school graduation or number of years of completed schooling (Riley, 1979; Weiss, 1995; Martorell, Clark, 2009).

Gender Differences

Descriptive comparisons suggest that relationships between adolescent behavioral problems, educational attainment, and employment outcomes in early adulthood may differ by gender. Females have higher rates of high school graduation and lower rates of employment in

their 20s (Swanson, 2004; Kienzl, Kena, 2006), suggesting that processes linking these outcomes may differ by gender. Additionally, studies document the higher prevalence rates among boys than girls of delinquency, physical aggression, and overt antisocial behaviors (Baillargeon et al., 2007; Verhulst et al., 2003; Black, 2000; Pursell, et al. 2008). Finally, studies from the labor economics literature (Altonji, Blank, 1999), and on labor market impacts of cognitive and behavioral factors (Murnane, Willett, Levy, 1995; Heckman, Stixrud, Urzua, 2006; Cawley, Heckman, Vytlacil, 2001) document significant gender differences (or restrict their analyses to only one gender). Accordingly, we estimate separate models for males and females. (We tested pooled vs. gender-specific models on our data and clearly rejected pooling: results are available from the authors.)

2. METHODS

Estimation Model

In our model, employment outcome depends on observable covariates (X_1), high school graduation, and an unobservable random error term u_1. We assume high school graduation probability depends on a set of observable covariates (X_2) and an unobservable error term u_2. We assume that u_1 and u_2 have a bivariate normal distribution with correlation ρ. In our initial analyses, the same covariates were included in X_1 and X_2. Subsequent analyses tested the stability of our principal findings when selected covariates were deleted from X_1. Note that the recursive structure of the model provides identification for the purposes of FIML estimation; further exclusion restrictions on the X_1 vector are not required (Wilde, 2000).

The from of the model estimated was:

Prob (HS=1| X_2) = Prob [($\beta_2 X_2 + u_1$)>0, Prob (EMP=1|HS, X_1) = Prob [($\beta_1 X_1 + \beta_3 HS + u_2$,)>0],

where β_1 and β_2 are the coefficient vectors for X_1 and X_2, β_3 is the coefficient for HS, and u_1 and u_2 are random draws from a bivariate normal distribution with corr(u_1, u_2)=ρ. A positive value for the correlation between the error terms, ρ, indicates that unobservables positively (negatively) related to the probability of high school graduation also increase (decrease) the probability of employment; negative values for ρ imply that unobservables have oppositely-signed influences on graduation and employment. Full-information maximum likelihood (FIML) (using Stata Version 9) is used for estimation.

Data Source, Variables, and Sample

Analysis is based on the data from the National Educational Longitudinal Study (NELS) from the base year (1988) through the fifth follow-up (2000) (12,144 cases) (Curtin et al. 2002). Employment and high-school graduation data are from the 2000 and 1994 waves, respectively. All other data are from the 1988 baseline survey. Because of missing data from parents, teachers and/or schools, 9,660 cases were available for analysis; deletion of cases where data were reported, but values for specific variables used in our analysis were missing, resulted in a final study sample of 8,405 subjects (3,927 males and 4,478 females).

The outcome variables high school graduation and employment are binary variables. We define high school graduation in a time window of up to 6 years after eighth grade (i.e., using the 1994 NELS data) to include those who were delayed in completing high school. For most models, we did not include a GED as equivalent to a high school diploma because of evidence that labor market returns to a high school diploma are significantly higher than returns to GED certification (Cameron and Heckman, 1993), and that the post-schooling labor-market outcomes for GED recipients more closely match those of high-school dropouts (Heckman and Rubinstein, 2001; Heckman, Stixrud and Urzua, 2006). Thus, in most specifications, we contrast

employment for high school graduates with a reference group of GED recipients and dropouts. (We also report results of sensitivity analyses with GED recipients coded as high school graduates.)

The employment outcome is an indicator of current employment for the 2000 survey year. Those who report current employment for pay in either a full-time or part-time job are coded as employed. (Results for models that define the employment outcome as = 1 only for full-time workers are discussed below in our presentation of sensitivity analyses.)

Explanatory variables pertain to behavior problems, academic performance, demographic/socio-economic background, and school characteristics. Information on behavior problems was obtained from teacher reports and student self-report. While this information was not derived from psychometrically validated scales, such as the Behavior Problems Index (BPI) (Zill, 1985), that have been used previously in economic research (e.g., Jones et al., 1999), the NELS data items could be viewed as roughly consistent with the two major dimensions of behavior problems (i.e., externalizing vs. internalizing) identified in the BPI. In particular, the NELS responses include one teacher-reported measure on student passivity in class, which could be regarded as potentially related to internalizing problems, as well as several items that are presumably related to externalizing problems: teacher reports on whether the student is frequently absent, and whether (s)he is disruptive class; and student-reported measures on skipping class and on being sent to the principal's office for misbehaving in class.

