Troubled in School: Does Maternal Involvement Matter for Adolescents?

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Abstract

We estimate the causal effect of mother's involvement on the amount of trouble an adolescent experiences in school. We use multiple measures of school trouble and factor analysis to construct a composite and then link this composite with noncognitive skills. Our measure of mother's involvement encompasses discussing school-related matters and providing help with school projects. Using an instrumental variable constructed from a suitably chosen peer group, our main finding is that an increase in maternal involvement leads to a significant decrease in school trouble. We find this result to be robust across a large number of sensitivity tests designed to account for possible selection effects, shocks at the peer group level, and further potential violations of the exclusion restriction. Additionally, we present evidence suggesting that the effect of maternal involvement may operate through its effect on adolescents' college aspirations, mental health, and the perception of parental warmth.

Keywords: noncognitive skills, maternal involvement
JEL Codes: C26, I31, J13, J31

1 Introduction

We study the causal effect of maternal involvement on a scale of adolescent trouble in school. Despite policy efforts in the U.S. to increase parental involvement, there is limited empirical evidence about its causal effects (Avvisati et al. 2010). In the fields of education and developmental psychology, there is an important and large literature studying the association between parental involvement and children's academic achievement. These studies, however, have generally not been able to address endogeneity and their results are not necessarily causal (e.g., Jeynes 2007; Boonk et al. 2018). In economics, there is a recent focus on the effect of parental investments during early childhood on skill development and inequality (Heckman and Mosso 2014). This work generally finds that early-life investments are important but much less is known about the efficacy of investments during adolescence. The main contribution of our paper is to provide new causal evidence for the effect of maternal involvement on adolescent trouble in school, which we interpret as a dimension of noncognitive skill.

Examples of noncognitive skills emphasized in the literature are perseverance, impulse control, trust, empathy, goal setting, and team-work (Heckman and Kautz 2014). These skills yield returns in the labor market that have been rising in the recent past and are associated with future life success across numerous dimensions (Heckman and Kautz 2012; Deming 2017). Moreover, the limited evidence currently available implies that these skills may remain the most malleable into adolescence, suggesting it is important to capture them as a measure of adolescent development (Heckman and Mosso 2014; Hoeschler et al. 2018).

We motivate our dependent variable based on capturing a degree of these noncognitive skills. We construct it from a factor analysis with multiple observed measures of adolescent school trouble, using data from the National Longitudinal Study of Adolescent to Adult Health (Add Health).[1] In our

1. The Add Health study was designed by J. Richard Udry, Peter S. Bearman and

analysis, we consider low levels of trouble in school equivalent to high levels of (a form of) noncognitive skills, and vice versa. We use follow-up waves of the survey and explore the association between school trouble and subsequent education and wage outcomes. Our results are very similar to the associations between noncognitive skills and education and wages found elsewhere in the literature and suggest that trouble in school can have long-term consequences.

We focus on maternal involvement for several reasons. First, previous studies have highlighted the importance of maternal investments during early childhood and the link between maternal education and child development (Heckman and Mosso 2014; Carneiro et al. 2013). Second, we use data from the Add Health parental survey, which focused primarily on mothers because they were expected to be the most involved in their children's day-to-day lives. Third, survey data was missing for fathers much more often than for mothers. In our robustness checks, we do test against potential bias from involvement by fathers and find a high degree of robustness.

To address endogeneity in the relation between maternal involvement and school-trouble, we propose an approach akin to that in Fruehwirth et al. (2019). They use variation within schools across an appropriately defined peer reference group to identify the effect of religiosity on mental health. In our study, we draw on evidence that parenting advice from social circles and families tends to be weighted more heavily than advice from experts (Kalil 2015). We expect that mothers are more likely to respond to a peer group of mothers who have similar education levels and children with the same exogenous characteristics (race, gender, school, and grade). This motivates

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our use of peer maternal involvement as an instrumental variable.

Our baseline estimates show that an increase in maternal involvement leads to a significant reduction in the adolescent's school trouble. This effect is obscured by a standard OLS regression, which yields a small effect estimate but one that may be biased toward zero by maternal responses to poor behavior (e.g., McNeal 2012).[2] Our evidence implies that continued maternal involvement beyond early childhood is important for skill development during adolescence. We conduct a large number of sensitivity analyses—aimed at detecting possible violations of the exclusion restriction—and find that our baseline estimates remain robust.

We also explore several mechanisms that may explain the influence of maternal involvement during adolescence. First, maternal involvement may change the adolescent's aspirations for future education. This is consistent with the theory that involvement is an effort to shift a child's choice set towards a more forward looking perspective (Doepke et al. 2019). Second, we examine whether involvement might affect the adolescent's mental health. Third, parenting style, and children's perceptions thereof, have been identified as an important factor determining child outcomes (Jeynes 2007; Doepke et al. 2019). We consider the effect of maternal involvement on the adolescent's perceptions of warmth, control and autonomy, which are three salient dimensions of parenting style (Steinberg et al. 1992; Marchant et al. 2001). Our evidence suggests that involvement is linked to mechanisms within the home that shift adolescent aspirations and, to a lesser extent, mental health and perceptions of warmth in the relationship with parents.

The remainder of this paper is organized as follows. In Section 2 we briefly review some of the relevant literature on parental involvement. This topic has been extensively studied in sociology, education and developmental psychology, but for conciseness we restrict our review to the literature in

2. Becker and Tomes (1976) present theoretical predictions in line with either enhancement or response. We discuss these implications further in section 4.

economics. Section 3 discusses the data and construction of the school trouble variable and mother's involvement. We outline our empirical strategy in Section 4 and present results in Section 5. Finally, Section 6 concludes.

2 Related Literature

Family background is known to be related to a wide range of outcomes (Björklund and Salvanes 2011). Only recently has attention in the economics literature turned toward how parents and their actions matter for children and adolescents (Heckman and Mosso 2014). Reasons for this include the difficulty of dealing with endogeneity—because of unobserved parent and family characteristics or simultaneity between parental action and children's behavior—and a lack of adequate data. A standard finding in the literature is that much of the correlation between parental action and child outcomes disappears once family background is controlled for (Avvisati et al. 2010). Moreover, Avvisati et al. (2010) find that programs in the U.S. targeted at increasing parental involvement often have negligible returns. Many of these studies, however, were based on small samples or were unable to address endogeneity concerns.

In contrast, studies on the development of cognitive and noncognitive skills generally find parental investments are critically important for skill production early in life. A number of studies have explored this dynamically for pre-adolescent children and found that parental investments matter at very early ages for cognitive skills and remain effective for noncognitive skills at later ages (Cunha and Heckman 2008; Cunha et al. 2010; Todd and Wolpin 2007).[3] Other work has concluded that interventions at early stages of life (often pre-kindergarten) can be effective in reducing noncognitive skill deficiencies among disadvantaged populations (Heckman and Mosso 2014), that after school supervision is related to improving antisocial behaviors but not test scores (Aizer 2004; Welsch and Zimmer 2008), and that parental

3. The age range for these estimates is around 6 to 13.

reading investments with very young children improve child reading ability (Kalb and Ours 2014; Price 2010).

Some experimental evidence also points toward the importance of parental investments for younger children. Avvisati et al. (2014) analyze a field experiment with sixth graders in disadvantaged Parisian schools. The intervention aimed to promote parental involvement both in school and at home. Parents in the treatment group responded with greater school- and home-based involvement. Further, their children experienced significant treatment effects, especially in terms of reducing truancy and the number of disciplinary infractions.

Elsewhere, Attanasio et al. (2015) study an intervention in Colombia targeted at disadvantaged 12- to 24-month-old children. Weekly home visits provided in-home training aimed at improving mother-child interactions and the quality of maternal involvement. They show that improvements in cognitive skills mainly resulted from material investments by mothers, while improvements in noncognitive skills were more related to time investments by mothers. Furthermore, and related to our findings, they find that failure to correct for endogeneity in maternal investments leads to a substantial underestimation of its impact. Our study relates to this body of literature but turns the focus to adolescence and to addressing the endogeneity of maternal investments.