Academic performance variables (as of eighth grade) were obtained from teacher reports or student-self-reports. They include the student's grade point average (GPA), teacher rating of the student's academic performance compared to his/her ability, and student self-report on whether (s)he had to repeat a grade.

Demographic/socio-economic background variables include race, presence of both biological parents, caregiver's employment status and educational attainment, and family income. The NELS school characteristics variables were obtained from school records (for attendance rate) and geocoding (for urban location).

3. RESULTS

Descriptive Statistics

Table 1 reports mean values for dependent and explanatory variables by gender. High school graduation as of 1994 is reported by more than 89 percent of study subjects, while current employment is reported by 92.1 percent of males and 82.7 percent of females. Other gender differences are clear from the data. While males and females report similar high-school graduation rates, females reported higher standardized grade point averages, lower rates of repeating a year by 8^{th} grade. Females were less likely to be rated by teachers as performing below ability. Males were more likely to be rated as being disruptive in class, and more likely to self-report skipping class and being sent to the office for misbehaving. While females were more likely to be reported as being frequently absent by their teachers, there is little gender difference in teacher-rated passive behavior in class. Males were more likely to report behavioral problems that are closely associated with attention and focus in classroom activities.

With regard to socio-demographic characteristics, about 71 percent of our study subjects were white. About 70 percent of the subjects reported living with both biological parents, 90 percent reported having an employed caregiver, and the mean annual household income level exceded $40,000. Slightly over 10 percent of respondents did not have at least one caregiver who had completed high school; just under 20 percent reported at least one caregiver who completed high school but no caregivers with any post-high-school education.

Regression Results for Males

Regression results were obtained with three similar but slightly different specifications for the employment model. One model regressed all covariates listed in Table 1, as well as the high school graduation outcome variable, on the employment outcome. Results indicated that the covariate for average attendance rate in eighth grade was clearly insignificant in the employment outcome model, so a second regression was estimated with this covariate excluded from the employment outcome model. In this case, the remaining school characteristic variable, the urban school dummy, was not quite significant in the employment outcome model, so a third variant was estimated in which both school characteristics variables were excluded from the employment outcome model. (In all three cases, both school characteristics were included in the high school graduate outcome model and were clearly significant.) In presenting our results in detail, we focus here on the results from the regressions with this third variant of the employment outcome model; comparisons with results with the first two variants of the employment outcome model are examined in our sensitivity analyses.

Using the third variant of our employment outcome model, Table 2 presents the simple and bivariate probit regression results for males. Simple probit estimates (in columns 1 through 4) ignore any possible correlation between the unobservables that affect high school completion and those that affect employment. Simple probit results for high school completion indicate highly significant coefficients for almost all covariates. Corresponding results for employment show a large and significant positive coefficient for high school graduation, but a significantly negative coefficient for grade-point average. Among the behavior problem variables, the only significant result is the negative coefficient for teacher-rated passivity in class. A joint likelihood ratio test for all behavior problem variables (as predictors of employment) approached significance (P =

0.0731) reflecting the importance of passivity as a negative predictor of employment; excluding this variable from the joint test yielded a joint P-value for the remaining (externalizing) behavior problem indicators of 0.8879. Among the remaining covariates, being white and living with both parents were significant and positive predictors of being employed. Conversely, family income had a significantly negative coefficient. One possible explanation for this negative relationship is that young adults whose parents had higher income can afford to postpone employment after high school and perhaps continue their education while continuing to rely on parental financial support. However, males whose most highly-educated caregiver received a high school diploma but no further education were significantly less likely to be employed relative to those with at least one caregiver with any post-high school education.

In the bivariate probit analysis for males, the results for high school graduation are very similar in sign, size and significance to the results in the simple probit model. In the employment equation, the bivariate coefficient on high school completion is substantially larger than in the simple probit model. Other employment results, however, parallel the findings for the simple probit model. Among the behavior problem variables, only teacher-rated passivity is significant. While all behavior problem variables have negative coefficients, as a group they only approach significance (P=0.0682). However, the joint P-value for the externalizing behavior problem variables (i.e., excluding passivity from the test) becomes clearly insignificant (p=0.9372). We again find that grade-point average is negatively related to employment and that students whose caregivers have post-high-school education are less likely to be employed (relative to children of caregivers with no post-high school education).

The bivariate probit regression provides an estimate of ρ (rho), the correlation between unobservables affecting high school graduation and those affecting employment decision. The

estimated ρ is negative and statistically significant (p=0.013). Thus, unobserved factors that are associated with higher probability of high school graduation are also predictive of a lower likelihood of employment during transition to adulthood. This implies a negative bias in the estimated effect of high school graduation on employment outcome for males, and is consistent with our finding of a smaller coefficient of high school graduation in the simple probit model of employment compared to the bivariate probit model.

In comparison to these results, bivariate probit regression with both school characteristics included in both outcome models, yielded P-values of 0.048 and 0.662 for the urban school dummy and the attendance rate respectively in the employment outcome model. When the attendance rate was excluded, the P-value for the urban school dummy fell to 0.051. (A variant of the employment outcome model with the urban school dummy excluded but the attendance rate included, yielded a P-value of 0.743 for the coefficient of the latter variable.) We tested the restriction that both school characteristics have no direct effect on the employment outcome and obtained an insignificant P-Value of 0.137. In all cases, the regression results for other explanatory variables in both outcome models were virtually unchanged.

Regression Results for Females

The specification of the regression models for females parallels that for males described above. Since the variants that included (1) both school characteristics, or (2) just the urban school dummy yielded clearly insignificant coefficients for school characteristics in the employment outcome models, we present in detail the results obtained when school characteristics are not used as predictors of employment outcomes. (See Table 3.) As in the case of males, most coefficients in the simple probit model of high school graduation are significant and plausibly signed. Once again the problem behavior indicators that may be viewed as

indicative of externalizing behavior problems are significantly negative while the indicator of passive behavior is again insignificant. However, apart from the significant positive coefficient for family income, the influences of family background characteristics on graduation probability appear to be slightly weaker for females than for males. An unexpected gender difference is that the sign of the significant coefficient for the urban school dummy is positive, while it was negative for males. This may reflect differing urban vs. rural patterns in availability of low-skill employment for males vs. females; further exploration of this pattern is warranted.

Simple probit results for the employment regression also show some interesting differences with the findings for males. High school graduation is a positive and significant predictor of employment, but the same is true of grade point average, while females who repeated a grade are significantly less likely to have been employed. Most behavior problem variables are insignificant, but the negative coefficients for being frequently absent and for being disruptive in class are, respectively, significant and approaching significance. A joint likelihood ratio test on all the behavior problem variables yielded a p-value of 0.0656. A similar p-value (0.0598) is obtained when the passive behavior variable is excluded from this test. Family background characteristics are also not significant predictors of employment, with the only exceptions being the positive effect of living with both parents and the negative result for high-school educated caregivers (relative to the reference group with some post-high-school education).

Bivariate probit results for the high school graduation model (columns 5 and 6) closely parallel the simple probit results. Our two school characteristics covariates have statistically significant coefficients ($p<0.05$) with positive signs as expected. Educational achievement variables are also significant and have the expected signs. Study subjects with relatively higher GPAs in eighth grade are significantly more likely to graduate from high school. Similarly, those

who repeated a grade (prior to 8th grade) and those reported by teachers as performing below ability are significantly less likely to complete high school. Among the behavioral problem indicators, being frequently absent, being disruptive in class, self-report of regularly skipping class, and being sent to the office for misbehaving, are all significant ($p<0.05$) with expected negative coefficients. Being passive in class again is clearly insignificant. Living with both parents has a positive and significant coefficient ($p=0.029$). In addition, students with no caregiver who completed high school are less likely to graduate from high school relative to those with a caregiver with any education beyond high school ($p<0.01$). Subjects, whose caregiver had only a high school diploma also appear less likely to graduate from high school compared with study subjects whose caregivers had education beyond high school, though this difference was not significant. Family income was a significant and positive predictor of high school graduation ($p<0.01$) while the coefficient for having an employed caregiver was positive and marginally significant.

Bivariate probit employment results (in columns 7 and 8) show some differences from the simple probit results. We obtain a larger positive and significant coefficient for high school graduation ($p<0.05$), but other educational achievement variables are no longer significant. Among behavioral problem indicators, being sent to office for misbehaving is marginally significant ($p=0.062$) and is (unexpectedly) positive. All other behavioral problem indicators have the expected negative coefficients but all are statistically insignificant. A joint likelihood ratio test on inclusion of the behavior problem variables yielded a P-value of 0.1319 in the bivariate model. (A similar p-value (0.1299) is obtained when the passive behavior variable is excluded from this test.) Results for other covariates parallel the simple probit results.

The bivariate probit estimate of ρ is negative but not statistically significant. This is consistent with the greater stability (compared to males) of the high school graduation results in the simple and bivariate probit models for employment.

When both school characteristics were included in both outcome models, bivariate probit estimation yielded P-values of 0.721 and 0.178 for the urban school dummy and the attendance rate respectively in the employment outcome model. When the attendance rate was excluded from this model, the P-value for the urban school dummy coefficient was still clearly insignificant (P=0.673). (When the urban school dummy was excluded but the attendance rate included in the employment model, we obtained a P-value of 0.172 for the coefficient of the latter variable.) We the restriction that both school characteristics have no direct effect on the employment outcome could not be rejected (P-Value of 0.362). In all cases, the regression results for other explanatory variables were virtually unchanged from those reported in Table 3.