Our study also relates to recent theoretical work that links the role of parental investments in the early life of a child with a broad set of parenting strategies and the child's later choice of effort and eventual human capital attainment (Doepke et al. 2019). This literature incorporates the typology of parenting *style* from developmental psychology—where parents are classified as permissive, authoritative or authoritarian—into an economic model and examines how style responds to varying economic conditions.

One particular implication is that parental investments in the form of effort and involvement can support better long-term outcomes by teaching the child noncognitive skills, such as patience, and allow them greater freedom to match their abilities to choices in the future (Doepke et al. 2019). However, much of the focus in both theory and empirical analysis has been on involvement during early life. Less is known about how involvement may matter for skill development during adolescence.

Finally, our work relates to recent literature examining the role of parental beliefs in changing parenting style or the level of parental investments. This literature has found that parents' subjective beliefs about the child's skill production function may be distorted and sensitive to the environment outside of the home. This can lead to lower investments among those lacking information and resources (Attanasio et al. 2019; Attanasio 2015; Cunha 2015; Kiessling 2019; Han 2017). Our results show that maternal investments can have a substantial influence on adolescent skill development. Beliefs that change parental investments may therefore remain important throughout adolescence.

3 Data and Variables

3.1 Data Description

For this study we use the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health began in 1994 as a nationally representative sample of adolescents in the U.S. The study was split between an in-school survey and an in-home survey. The in-home survey is a subset of 20,745 adolescent students out of the 90,000 in-school participants. The in-home group has been followed through four waves, with the wave IV sample aged 26-32.

At wave I for the in-home sample, Add Health also conducted a parent survey. The mother was the targeted respondent. If the biological mother was not in the home, then the next mother figure was requested before the father. The expectation was that mothers would be more involved with the children's school and other activities and be able to provide more detail. We draw on this survey for several important measures on mothers.

The in-home sample provides rich information about the participants' home, social, and school life during the adolescent years. It also provides detailed information on young adult life outcomes. Key for our identification strategy is that, in wave I, we observe reference groups of "peer mothers." These are mothers who are similar along several dimensions and who have children with shared characteristics. For the analysis of mother's involvement and school trouble, we take advantage of random variation across groups of peer mothers to identify the effect of interest.

3.2 School Trouble and Skills

We conduct a factor analysis on observed school-trouble measures, with a single latent variable (factor) to capture the underlying skills these trouble measures proxy. Our observed measures of latent skills are all self-reported and consist of grade point average, the number of unauthorized missed school days, reports on a zero to four scale of trouble with teachers, trouble with other students, and trouble getting homework done, a measure for the frequency one gets into fights, and an indicator for being suspended at any point during the school year.[4][5] We take the negative of grade point average so that higher values imply greater trouble to be consistent with the rest of our measures.

To create a single measure of skill, we estimate a basic latent factor structural equations model and predict the latent skill factor for each adolescent in the sample. For most observed measures, we use a linear measurement

4. We drop students who missed more than 30 days of school. This reduces the sample by 236 observations.

5. Kautz and Zanoni (2014) have some overlapping measures with us in their analysis of the Chicago One Goal Program. They argue such measures are more likely observable for a school than personality measures.

equation

$$M_j = \alpha_j \theta + \epsilon_j, \quad j = 1, \dots k - 1, \tag{3.1}$$

where M_j is the j-th indicator, α_j is the factor loading, θ is the latent skill factor, and ϵ_j is measurement error. Following standard practice, we set the scale of θ by constraining the factor loading for one of the observed measures to 1. For school suspension we use a probit measurement equation

$$M_k = \Phi(\alpha_k \theta) + \epsilon_k, \tag{3.2}$$

where $\Phi(\cdot)$ is the CDF of the standard normal distribution. We estimate the measurement system in (3.1) and (3.2) using the `gsem` command in Stata. We also drop missing observations in our measures to ensure that the measurement equations are estimated on the same sample. Summary statistics for the measures are available in the appendix, Table A.1. The estimated factor loadings are given in column 1 of Table A.2 in the appendix. Each measurement is strongly related to the latent skill variable θ. We standardized the scale to a mean of zero and a standard deviation of one. For ease of exposition, we often refer to the latent skill variable as the school-trouble scale.

To test against significant heterogeneity in the loadings, we also report them split across gender and grade-levels. Columns 2-3 in Table A.2 illustrate that the measures load onto our scale evenly across gender. Columns 4-9 illustrate the same by grade-level. The only exception is that days of skipping school loads more heavily at later grade-levels, otherwise the loadings are consistent. We think this is sensible because skipping school may be easier when one is older. However, in all specifications to come we will control for the grade-level effect in a non-linear manner.

Finally, we explore the relation between our composite school-trouble scale and two future outcomes observed in wave IV: completed education level and wages. We report our results in the supplemental appendix, Section B.1.

In terms of both completed education and wages, our school-trouble scale follows closely to the patterns reported by Heckman (2008) and Heckman et al. (2014) for noncognitive skills.[6] Likewise, the picture vocabulary test score closely matches the patterns found for cognitive skills. These results suggest that we have a reasonable proxy for noncognitive skills and that there are returns to these skills in the long run.

3.3 Mother's Involvement

The Add Health survey contains a number measures for maternal involvement. Our set of interest involves responses to a series of questions about whether the adolescent has done a particular activity with their mother in the last four weeks.[7] The full list is reported in the appendix, Table A.3.

We construct three scales from the available involvement questions. We primarily focus on a subset of binary variables related to mother's involvement in school-related matters. These are: (1) talking about school work or grades, (2) working together on a school project, and (3) talking about other things you are doing in school. Our hypothesis is that these are most directly related to school-trouble. Our primary measure of mother's involvement is the standardized sum of the 3 variables discussed above. Figure A.1 displays the distribution of the scale prior to normalization and indicates a substantial amount of variation in mother's involvement. For comparison, we construct two additional scales both of which are normalized sums of binary responses. The first is based on a total of all ten involvement questions, including both school-related activities and other activities. The second additional scale is constructed based only on the non-schooling-related questions.

Additionally, we explore the data with a principle components analysis (PCA).[8] We report these results in the appendix, Table A.4. There are three

6. These studies use different data from ours and identify separately the distribution of noncognitive skills and cognitive skills.

7. Answers are no, yes (0,1).

8. Because of the binary nature of the involvement variables, we use the polychoric

components with an eigenvalue above 3, so three components explain more variance than a single measure. This is the common cutoff rule for considering a component. After rotating the loadings to obtain orthogonal components, we find that component 1, which has the largest eigenvalue and explains the largest amount of shared variance, almost entirely loads on the three schooling-related involvement variables. This supports our intuition that the schooling-related variables are related and reasonable to focus upon.

We also repeat this analysis using an exploratory factor analysis on the mother involvement measures.[9] We report this result in the last column of Table A.4 in the appendix. Only one factor achieves an eigenvalue greater than 1, thus we only examine this first factor. The largest factor scores are again on the schooling-related measures. We do see some additional measures with relatively decent sized loadings; however, none of these are as strong as the schooling-related measures.[10] Thus, the data again points towards a clustering around the schooling-related variables, suggesting they explain a fair amount of shared variance.

3.4 Sample Selection and Controls

We control for observable maternal characteristics, household characteristics, and adolescent individual characteristics drawn from the in-home wave I and the wave I parent survey. These include mother's education level indicators, mother's age, household income, the number of siblings in the home, an indicator for single parent homes, whether the adolescent is female, race and ethnicity, school-grade indicators, and school fixed effects.

correlation matrix from the involvement variables for the PCA.

9. In general, PCA is considered appropriate for reducing a set of measures into a scale without positing underlying latent variables; however, we check the factor analysis for completeness. Again, we use the polychoric correlation matrix of the measures in the analysis.