Estimated Marginal Effects of Behavior and Academic Indicators

To examine the magnitudes of the impacts of behavior problems and academic progress indicators on outcomes, we computed the sample mean values for changes in the probabilities of these outcomes predicted to result from changes in our behavior and academic indicators. For example, to compute the impact of having repeated a grade (by the time a student was in eighth grade) on the probability of high school graduation we used our estimated coefficients for high school graduation to predict graduation probabilities <u>for each respondent</u> 1) assuming they had not repeated a grade and 2) assuming they had repeated a grade. The difference in the sample means for these two probabilities was our measure of the <u>direct</u> influence of repeating a grade on the probability of high school graduation. (For both sets of predicted probabilities, other explanatory variables for each respondent were set at their actually observed values.) To

compute the total (direct plus indirect) influence of repeating a grade on the probability of employment, we computed for each respondent the change in the predicted probability of employment resulting from two changes in the predictors of employment: 1) a change from not having repeated a grade to having repeated a grade and 2) the change in the predicted probability of high-school graduation for that respondent resulting from repeating a grade. Combining these changes for each respondent with their actual values for all other predictors and with the coefficients from our bivariate probit employment regressions, we computed that change in employment probability for each respondent. The sample mean value of the latter change indicates the total influence on employment probability of having to repeat a grade.

We also computed the mean estimated indirect effect of each variable on employment. For each individual this effect for each variable was computed in two steps. We first used the estimated coefficient from the bivariate probit employment regression to compute the estimated direct effect on employment, holding the high school graduation variable constant at its observed level. We then computed the estimated indirect effect as the difference between the estimated total employment effect for that variable and the estimated direct effect.

The results of these calculations are in Table 4. Estimated employment impacts for each variable are generally small in magnitude (the maximum absolute value is 0.0617). The estimated high school graduation effects are somewhat larger but in several instances the signs of the coefficients in the high school graduation and employment bivariate probit regressions are opposite, tending to produce small total employment impacts. Also, a number of the estimates in Table 4 (in columns 3 through 6) are based on coefficient point estimates that are small and imprecise. It seems reasonable to expect that confidence intervals for these estimates (which

could be computed by complete bootstrapping of the entire estimation process) would be fairly wide.

Sensitivity Analysis Results

The stability of the results reported in Tables 2 and 3 above were tested by estimating a variety of alternative models. Three variants of the employment outcome specification were tested: one including both school characteristics as covariates, one including only the urban school dummy, and one excluding both (which was used for the regressions in Tables 2 and 3). We re-estimated our regressions with each of these three variants using two other modifications. In the first, we redefined our high school graduation outcome to include persons with a GED. This assumes that the high school graduate and GED groups can be treated as homogeneous while dropouts groups serve as the reference group. In the second, we excluded persons in our study samples who reported that they were full-time students in the year 2000. This relaxes the potentially important assumption that the impact of high school graduation on employment probability 8 years later is invariant to the factors that induce some persons to extend their full-time schooling to the 8-year follow-up time point. The foregoing implies a total of 9 different specifications for testing the stability of our results.

Tables 5 and 6 report the range of our employment outcome coefficient estimates (and the associated P-values) across all 9 models for the high school graduation dummy, the other educational achievement variables, and the behavior problem variables. For bivariate regressions, we also report the range of estimates and for the random disturbance correlation (rho). (Full results are available from the authors.)

For the behavior problem variables, our estimates and P-values tend to be very stable for both genders across all different specifications. While some coefficient magnitudes change, none

show substantial changes in significance or changes in sign (except for a few cases of very small coefficients with very high P-values).

Coefficient estimates for other variables are generally stable though slightly more variable across the specifications. In bivariate probit regressions, the high school graduation coefficient falls in size and significance when full-time students are excluded from the analysis; note, however, that these weaker results for high school graduation are obtained in models in where the estimated rho is also at its smallest magnitude and is clearly insignificant. This suggests that the coefficient estimates for these models are inefficient; by contrast, the corresponding simple probit results for these same employment outcome models show highly significant high school graduation coefficient estimates. Considering the other three educational achievement covariates, the most notable variation in results pertained to the grade point average variable. The negative coefficient of this variable for males fell substantially in magnitude and significance in both the simple and bivariate probit results when full-time students were excluded from the analysis. For females, excluding full-time students resulted in larger positive and more significant coefficient for this variable.

In summary, our sensitivity analyses do not indicate substantial variability in our main findings across the 9 different specifications that we tested. This is consistent with several facts about our study sample. First, the fraction of GED holders is relatively small, 3.9 percent for males and 3.8 percent for females. Second, the employment rate among full-time students in the year 2000 is relatively high (77.19 per cent) and the number of full-time students is small (14.77 per cent).

One additional sensitivity analysis was carried out using the specifications reported in Tables 2 and 3 but defining the employment outcome as = 1only for persons who were employed

full-time. Results for the employment probits (available from the authors) were fairly robust to this change in specification. For males, the estimated coefficient for repeating a grade became positive in both simple and bivariate employment probits, and significant in the latter. For females, in the bivariate employment results, the coefficient for grade point average became significant. None of the qualitative results for the behavior problem variables was substantially altered; the most notable change was a decline in size and significance of the bivariate coefficient for females for being sent to the office for misbehaving.

4. DISCUSSION

Results from the probit regressions (Tables 2 and 3) indicate generally significant or nearly significant effects of behavior problems in early adolescence on the probability of high school graduation, but much less significant effects of these problems, conditional on high school graduation, on the probability of employment approximately 8 years later. This general conclusion holds for both males and females, but an exception is the significant negative direct effect of classroom passivity on future employment for males. This result accords with recent developmental models (Rubin, Burgess, Kennedy, 2003) that indicate social withdrawal among school age children is associated with establishment of negative peer reputations, peer rejection, and unpopularity. Social withdrawal could consequently be associated with multiple interpersonal and emotional difficulties in interpersonal that limit employment in adulthood.

The significant results for behavior problems in the high school graduation regressions, combined with insignificant results in the employment regression, supports the educational screening/signaling hypothesis that employers make judgments about prospective employees' productivity from readily observable indicators such as high school graduation or years of

completed schooling (Riley, 1979; Weiss, 1995). This pattern of results may also have implications for strategy in evaluating interventions directed at preventing or ameliorating behavior problems. While long-term economic benefits of these programs on post-educational labor market outcomes may be important, much of their impact on post-high school labor market outcomes can be captured by the projected long term effects of high school graduation on labor market outcomes. We illustrate this point quantitatively by using the results in Tables 2 and 3 to compute the combined total and indirect impacts of our five dichotomous indicators of behavior problems on future employment probability (in Table 4). The indirect impact estimates correspond to estimates based on the proximal outcome (high school graduation) while the total estimates incorporate both proximal and distal impacts. For males, the indirect and total employment impact estimates of all behavior problems combined were respectively -0.067 and -0.106. The corresponding estimates for all externalizing behavior problems combined (i.e., excluding the passive behavior dummy) were -0.046 and -0.031. Analogous figures for females for all behavior problems combined were -0.091 and -0.133, and for all externalizing problems combined were -0.090 and -0.108. As noted above, these impact estimates are based on point estimates for some coefficients that are not precisely estimated, especially the coefficients of behavior problems in the employment regressions.

We also find some evidence that unobservable factors have opposite effects on our two outcomes, implying endogeneity of high-school graduation in the employment regressions. This is most clearly true for males, but a similar result emerges for females in regressions when insignificant behavioral and academic predictors are deleted from the bivariate probit employment models (results available on request from the authors). This influence of

unobservables may be related to post-high-school continuation of schooling for some respondents.

The stronger evidence for males of unobservables that jointly affect graduation and employment could be related to gender differences in the returns to schooling for occupations that tend to attract males versus females. Studies report that males who drop out of high school have higher skills in the kinds of jobs that do not require a high school diploma (Eckstein, Wolpin, 1999). For male dropouts, an extra year of schooling could have a higher opportunity cost of potential earnings in well paid blue-collar jobs, at least during early adulthood. Lower expected returns to a high school diploma may encourage male low-ability students to discontinue their education and accept employment at an earlier age.

Several limitations of our research should also be noted. The NELS measures of behavior problems are relatively crude compared to behavior measures based on the more extensive questions found in widely used psychological instruments such as the BPI (Jones et al., 1999). The limitations of the NELS measures may have contributed to the insignificant results in the employment regressions; conversely the significance of these NELS measures in the high school graduation regressions may be enhanced because they measure behavior problems specifically in the school and classroom context.

Another limitation is the fact that our labor market outcome measure is obtained in early adulthood. It would be desirable to replicate our analysis with more precise labor market measures (e.g., earnings) at later ages, after more respondents had completed post-high-school schooling and had established a clearer work history and earnings trajectory. Measures of wages or earnings may show more variation in later years because of differential returns to experience in high-skill vs. low-skill jobs. Also, at later ages employers have more opportunity to make

inferences about employees' cognitive and non-cognitive skills from direct observations on employee productivity. It is interesting to note that a recent study using British data (Fronstin, Greenberg, Robins, 2005) did report at least mixed evidence that behavior problems for males, observed at age 16, may impact labor market outcomes observed at age 33. Results for females, however, were somewhat weaker. (For both genders, behavior problem effects on wages were somewhat stronger than effects on labor-force status and employment.)