10. Examining the two additional components in Table A.4, it appears component 2 may load on outside the home activities and component 3 on communication unrelated to schooling. In the supplementary appendix, Table B.6, we return to the PCA and Factor scores and check our results against using scales generated by them.

To construct our dependent variable, we dropped individuals who were not in school during wave I (395), who were older than 19 (85), who have missing values for any of the school-trouble scale measures (412), or who are extreme outliers in the number of skipped school days (236). The full sample, after constructing the dependent variable, consists of 19,617 observations. For our final selected sample, we drop observations with missing values for mother's involvement or peer mothers' involvement.[11] We also drop observations whose respondent to the parental survey is listed as male or as not the biological mother, when the biological mother, in fact, lives in the home. We do this because maternal education is taken from responses to the parental survey. This accounts for only a small percentage of observations that are dropped (384 total).[12] Our final selected sample consists of 12,316 observations.[13]

In the appendix, Section A.2, we report summary statistics for the sample used to construct school-trouble and for the final selected sample. Table A.5 shows that the mean differences are in some cases statistically significant; however, in all cases the magnitudes of these differences are very small, indicating that the full sample and the selected sample are very similar.

4 Empirical Strategy

We use a standard linear regression model to estimate the causal effect of mother's involvement on school-trouble:

$$Y_{is} = X_{is}'\beta + I_{is}\gamma + \alpha_s + \varepsilon_{is}. \tag{4.1}$$

11. When one of the control variables is missing, we impute a value (the mean for a continuous variable and zero for a discrete variable) and add a missing indicator.

12. The specific numbers of observations dropped at each stage of the sample selection process are given in Table A.5 in the appendix.

13. Our sample selection is not unlike other studies who have used Add Health for similar analysis with the in-home data. For example, see Fruehwirth et al. (2019) who use Add Health and a similar identification strategy to ours to explore the effect of religiosity on mental health and have a very similar selected sample size.

Y_{is} the measure of school trouble for individual i in school s; X_{is} is the vector of covariates; I_{is} is our measure of mother's involvement; α_s is a school fixed effect and ε_{is} represents unobserved heterogeneity. An obvious concern is that I_{is} may be endogenous due to reverse causality between Y_{is} and I_{is}.

Becker and Tomes (1976) suggest that parents' involvement with their children may follow either an "enhancement model" or a "response model." In the enhancement model parents become more involved when their children do better and experience less school trouble, resulting in a negative correlation between I_{is} and ε_{is}. Assuming for the moment that γ in equation (4.1) is negative, the OLS estimator $\hat{\gamma}$ will then be biased away from zero and will overestimate the magnitude of the effect of involvement.

Alternatively, in the response model parents increase their involvement in response to school trouble.[14] Consequently, I_{is} and ε_{is} will be positively correlated. In this case—assuming again that γ is negative—the OLS estimator $\hat{\gamma}$ will be biased towards zero and will underestimate the magnitude of the involvement effect.

To estimate the effect of mother's involvement on school-trouble, we use an instrumental variables (IV) estimator. We follow an identification strategy similar to the one proposed by Fruehwirth et al. (2019), who use peer religiosity as an instrument to estimate the effect of religiosity on mental health. In this paper, we use as an instrument the average of maternal involvement, excluding the individual, in a suitably chosen peer group.[15]

For a given mother, say A, the peer reference group is defined as the group of mothers with the same level of education as A, and whose children are in the same school, in the same grade, and are of the same race and gender as the child of A. In our data, we categorize the mother's self-reported level of education as (1) no high school, (2) high school diploma, (3) some college,

14. This is sometimes referred to as the "reactive hypothesis." See, for example, McNeal (2012).

15. This is known as the leave-one-out average and is standard in the peer effects literature.

(4) college graduate and (5) post-college training. Thus, our instrument is average involvement among peer mothers who share the same school-grade-race-gender-mother's education (SGRGE).

The motivation behind using this instrument is the idea that mothers who share similar education levels and whose children are similar (in terms of the characteristics listed above) are more likely to interact and influence each other. This idea is not new: earlier studies by Carbonaro (1998), Sheldon (2002), McNamara Horvat et al. (2003), and Mullis et al. (2003) have all found that parental networks can influence parents. Additionally, Kalil (2015) point out evidence suggesting parents, especially less educated parents, are more likely to take advice from their social circle than from experts.[16] Thus, by choosing a peer reference group at a level where the mothers are likely to interact, we expect the instrument to be relevant for mother's involvement.

The exclusion restriction for the instrument is, of course, not directly testable. One concern is a potential violation due a selection effect: unobservables predict the reference group, which in turn could be related to the level of their respective mothers' involvement and be correlated with school trouble. Our peer reference group selection strategy is designed to eliminate this problem by isolating within-school, across-cohort variation, conditional on school fixed effects.

The peer reference group is defined by predetermined characteristics. Interaction within the peer group is likely due to homophily, and necessary for instrument relevance. However, variation in maternal involvement across cohorts of our chosen reference group will be random if parents select into schools based on school-level characteristics.[17] On this assumption, instru-

16. Consistent with this point, in the supplementary appendix, Table B.2, we indeed find a pattern suggesting a stronger involvement response to peer mothers' involvement by mothers with less education.

17. This is a now well known argument in the peer effects literature. See Sacerdote (2014) for a comprehensive review.

ment assignment is as good as random once controlling for the school fixed effect. Thus, we expect that the variation in mothers' involvement across peer groups will be free of selection bias in our baseline result. Moreover, in Section 5.2 we consider a number of sensitivity tests around the assumption of selection based on fixed school factors and find a high degree of robustness.

A second concern is that peer mothers' involvement could influence adolescent school trouble through the adolescent's peer group. An advantage of our data is that we can observe numerous peer outcomes and characteristics. In section 5.3, we use this information to check the sensitivity of our results and again find a high degree of robustness.

Finally, in Section 5.4 we explore sensitivity checks related to fathers' involvement and a machine learning approach for instrument and control variable selection. We continue to find evidence consistent with our baseline result, lending further credibility to the exclusion restriction. Subsequently, we examine heterogeneity in Section 5.5 and explore some potential mechanisms that can explain the effect of mother's involvement on school trouble in Section 5.6.

5 Results

5.1 Baseline Results

We report our baseline results in Table 1.[18] All specifications control for school fixed effects, our controls and, where applicable, missing indicators for the controls. Standard errors are clustered at the school level. In the first row, we report estimates for the schooling-related involvement scale. The OLS estimate of mother's involvement in column 1 is negative but small in magnitude. Based on the response model, if mothers tend to respond to poor behavior in school with more involvement, then this estimate is biased toward zero.

18. A full table of results is available in the supplementary appendix, Table B.3.

Next, we turn to 2SLS. The first-stage estimate in column 2 shows that peer mothers' involvement is positively and significantly related to maternal involvement, suggesting that the instrument is indeed relevant. In column 3, we report the second-stage estimate. A standard deviation increase in mother's involvement roughly corresponds to an additional positive response to one of the three schooling-related involvement measures.[19] The 2SLS estimate shows that an increase of this magnitude results in nearly half a standard deviation decrease in school trouble. This effect is much larger in magnitude than the OLS estimate and suggests that endogeneity leads to a substantial attenuation bias.[20]

The Kleibergen-Paap F statistic (K-P F) is 14.128, suggesting that the instrument is reasonably strong. However, it is still relatively close to 10, the common rule-of-thumb cutoff for weak instruments. Following the advice of Andrews et al. (2018), we report the Anderson-Rubin (AR) weak instrument robust test for the null hypothesis that $\gamma = 0$.[21] The AR test rejects the null with a p-value of 0.5% and yields a 95% confidence interval for the effect of mother's involvement of $[-1.272, -0.159]$. Also, this interval does not overlap with the 95% confidence interval for the OLS estimate in column 1.[22] Thus, our IV estimate does not appear to be driven by weak instrument bias.