5. CONCLUSIONS

We estimated the effects of behavioral problems during early adolescence on employment during early adulthood. We used FIML to estimate a recursive bivariate probit model to control for direct effects of behavioral problems on employment as well as the indirect effects through endogenous high school graduation. Our main finding is that middle-school behavior problems were strongly and negatively related to the probability of having a high school diploma 6 years later, but not to the probability of employment, conditional on high school graduation, 12 years later. Results were consistent across both genders; they indicate that effects of behavior problems on high school graduation can account for a substantial portion of the more distal economic impacts on employment status in young adulthood. The practical implication is that more timely evaluations of early prevention programs, based on shorter follow-up periods, can provide useful assessments. Timeliness is a virtue in this context for reasons of cost and for enabling more rapid dissemination of effective programs.

The limitations of our data and measures, however, imply that these results are tentative. Further analyses of long-term follow-up data, including analyses linked directly to preventive interventions in young childhood or early adolescence, are needed.

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Table 1. Variable Definitions, Sources, and Descriptive Statistics					
		Males (n=3,927)		Females (n=4,478)	
Definition	Source	Mean	Std. Dev.	Mean	Std. Dev.
Outcomes					
High-school graduate	Self-report (1994)	0.891	0.311	0.892	0.310
Employed*	Self-report (2000)	0.921	0.270	0.827	0.378
School Characteristics					
Urban School	NELS geo-coding	0.265	0.441	0.252	0.434
Daily attendance rate	School-report	94.14	3.605	94.01	3.836
Educational Performance					
Standardized GPA**	Self-report	-0.036	1.001	0.112	0.967
Repeated a grade	Self-report	0.177	0.381	0.114	0.317
Performing below ability	Teacher-report	0.249	0.432	0.178	0.382
Behavioral Problems					
Frequently absent	Teacher-report	0.070	0.254	0.091	0.288
Passive in class	Teacher-report	0.068	0.251	0.070	0.255
Disruptive in class	Teacher-report	0.148	0.356	0.061	0.238
Skip class	Self-report	0.085	0.279	0.060	0.237
Sent to office for misbehav.	Self-report	0.373	0.484	0.166	0.372
Other Covariates					
White	Self	0.715	0.451	0.704	0.457
Living with both parents	Self	0.732	0.443	0.699	0.459
Caregiver employed	Self	0.900	0.300	0.905	0.293
Caregiver < high school***	Parent/Self-Report	0.116	0.320	0.101	0.302
Caregiver has h.s. educ.***	Parent/Self-Report	0.187	0.390	0.199	0.399
Family income	Parent report	$43,102	$35,971	$40,453	$35,616
Northeast Region	NELS geo-coding	0.188	0.391	0.176	0.381
North Central Region	NELS geo-coding	0.296	0.456	0.299	0.458
South Region	NELS geo-coding	0.339	0.473	0.351	0.477

*Defined as a survey response indicating currently working for pay (either full-time or part-time).

**Standardized to a zero mean distribution for all available respondents with s.d.=1.0.

*** Defined for adult with highest level of educational attainment. Omitted category is any education beyond high school.

NOTE All variables are 0-1 dummies except for daily attendance rate, standardized GPA, and family income.

Table 2. Probit analyses of employment outcome for males (n=3,927)								
	Simple Probit				Bivariate Probit			
	High-school grad.		Employment		High-school grad.		Employment	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
School Characteristics								
Urban School	-0.198	0.008	---	---	-0.202	0.006	---	---
Daily attendance rate	0.017	0.039	---	---	0.018	0.023	---	---
Educational Achievement								
High-school graduation	---	---	0.321	0.002	---	---	1.041	<0.001
Grade Point Average	0.258	<0.001	-0.211	<0.001	0.262	<0.001	-0.230	<0.001
Repeated a grade	-0.628	<0.001	-0.112	0.190	-0.618	<0.001	-0.014	0.879
Performing below ability	-0.297	<0.001	-0.052	0.527	-0.292	<0.001	-0.019	0.814
Behavioral Problems								
Frequently absent	-0.710	<0.001	-0.076	0.526	-0.711	<0.001	0.064	0.619
Passive in class	-0.042	0.712	-0.338	0.002	-0.053	0.634	-0.342	0.002
Disruptive in class	-0.159	0.047	-0.032	0.725	-0.146	0.069	-0.012	0.890
Skip class	-0.182	0.064	0.040	0.720	-0.191	0.050	0.075	0.498
Sent to office for misbehav.	-0.418	<0.001	-0.049	0.476	-0.424	<0.001	-0.018	0.787
*Other Covariates**								
White	-0.153	0.039	0.256	<0.001	-0.164	0.026	0.261	<0.001
Living with both parents	0.195	0.004	0.178	0.010	0.198	0.003	0.157	0.022
Caregiver employed	0.211	0.024	-0.074	0.481	0.209	0.024	-0.105	0.314
Caregiver < high school	-0.488	<0.001	-0.061	0.598	-0.479	<0.001	0.030	0.802
Caregiver with high school	-0.168	0.034	0.040	0.636	-0.155	0.049	0.050	0.551
Family income (in $10,000's)	0.061	<0.001	-0.037	<0.001	0.063	<0.001	-0.039	<0.001
Rho							-0.389	0.013

* Three Census region dummies are also included in all regressions.