As demonstrated in the supplementary appendix, Table B.2, the school-trouble scale is strongly associated with future education and wages. Depending on the specification chosen from Table B.2 and based on a simple translation, a standard deviation increase in mother's involvement is associated with a 2.5%-6.5% increase in future wages. Together with the 2SLS estimate, this result implies that mother's involvement can have a long-lasting impact.

19. See Section 3.3.

20. Recent evidence on the impact of parental investments during early childhood also point to attenuation bias in OLS (Attanasio 2015; Attanasio et al. 2015).

21. In our single endogenous regressor just identified case, the AR test is both robust to weak instruments and efficient (Andrews et al. 2018).

22. The OLS confidence interval is $[-0.105, -0.068]$.

Table 1: School-Trouble and Maternal Involvement

	OLS	First-Stage	2SLS		
	(1)	(2)	(3)	(4)	(5)
Mother's Involvement	-0.086***		-0.509**		
	(0.009)		(0.216)		
Peer Mothers' Involvement		0.072***			
		(0.019)			
Mother's Involvement (All)				-0.589*	
				(0.310)	
Mother's Involvement (Alt.)					-0.383
					(0.242)
N	12316	12316	12316	12316	12316
K-P F			14.128	8.904	9.724
AR Weak IV Robust p			0.005	0.009	0.054

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
All specifications include school fixed effects, our base set of controls, and missing indicators for missing observations in our control set.
Mother's involvement is constructed from the three questions on involvement with schooling-related matters. Mother's involvement (all) includes all available mother involvement questions in the scale. Mother's involvement (alternative) includes all involvement questions except for the schooling-related questions used in the primary scale. All scales are summed over the included measures and then standardized.
Column 2 reports the first stage of average peer mother involvement at the school-grade-race-gender-mother education level on mother's involvement.
The Anderson-Rubin (AR) weak IV robust p-values are reported at the 95% level and 250 gridpoints. These report a weak instrument robust test of the null that $\gamma = 0$.

Our primary baseline result is the estimate for schooling-related maternal involvement; however, in columns 4 and 5 we replace this scale with a scale that either uses all available involvement variables (column 4) or only the involvement variables that are *not* related to school (column 5). Our aim is to explore the relationships between school trouble and different available measures of involvement. For each measure, we define the instrument as the average of that measure in our reference group.[23]

Much of the relationship between involvement and school trouble appears to be driven by schooling-related involvement. The full-scale estimate in column 4 is similar to that of our schooling-related scale but the first-stage is a bit weaker (the K-P F statistic is 8.904) and only significant at the 10% level. In column 5, the estimate based on the non-schooling-related involvement measure is closer to zero and insignificant.

In Section B.5 of the supplementary appendix, Table B.6, we further explore the use of principal components and a latent factor as measures for maternal involvement. The strongest component (PCA RC1 in Table A.4) aligns closely with our schooling-related scale and returns an effect estimate that is very similar to our baseline estimate. We do not claim that other measures of involvement are irrelevant; rather, the schooling-related measures seem particularly important.[24] Thus, in the remainder of this paper we use our preferred measure of mother's involvement. Of course, the reliability of our baseline estimate relies on the validity of the exclusion restriction. In the following sections we explore several robustness checks aimed at detecting potential violations of that restriction.

5.2 Robustness to Selection

In this section, we investigate whether selection effects may be driving our results. Our identification strategy hinges on the variation across peer groups being random, conditional on school fixed effects. If selection into schools is not only based on factors that are fixed at the school level, then the unobservables determining selection may be correlated with peer mothers' involvement and school trouble, thereby violating the exclusion restriction.

23. In the supplementary appendix, Table B.6, we examine the first stage relationship between the peer average of our primary scale and each iteration of the scale. We show that the average of peer mothers' schooling-related involvement is not related to the alternative scale.

24. See Appendix B.5 for additional discussion.

We first consider the inclusion of a variety of additional controls that would reasonably be associated with a selection mechanism, if one is present. Table 2 reports our results. In columns 1-3, we control for peer maternal involvement in different peer groups that get progressively closer to the group that defines our instrument. We control for peer maternal involvement at the same school and grade level in column 1, at the same school, grade and race level in column 2, and at the same school, grade, race and gender level in column 3. We expect that if unobservables are correlated with both our instrument and school trouble, then controlling for maternal involvement in different peer groups should result in sensitive estimates. However, we find that estimated effect of mother's involvement remains quite similar to our baseline estimate and significant at the 5% level in all cases. Moreover, the estimates for the peer mothers' involvement controls are never statistically significant.

In column 4, we include the Add Health Peabody picture vocabulary test (AH PVT) score as a control for cognitive ability. This has little impact on the estimated effect of mother's involvement, nor does it affect the strength of the instrument. Finally, in columns 5-6 we include school trends. Our first approach is to interact each school indicator with a grade-level variable (column 5), allowing across grade trends. The estimated coefficient for maternal involvement increases in magnitude to -0.745 but is less precise and significant at the 10% level. Our second approach is to interact each school indicator with the same school-grade peer average maternal involvement to control for school trends at the school-grade level in peer mothers' involvement. In column 6, controlling for differences in peer mothers' involvement between schools and grades, the estimate is more precise and much closer to our baseline estimate.

Overall the results in Table 2 support our claim that selection into schools is largely based on factors fixed at the school level. These are accounted for by the school fixed effects. To test this further, we also explore balancing tests in

Table 2: Selection Robustness Checks: Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)
Mother's Involvement	-0.427**	-0.475**	-0.643**	-0.475**	-0.745*	-0.445**
	(0.172)	(0.187)	(0.284)	(0.212)	(0.437)	(0.208)
SG Peer Mothers' Inv.	-0.106					
	(0.074)					
SGR Peer Mothers' Inv.		-0.022				
		(0.044)				
SGRG Peer Mothers' Inv.			0.040			
			(0.041)			
AH PVT				-0.127***		
				(0.013)		
School FE	Yes	Yes	Yes	Yes	Yes	Yes
SG Trend	No	No	No	No	Yes	No
SG-Peer Mothers' Inv. Trend	No	No	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Missing Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	12316	12316	12316	12316	12316	12316
K-P F	19.452	16.979	9.595	13.843	4.574	14.437

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. Inv. is involvement.
SG is school-grade. SGR is school-grade-race. SGRG is school-grade-race-gender. Each of these refers to the definition of the peer group level used in controlling for the peer mean.
AH PVT is the Add Health Peabody Picture Vocabulary test score.
SG-peer trend includes an interaction between grade-level and each school indicator.
SG-peer mothers' involvement trend includes an interaction between school-grade level average peer mother involvement and each school indicator.

Section B.3 and Table B.4 of the supplementary appendix. In these tests, we regress the observable controls that are not part of our peer group definition on our instrument. If selection effects are removed conditional on school fixed effects, then we do not expect much correlation to exist between these variables and our instrument. We find little evidence that our instrument is related to these controls, providing more evidence that any selection effects have been removed.

5.3 Robustness Tests at the Peer Group Level

In this section, we investigate possible violations of the exclusion restriction that could run through the peer group. A primary concern is whether our instrument may influence school trouble through an adolescent's peers' school trouble. We test for this possibility in Table 3.

In column 1, we control for peer average school trouble at the school, grade, race, gender and mother's education peer group level. While this variable should not suffer from selection effects, it likely does suffer from simultaneity. Our focus, however, is to check the sensitivity of our baseline result to its inclusion. We also control for the peer average in the Add Health picture vocabulary test score to capture a broader array of peer skills and for peer averages of our controls where applicable.[25] Our estimated maternal involvement effect is -0.479, significant at the 5% level, and close to our baseline estimate.