Table 3. Probit analyses of employment outcome for females (n=4,478)								
	Simple Probit				Bivariate Probit			
	High-school grad.		Employment		High-school grad.		Employment	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
School Characteristics								
Urban School	0.148	0.044	---	---	0.156	0.034	---	---
Daily attendance rate	0.015	0.028	---	---	0.015	0.035	---	---
Educational Achievement								
High-school graduation	---	---	0.512	<0.001	---	---	0.932	0.001
Grade Point Average	0.289	<0.001	0.056	0.041	0.291	<0.001	0.038	0.194
Repeated a grade	-0.675	<0.001	-0.185	0.008	-0.670	<0.001	-0.108	0.203
Performing below ability	-0.175	0.020	-0.004	0.954	-0.173	0.021	0.015	0.826
Behavioral Problems								
Frequently absent	-0.575	<0.001	-0.172	0.027	-0.570	<0.001	-0.104	0.238
Passive in class	0.050	0.629	-0.084	0.335	0.038	0.710	-0.088	0.311
Disruptive in class	-0.232	0.024	-0.154	0.103	-0.234	0.023	-0.128	0.179
Skip class	-0.273	0.008	0.008	0.934	-0.270	0.009	0.032	0.737
Sent to office for misbehav.	-0.324	<0.001	0.097	0.144	-0.328	<0.001	0.127	0.062
*Other Covariates**								
White	-0.041	0.549	0.024	0.646	-0.043	0.529	0.024	0.635
Living with both parents	0.130	0.038	0.121	0.016	0.137	0.029	0.112	0.026
Caregiver employed	0.152	0.082	0.044	0.565	0.146	0.096	0.027	0.726
Caregiver < high school	-0.322	0.001	<0.001	0.778	-0.312	<0.001	0.061	0.463
Caregiver with high school	-0.057	0.434	-0.154	0.007	-0.055	0.446	-0.153	0.008
Family income (in $10,000's)	0.090	<0.001	-0.001	0.259	0.093	<0.001	-0.001	0.167
Rho							-0.23	0.142

* Three Census region dummies are also included in all regressions.

Table 4: Estimated Bivariate Probit Marginal Effects of Behavior and Educational Achjevement Indicators

	High-school Grad. Effect		Total Employment Effect*		Indirect Employment Effect****	
	Males	Females	Males	Females	Males	Females
Educational Achievement						
Relative Grade Point Average**	-0.0184	-0.0204	0.0133	-0.0100	.0038521	.0062887
Repeated a grade	-0.0990	-0.1178	-0.0169	-0.0605	-.0212223	-.036744
Performing below ability	-0.0410	-0.0249	-0.0028	-0.0028	-.0086644	-.0076529
All Indicators Combined	-0.1894	-0.1942	-0.0161	-.08340	-.0416306	-.0603194
Behavioral Problems						
Frequently absent	-0.1248	-0.0973	-0.0094	-0.0541	-.026232	-.0304273
Passive in class	-0.0071	0.0051	-0.0617	-0.0213	-.0017031	.0016144
Disruptive in class	-0.0201	-0.0350	-0.0048	-0.0434	-.0042297	-.0110596
Skip class	-0.0271	-0.0410	+0.0068	-0.0026	-.0055271	-.0125386
Sent to office for misbehav.	-0.0580	-0.0495	-0.0111	+0.0180	-.0121962	-.0150352
All Indicators Combined	-0.3181	-0.3027	-0.1055	-0.1330	-.0771504	-.0960643
All Externalizing Indicators***	-0.3022	-0.3142	-0.0308	-0.1084	-.0639155	-.0980264

* - Marginal effects are direct effects on employment probabilities plus indirect effects working through direct effects on high-school graduation.

** - Effects shown are for a decline in relative GPA from one standard deviation above the mean score to one standard deviation below the mean score.