In column 2, we shift to the school-grade peer group level and again control for peer skills and peer averages in the control variables. Again, our estimate of the effect of maternal involvement remains stable. Finally, we return to our original peer group definition and use peer averages of the number of siblings, mother's age, and single parent homes in our instrument set. In column 3, we only report the first-stage estimate for peer maternal involvement. It remains positively related to mother's involvement and efficient. Column 4 shows, however, that the instrument set is relatively weak, with the K-P F statistic falling to 4.651. Nevertheless, we do pass the overidentification test and our second-stage estimate remains consistent with the baseline.

For a second set of sensitivity checks, we develop an additional instrument

25. We cannot control for peer averages of the variables used to define the reference group. These would not vary within groups.

Table 3: Peer Group Level Robustness Checks I

	(1) 2SLS	(2) 2SLS	(3) 1st Stage	(4) 2SLS
Mother's Involvement	-0.479**	-0.504**		-0.411**
	(0.234)	(0.225)		(0.190)
Peer School Trouble	-0.007			
	(0.025)			
Peer AH PVT	0.001			
	(0.020)			
SG Peer School Trouble		-0.003		
		(0.084)		
SG Peer AH PVT		0.041		
		(0.069)		
Peer Mothers' Involvement			0.073***	
			(0.019)	
SGRGP Avg. Controls	Yes	No	Yes	No
Sch-Grade Avg. Controls	No	Yes	No	No
N	12316	12316	12316	12316
K-P F	12.525	12.756		4.651
Over-ID p				0.379

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
All specifications control for school fixed effects, our base set of controls, and missing indicators for our controls.
Column 1 reports 2SLS estimates using our primary instrument definition and controlling for peer level averages at the same reference group level (SGRGP) as our instrument. In addition to reported estimates for peer school-trouble and AH PVT we also control for peer number of siblings, parental age, single parent homes, and household income. We cannot include peer controls on the variables used to define the peer reference group. AH PVT is included among the controls because we also control for the peer level of AH PVT. Missing indicators are included for these variables where needed.
Column 2 reports 2SLS estimates using our primary instrument definition and controlling for peer level averages at the school-grade level. In this case, we can include peer level averages of all controls (and skills) excepts for grade-level. AH PVT is included among the controls because we also control for the peer level of AH PVT. Missing indicators are used where needed.
Columns 3 and 4 report the first and second stages from including peer controls at the school-grade-race-gender-mother education level in the instrument set. We only report the estimate for our primary instrument in column 3. All other peer variables are insignificant and near zero. Peer variables used are average of number of siblings, mother's age, and single parent homes.

by redefining the peer group based on another potentially relevant dimension for mothers, namely religious denomination.[26] To sort denominations, we follow the same approach as Fruehwirth et al. (2019).[27] We list the categories in the supplementary appendix, Table B.5 and provide the frequency distribution.

In Table 4 we report the first- and second-stage, using as an instrument only the average of peer mothers' involvement from the new peer group definition. We first condition on observations that are non-missing in this variable. The first-stage (column 1) is similar to the baseline first-stage effect, although it is slightly weaker with a K-P F of 7.816. However, the second-stage estimate for mother's involvement (column 2) remains similar to our baseline estimate and the AR test rejects the null of $\gamma = 0$ at the 5% level.

In columns 3-4, we use both our new and initial instrument, conditioning on the sample that is non-missing in either instrument ($N = 10,670$). In the first-stage, each instrument remains significantly correlated with maternal involvement, and our second-stage estimate, while slightly higher, again remains stable. Moreover, we do not reject the null hypothesis that the overidentifying restrictions are valid and we continue to pass the AR weak instrument robust test.

Finally, we return to our original selected sample by imputing missing observations in SGRGR peer mothers' involvement to the mean and including an indicator for missingness. We include the missing indicator in both stages but maintain our instrument set. The K-P F rises closer to 10 and our second-stage estimate on maternal involvement of -0.524 falls very close to our baseline estimate. Again, we easily pass the overidentification test and maintain weak instrument robust inference.

The evidence in this section again points to the robustness of our baseline

26. We will refer to this as the school-grade-race-gender-mothers' religious denomination (SGRGR) peer group.

27. The only difference is that we use the mother's report of religious denomination, whereas Fruehwirth et al. (2019) use the adolescent's report.

Table 4: Peer Group Level Robustness Checks II

	(1) 1st Stage	(2) 2SLS	(3) 1st Stage	(4) 2SLS	(5) 1st Stage	(6) 2SLS
Mother's Involvement		-0.586**		-0.607**		-0.524***
		(0.293)		(0.270)		(0.196)
Peer Mothers' Involvement			0.048**		0.065***	
			(0.020)		(0.019)	
SGRGR Peer Mothers' Inv.	0.065***		0.048*		0.049**	
	(0.023)		(0.025)		(0.024)	
N	12117	12117	10670	10670	12316	12316
K-P F		7.816		6.131		9.402
Over-ID p				0.694		0.641
AR Weak IV Robust p		0.015		0.021		0.008

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. Inv. is involvement.
All specifications control for school fixed effects, our base set of controls, missing indicators for our controls, and indicators for the mother's religious denomination.
Columns 1 and 2 report the first and second stages from redefining the reference group to the same school-grade-race-gender-mother's religious denomination (SGRGR). We omit observations missing peer mother involvement at this reference group definition.
Column 3 and 4 report the first and second stages using peer mother involvement at both our original reference group and redefined group as instruments.
Column 5 and 6 report results after setting missings in peer mother involvement for the redefined level to the mean and controlling for a missing indicator in both stages. Again we have two instruments of peer mother involvement at two definitions of the reference group.

estimates. We checked for possible violations of the exclusion restriction that may run through the peer group but find no evidence consistent with this concern. Next, we turn to some final checks with a focus on involvement by fathers and instrument and control variable selection.

5.4 Additional Robustness Tests

5.4.1 Alternative Forms of Mother's Involvement

We explored the relationship between our schooling-related involvement instrument and alternative forms of mother's involvement. If the instrument also affects other types of involvement, it could violate the exclusion restriction. Based on the estimates reported in Section B.6 of the supplementary appendix, Table B.7, we find no evidence that the instrument based on schooling-related involvement is related to other forms of involvement. This suggests that peer mothers' involvement in schooling-related measures is indeed strongly related to mother's involvement of the same type but not to other types of involvement.

5.4.2 Involvement by Fathers

If fathers respond to peer mothers' involvement, we would again have a potential violation of the exclusion restriction. We examine this in Table 5. We use the average of peer mothers' schooling-related involvement as the instrument and consider different ways of controlling for mother's and father's involvement in the school trouble equation. First, we form a combined involvement measure that is the sum of the mother's and father's schooling-related involvement. When data on the father is missing, which frequently occurs, we use mother's involvement instead. The estimate in column 1 is similar to our baseline result. The same is true for the first-stage K-P F statistic.

Second, the estimates in column 2 are based on instrumenting mother's involvement while controlling for father's involvement. We impute missing fathers to the mean and use a missing indicator as control variable. Column 2 shows that our estimate for mother's involvement is somewhat larger but still yields the same conclusions as our baseline model.

Third, in columns 3-4 we report results from regressing father's involvement on our instrument. As long as fathers only respond to the mother but not to the peer mothers, there is no threat to the exclusion restriction. In this case, conditional on mother's involvement, we should see no correlation between peer mothers' involvement and the father. While mother's involvement is endogenous, we emphasize that a lack of correlation between our instrument and father's involvement is consistent with the notion that peer mothers do not affect a father's involvement.