*** - Excludes being passive in class

Table 5: Sensitivity Results Range for Employment - Males

	Largest Coeff. *	P	Model/Sample	Smallest Coeff *	P	Model/Sample
Simple Probit						
Educational Achievement						
High-school graduation	0.473	<0.001	NEITH/GED	0.311	0.003	URB/ALL
Grade Point Average	-0.219	<0.001	URB/GED	-0.061	0.187	URB/EXCST
Repeated a grade	-0.171	0.077	BOTH/EXCST	-0.103	0.232	NEITH/GED
Performing below ability	-0.061	0.462	BOTH/GED	-0.025	0.794	NEITH/EXCST
Behavioral Problems						
Frequently absent	-0.082	0.496	BOTH/GED	-0.014	0.918	URB/EXCST
Passive in class	-0.366	0.004	URB/EXCST	-0.337	0.002	URB/ALL
Disruptive in class	-0.035	0.698	BOTH/ALL	0.010	0.926	URB/EXCST
Skip class	0.109	0.427	BOTH/EXCST	0.040	0.725	NEITH/GED
Sent to office for misbehav.	-0.129	0.122	BOTH/EXCST	-0.048	0.479	NEITH/GED
Bivariate Probit						
Educational Achievement						
High-school graduation	1.284	<0.001	NEITH/GED	0.593	0.160	BOTH/EXCST
Grade Point Average	-0.237	<0.001	URB/GED	-0.073	0.132	URB/EXCST
Repeated a grade	-0.129	0.255	BOTH/EXCST	-0.014	0.879	NEITH/ALL
Performing below ability	-0.045	0.583	BOTH/GED	-0.005	0.956	NEITH/EXCST
Behavioral Problems						
Frequently absent	0.064	0.619	NEITH/ALL	0.019	0.877	BOTH/GED
Passive in class	-0.373	0.003	NEITH/EXCST	-0.341	0.002	URB/ALL
Disruptive in class	0.024	0.825	NONE/EXCST	-0.012	0.890	NONE/ALL
Skip class	0.126	0.363	BOTH/EXCST	0.062	0.580	NEITH/GED
Sent to office for misbehav.	-0.112	0.199	BOTH/EXCST	-0.018	0.787	NEITH/ALL
rho	-0.432	0.011	NEITH/GED	-0.156	0.520	BOTH/EXCST
Models: **BOTH** - incl. Urban School and Daily Attendance rate: **URB** - incl. only Urban School; **NEITH** - incl. neither						
Samples: **ALL**- All obs., High-school grad. excludes GED; **GED**- All obs., High-school grad. includes GED; **EXCST** - Excludes full-time students, High-school grad. excludes GED.						
* - Based on absolute value.						

Table 6: Sensitivity Results Range for Employment - Females						
	Largest Coeff.*	P	Model/Sample	Smallest Coeff.*	P	Model/Sample
Simple Probit						
Educational Achievement						
High-school graduation	0.526	<0.001	BOTH/GED	0.503	<0.001	URB/EXCST
Grade Point Average	0.111	<0.001	NONE/EXCST	0.056	0.042	URB/ALL
Repeated a grade	-0.216	0.002	URB/GED	-0.184	0.009	BOTH/ALL
Performing below ability	0.014	0.846	URB/EXCST	0.000	0.995	BOTH/GED
Behavioral Problems						
Frequently absent	-0.217	0.005	BOTH/GED	-0.115	0.168	NONE/EXCST
Passive in class	-0.085	0.328	BOTH/ALL	-0.071	0.419	NONE/GED
Disruptive in class	-0.160	0.090	URB/GED	-0.138	0.171	NONE/EXCST
Skip class	0.066	0.521	URB/EXCST	-0.002	0.987	NONE/GED
Sent to office for misbehav.	0.097	0.141	URB/ALL	0.045	0.516	NONE/EXCST
Bivariate Probit						
Educational Achievement						
High-school graduation	0.955	<0.001	BOTH/ALL	0.546	0.149	URB/EXCST
Grade Point Average	0.109	0.002	URB/EXCST	0.038	0.194	NONE/ALL
Repeated a grade	-0.182	0.021	URB/GED	-0.103	0.222	BOTH/ALL
Performing below ability	0.018	0.793	BOTH/ALL	0.009	0.891	NONE/GED
Behavioral Problems						
Frequently absent	-0.192	0.018	BOTH/GED	-0.104	0.238	NONE/ALL
Passive in class	-0.090	0.303	BOTH/ALL	-0.066	0.450	NONE/GED
Disruptive in class	-0.147	0.124	URB/GED	-0.125	0.189	BOTH/ALL
Skip class	0.072	0.495	NONE/EXCST	0.006	0.954	BOTH/GED
Sent to office for misbehav.	0.127	0.062	URB/ALL	0.050	0.513	URB/EXCST
rho	-0.235	0.142	NONE/ALL	-0.024	0.908	URB/EXCST
Models: **BOTH** - incl. Urban School and Daily Attendance rate: **URB** - incl. only Urban School; **NEITH** - incl. neither						
Samples: **ALL**- All obs., High-school grad. excludes GED; **GED**- All obs., High-school grad. includes GED; **EXCST** - Excludes full-time students, High-school grad. excludes GED.						
* - Based on absolute value.						