Table 5: Father Involvement Robustness Checks

	(1) School Trouble	(2) School Trouble	(3) Father Inv.	(4) Father Inv.
Parental Involvement	-0.574**			
	(0.234)			
Mother's Involvement		-0.655**	0.452***	0.634***
		(0.329)	(0.014)	(0.014)
Father's Involvement		0.298		
		(0.204)		
Missing Father's Involvement		0.429**	-0.393**	
		(0.200)	(0.164)	
Peer Mothers Involvement			0.002	0.013
			(0.010)	(0.013)
N	12316	12316	12316	8775
K-P F	15.069	9.497		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
All specifications include the base set of controls, missing indicators for controls, and school fixed effects. Inv. is involvement.
Column 1 uses a combined mother/father standardized scale of the sum of mother and father involvement (equal to mother if father missing and vice-versa). Column 2 instruments mother's involvement and controls for father involvement and missingness in father involvement. Columns 3 reports on a father involvement specification where we maintain our analytic sample via imputation to the mean and controlling for missingness in father involvement. Columns 4 reports on a specification removing imputation and dropping observations missing in father involvement.

To maintain our selected sample, we maintain the imputation for missing fathers in column 3 and control for the missing father indicator. Involvement by fathers and mothers is highly correlated as expected, but we find no correlation between peer mothers' involvement and the father's involvement. To ensure that this result is not driven by data imputation for missing fathers, we restrict the sample to non-missing fathers in column 4. Again, we find no correlation between our instrument and the father's involvement. Thus, our evidence is consistent with peer mothers' schooling-related involvement affecting the mother directly but not the father.

5.4.3 Selecting Instruments and Controls

Our choice of instrument is based on a homophily argument: mothers are more likely to interact with and be influenced by other mothers who have similar education levels and whose children have similar characteristics. However, that still allows for several different ways to define a peer group. Beforehand, it is not necessarily clear what the most relevant grouping will be. A second issue relates to functional form: can we use a linear model for the relation between the instrument and maternal involvement, or should we account for possible nonlinearities (e.g., through polynomials or interactions)? If a large number of nonlinear transformations of the instrument are used, however, the instrument set overall may be weak and can lead to familiar bias problems.

To address these issues and assess the robustness of our baseline results further, we employ the lasso-based method developed by Belloni et al. (2012).[28] In this approach, the lasso is used to select the optimal instruments among a large set of candidate instruments. The selected instruments are then used to calculate the standard 2SLS estimator.[29]

Finally, variable selection issues also affect the school trouble equation. Inclusion of too many controls limits the efficiency of the estimator. We apply the post-double-selection (PDS) lasso approach proposed by Belloni et al. (2014b).[30] In this approach, the lasso is used twice to select two sets

28. For a brief overview of the lasso and other machine learning methods, see Mullainathan and Spiess (2017).

29. Belloni et al. (2012) show that this post-lasso 2SLS estimator is asymptotically normal and robust to instrument selection mistakes in the first stage.

30. The PDS in our case is similar to the Belloni et al. (2014b) approach and easily

of control variables: one that predicts school trouble and one that predicts mother's involvement. A third lasso step is employed for instrument selection, whereby the selected controls from the mother's involvement lasso are always included in the model. The final step calculates the 2SLS estimator with the union of selected controls from first two lasso steps and the selected instruments from the third step. The advantage is that we can reduce the dimensions of the control set and can also explore including many controls at once.

In Table 6, we report our results using the lasso.[31] In column 1, we only allow selection on instruments. The instruments are the average of peer mothers' involvement at six different configurations of the peer group.[32] For each instrument definition, we also include second and third degree polynomials to capture possible nonlinearities. The total number of included instruments is 18. In column 2, we repeat the exercise but also allow the controls to be selected. There are a total of 21 controls in our original control set. In column 3, we add a new reference group based on a mother's religious denomination and again include a third degree polynomial.[33] Finally, in column 4, we maintain our baseline instrument but include all controls from our robustness check sections, except ones that are possibly endogenous, and follow the PDS method for selection on controls. In this case we have 333 possible controls.[34]

In all cases, we find that the 2SLS estimate is close to our baseline esti-

extends to 2SLS (Belloni et al. 2014a; Ahrens et al. 2018).

31. We used Stata and the *ivlasso* package of Ahrens et al. (2018) for estimation. School fixed effects were included throughout.

32. The reference group definitions are same school-grade, school-grade-race, school-grade-race-gender, school-grade-race-gender-mother education, school-grade-mother education, and school-grade-gender-mother education.

33. We add two new reference groups. These are same school-grade-race-gender-mother's religious denomination and school-grade-race-mother's religious denomination. As before use of religious denomination lowers our selected sample size.

34. We omit peer school trouble and father's involvement because of endogeneity concerns.

Table 6: Machine Learning and 2SLS

		Select IVs		High-Dimensional Controls
2SLS–Mom Involve	-0.508**	-0.493**	-0.559**	-0.584**
	(0.215)	(0.196)	(0.281)	(0.225)
# IVs Included	18	18	24	1
SGRGR IVs Included	No	No	Yes	No
IVs Selected	SGRGE	SGRGE	SGRGE	NA
Penalized Controls	No	Yes	Yes	Yes
# Controls Included	21	21	26	333
# Controls Selected	NA	8	7	21
N	12316	12316	10670	12316
Cluster-Robust IV F	14.14	17.58	11.74	13.20

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
The instrument set is always based on peer mother involvement. We include this at different versions of the peer reference group and include up to a third degree polynomial in peer mother involvement at each reference group level.
SGRGE is the same school-grade-race-gender-mother's education reference group that we use in our baseline estimates. The SGRGE selected IV is the leave-one-out SGRGE average mothers' involvement.
SGRGR is the same school-grade-race-gender-mother's religious denomination reference group used in section 5.3.
In column 4, we include all base controls plus all controls from our robustness checks, except for ones that may be endogenous (peer school-trouble and father involvement are omitted).
Number of controls does not include the school fixed effects. These are always included as they are crucial for the identification assumption.

mate. In columns 1-3, the lasso always selects just one instrument, our initial baseline instrument. This is consistent with our expectation that mothers with similar children and who share similar education levels will be the most likely to influence each other, and thus, the most relevant choice for our peer reference group. In column 2 only 8 controls are selected. Not surprisingly, the first-stage relevance increases, as the value of the F-statistic increases. In column 3, the sample size falls because we include the religious denomination based reference groups, but our effect estimate remains similar.[35] Finally, in column 4, we find that of the 333 possible controls only 21 are selected by the PDS method. Again, the second-stage estimate is close to our baseline estimate. Overall, these results suggest that our baseline estimate is not sensitive to different choices of instruments or control variables.

5.5 Heterogeneity

We explore heterogeneity across three dimensions. First, there is evidence in the literature that parental influence on skill development decline as a child ages (Doepke et al. 2019; Heckman and Mosso 2014). In our sample we have some 7th and 8th graders, so we aim to test whether a mother's response to peer mothers' involvement is driven only by mothers of the youngest adolescents in our sample, and likewise, for the effect of mother's involvement. Second, the efficacy of a mother's involvement may depend on the mother's skill. In our sample, we explore whether a mother's response to peer mothers' involvement and the effect of mother's involvement varies by education level. Third, we test for heterogeneity by gender since in our data we find that males generally experience more trouble in school.

Our ability to explore heterogeneity is limited. First, our sample size precludes many refined cuts of the data. Second, the instrument may not be strong enough to disentangle multiple layers of heterogeneity. Third, some of the heterogeneity questions may be substantive. How parents choose to invest and their subsequent influence along differing dimensions of socio-economic status, neighborhoods, and other characteristics may depend on a number of factors that are beyond the scope of this study and that deserve careful theoretical and empirical attention.[36] Thus, our analysis here is more

35. Also, the control set increases because we include indicators for the mother's religious denomination.

36. See Doepke et al. (2019) for a theoretical model dealing with some of these issues along with a review of the literature.

exploratory and may provide a motivation for further work.

We report our analyses in the supplementary appendix, Section B.7. We find no evidence for heterogeneity by grade level or, more specifically, no evidence that our results are driven by those in lower grades. This applies to both the mother's response to peer mothers' involvement and to the efficacy of mother's involvement. For heterogeneity by mother's education, we do find some evidence that less educated mothers have the strongest response to changes in peer mothers' involvement. As noted in Section 4, this result is consistent with evidence that parents, especially less educated parents, put more weight on parenting advice from their social relationships, communities, and families (Kalil 2015). Turning to the efficacy of involvement, we find that the effect of mother's involvement is largely driven by mothers who did not complete college. Given that more highly educated parents tend to invest more in their children, interventions attempting to boost maternal involvement will likely be focused on those with lower levels of education (Heckman and Mosso 2014). Our evidence implies that such targeted interventions can indeed be beneficial.

Finally, school trouble exhibits substantial variation by gender. In the supplementary appendix, Figure B.3, we plot the estimated density of school trouble by gender. The distribution of school trouble for males is substantially shifted to the right, compared to females. This can partly be explained by the fact that male noncognitive development at early ages lags behind that of girls (Bertrand and Pan 2013). We do not find evidence in our data that the effect of mother's involvement varies substantially by gender.

5.6 Mechanisms

Research in education and developmental psychology has identified a number of contextual factors that predict academic achievement. Some of these factors may represent mechanisms or channels through which maternal involvement affects school trouble. Below we discuss three potential mechanisms that we can explore empirically in the Add Health data.

The first mechanism is the transfer of educational values and expectations from parents to children. Fan and Chen (2001), Hill and Tyson (2009), Jeynes (2007) and Castro et al. (2015) show that parental expectations and aspirations for their children's academic achievement are significant predictors of academic outcomes. If maternal involvement coincides with communicating and transferring values, expectations, and aspirations to adolescents, then this may be one channel through which maternal involvement reduces school trouble.

The second mechanism is adolescent mental health. Wang and Sheikh-Khalil (2014) present evidence that parental involvement reduces adolescent symptoms of depression. This may occur because involvement provides parents an opportunity to give emotional support to their children. Involvement may also foster a feeling of connectedness between parents and children that improves emotional and mental well-being. In turn, this can facilitate the transfer of values and aspirations between parents and adolescents and increase academic engagement in school (Wang and Sheikh-Khalil 2014).

The third and final mechanism we consider is parenting style. Parenting style reflects the relation between parents and children and is a strong predictor of academic achievement (Jeynes 2007). Steinberg et al. (1992) identifies three salient dimensions of style: parental warmth and responsiveness, behavioral supervision and strictness, and granting psychological autonomy. The empirical results of Dornbusch et al. (1987), Steinberg et al. (1992), Deslandes et al. (1997) and Marchant et al. (2001) show that an "authoritative" parenting style, characterized by high levels of emotional responsiveness and parental supervision but without being overly strict, is associated with higher academic achievement. An authoritative style may take greater effort and may require more involvement to habituate the child towards a more forward looking perspective (Doepke et al. 2019). Greater involvement, in turn, may alter an adolescent's perception of their parents' style, boosting their aspirations or providing protective emotional support. These predictions suggest we should find a link between involvement and some measure of parenting style.

We constructed several measures from the Add Health survey to explore these mechanisms. Details about the construction of each measure can be found in Appendix B.8. One measure represents college aspirations, three measures represent mental health (depression, self-esteem and suicidal ideation) and three measures reflect parenting style (warmth and responsiveness, behavioral supervision and strictnesses, and autonomy).[37]

Table 7: College Aspirations and Mental Health

	(1) College Aspirations	(2) CES-D	(3) Self-Esteem	(4) Suicidal Ideation
Mother's Involvement	0.527**	-0.399*	-0.040	-0.064
	(0.223)	(0.215)	(0.202)	(0.063)
N	12240	12240	12240	12240
K-P F	14.136	14.136	14.136	14.136

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors are in parentheses and are clustered at the school level.
Column headers indicate the dependent variable for the specification.
We drop missing observations in college aspirations and mental health variables reducing our sample compared to the baseline by 74.

Table 7 shows the estimated impact of mother's involvement on college aspirations and mental health, using peer mothers' involvement as an instrument. An increase in mother's involvement leads to a statistically significant increase in the level of college aspirations and a decrease on the depression scale. Self-esteem and suicidal ideation do not appear to be affected by our involvement measure. In general, we see a link where prior studies suggests

37. For depression we use the 19 scale questions from the Center for Epidemiological Studies Depression (CES-D) scale. Our construction of the CES-D scale and the self-esteem scale is the same as in Fruehwirth et al. (2019).

we should. Greater involvement boosts aspirations and reduces depressive symptoms, which suggests that involvement can habituate a child toward a more forward-looking perspective and can provide protective emotional support.

In Table 8 we turn to the parental style measures. Mother's involvement is significantly related to the perceived warmth of the parents (column 1) but has no apparent impact on perceived parental control and autonomy. The link with warmth, however, is consistent with the notion that involvement and parenting style are intertwined.

Table 8: Measures of Parenting Style

	(1) Warmth	(2) Control	(3) Autonomy
Mother's Involvement	0.410**	0.143	0.112
	(0.193)	(0.177)	(0.160)
N	12,215	12,215	12,215
K-P F	14.030	14.030	14.030

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. Column headers indicate the dependent variable for the specification. We drop observations if the parenting style variable is missing. Compared to the baseline model, this reduces the sample size by 110.

In summary, the estimates presented here suggest that the beneficial effect of a mother's involvement may operate through several channels. When mothers and adolescents interact more in relation to school-related matters, the adolescent has higher aspirations for going to college, fewer symptoms of depression, and perceives a greater level of warmth in the relationship with their parents. This, in turn, may protect the adolescent from experiencing trouble in school.

6 Conclusion

Over the past few decades parental involvement has been promoted by policy makers and educators as an important factor that can help drive student success. The No Child Left Behind Act of 2002 and the Every Student Succeeds Act of 2015 both required states to formulate strategies to promote parental involvement at home and in the school. Part of this policy focus has been driven by a large body of research, emanating from education and developmental psychology, that has pointed to a positive association between parental involvement and student outcomes.

Very few studies have been able to estimate the causal effect of parental involvement on academic achievement and noncognitive outcomes. Recent evidence has emerged about the causal link between parental investments and skill formation during early childhood but much less is known about the period of adolescence. The contribution of this paper is to provide new results in this area. Specifically, we estimate the causal effect of mother's involvement on adolescent trouble in school.

We construct a measure of adolescent school trouble and link it with noncognitive skills. We identify the causal effect of mother's involvement on adolescent school trouble by using the average of mothers' involvement in an appropriately chosen peer group as an instrument. The peer group of mothers is not self-selected but rather defined as the group of mothers who have a number of exogenous characteristics in common (the child's race, gender, school and grade, and the mother's education level). Our baseline estimates point to a statistically significant and substantial effect of mother's involvement: an increase of 1 standard deviation leads to a reduction in school trouble of about 0.5 standard deviations. The richness of the Add Health data allows us to conduct a wide range of robustness checks around the exclusion restriction. We find our result to be remarkably stable, lending further credibility to our baseline results.

Finally, we explore a number of mechanisms that may explain the causal effect of mother's involvement on school trouble. These include the impact of involvement on the adolescent's college aspirations, mental health and perceptions of parenting style. We find that an increase in involvement is associated with higher college aspirations, lower levels of depression, and a higher perceived level of warmth in the relationship with parents. What mothers do may shift how an adolescent feels about themselves and their family, and this mechanism can operate as a protective device that prevents subsequent poor choices by the adolescent at school. A more thorough study of processes within the family remains a promising topic for future study.

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A Appendix

A.1 School-Trouble Scale Measures and Factor Loadings

Table A.1: Summary Statistics for Measures of School Trouble

	Wave I			
	Mean	SD	Min	Max
GPA	2.761	0.766	1.000	4.000
School Skips	1.620	4.219	0.000	30.000
Trouble with Teachers	0.856	0.959	0.000	4.000
Trouble with Students	0.857	0.978	0.000	4.000
Trouble Getting Homework Done	1.187	1.074	0.000	4.000
Frequency of Fighting	0.455	0.716	0.000	2.000
Been Suspended from School	0.278	0.448	0.000	1.000
Observations	19617			

Table A.2: Factor Loadings for School Trouble Scale

	(1) Baseline	(2) Female	(3) Male	(4) Grade 7	(5) Grade 8	(6) Grade 9	(7) Grade 10	(8) Grade 11	(9) Grade 12
Negative of GPA	0.516***	0.513***	0.536***	0.534***	0.541***	0.491***	0.538***	0.521***	0.465***
	(0.014)	(0.021)	(0.022)	(0.038)	(0.037)	(0.029)	(0.033)	(0.035)	(0.038)
Days of Skipping School	1.809***	1.712***	2.122***	0.509***	1.099***	1.588***	2.591***	2.682***	3.173***
	(0.061)	(0.086)	(0.101)	(0.060)	(0.100)	(0.109)	(0.177)	(0.199)	(0.270)
Trouble with Teachers	0.636***	0.637***	0.698***	0.753***	0.814***	0.569***	0.550***	0.577***	0.616***
	(0.019)	(0.028)	(0.030)	(0.056)	(0.059)	(0.037)	(0.037)	(0.043)	(0.054)
Trouble with Students	0.508***	0.583***	0.527***	0.592***	0.564***	0.420***	0.469***	0.496***	0.558***
	(0.017)	(0.027)	(0.027)	(0.050)	(0.048)	(0.031)	(0.036)	(0.041)	(0.053)
Home Work Done	0.685***	0.649***	0.785***	0.707***	0.827***	0.603***	0.634***	0.646***	0.765***
	(0.021)	(0.030)	(0.036)	(0.056)	(0.063)	(0.041)	(0.045)	(0.051)	(0.070)
Fighting	0.377***	0.341***	0.389***	0.360***	0.398***	0.333***	0.365***	0.422***	0.394***
	(0.011)	(0.014)	(0.018)	(0.029)	(0.030)	(0.022)	(0.025)	(0.029)	(0.032)
Suspension	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Observations	19617	9952	9665	2667	2665	3480	3820	3686	3204

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses.
Each coefficient represents the factor loading for the measurement equation given by the row variable.
Column 1 is our primary scale for analysis. The following factor analyses are on sub-samples given by the column except in the last columns where we expand to include attitudes about college.

A.2 Variable Lists and Descriptive Statistics

Table A.3: List of Variables for Scale Measures of Mother's Involvement

Q: Which of these things listed on this card have you done with your Mother/Adoptive Mother/Stepmother/Foster Mother/etc. in the past 4 weeks?	Mother School Related Scale	Mother Full Scale	Mother Alt. Scale
gone shopping		yes	yes
played a sport		yes	yes
gone to a religious service or church-related event		yes	yes
talked about someone you're dating or a party you went to		yes	yes
gone to a movie, play, museum, concert, or sports event		yes	yes
had a talk about a personal problem you were having		yes	yes
had a serious argument about your behavior		yes	yes
talked about your school work or grades	yes	yes	
worked on a project for school	yes	yes	
talked about other things you're doing in school	yes	yes	

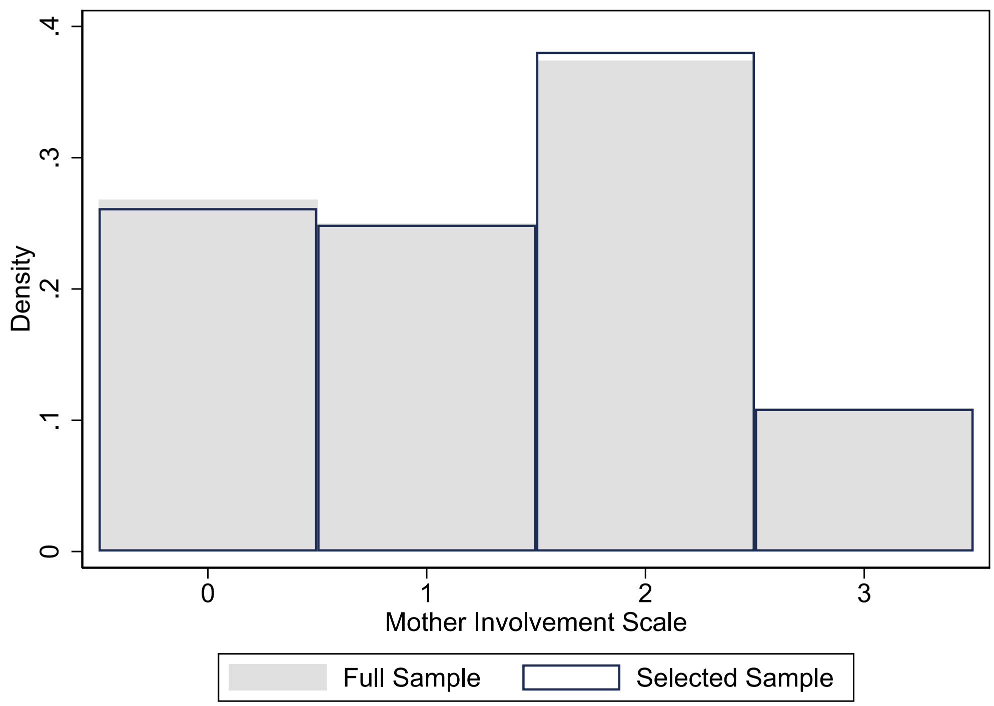

Figure A.1: Histogram of Mother's Involvement Scale

Table A.4: PCA Rotated Loadings and Factor Scores for Involvement Variables

	RC1	RC2	RC3	Factor Scores (unrotated)
gone shopping	-0.000	0.464	0.087	0.3882
played a sport	0.066	0.548	-0.014	0.3259
gone to a religious service or church-related event	0.106	0.278	-0.144	0.2173
talked about someone you're dating or a party you went to	0.038	-0.007	0.600	0.3945
gone to a movie, play, museum, concert, or sports event	-0.024	0.592	0.017	0.4316
had a talk about a personal problem you were having	0.085	0.058	0.569	0.4841
had a serious argument about your behavior	-0.113	-0.016	0.526	0.1677
talked about your school work or grades	0.601	-0.076	0.056	0.6921
worked on a project for school	0.463	0.209	-0.087	0.6395
talked about other things you're doing in school	0.623	-0.059	0.016	0.7165
Eigenvalue (pre-rotate)	2.940	1.428	1.232	2.301

RC is rotated component. Rotated loadings on each variable for the three components with an eigenvalue above 1 (prior to rotation) are reported in each row. We use standard orthogonal varimax rotation returning component loadings such that the components are orthogonal to each other. The PCA is conducted using the polychoric correlation matrix for involvement variables because of their binary nature.

The factor analysis returned only one factor with an eigenvalue above 1. The next largest factor had an eigenvalue of 0.656, implying it explains less variance than a single variable. Therefore, we only report the the first factor and rotation is not needed. The factor analysis is also conducted using the polychoric correlation matrix.

Table A.5: Summary Statistics for Primary Covariates

	Full Sample Mean / SD	Selected Sample Mean / SD	p-value of difference in means
School Trouble	0.000	-0.030	0.000
	(1.000)	(0.986)	
Mother's Involvement	0.022	0.035	0.010
	(0.997)	(0.993)	
Peer Mothers' Involvement	0.032	0.031	0.340
	(0.641)	(0.640)	
Mother's Characteristics			
No HS Diploma	0.172	0.162	0.000
	(0.378)	(0.369)	
HS Diploma	0.293	0.316	0.000
	(0.455)	(0.465)	
Some College	0.300	0.319	0.000
	(0.458)	(0.466)	
College Graduate	0.144	0.131	0.000
	(0.351)	(0.337)	
Post-College Training	0.092	0.073	0.001
	(0.289)	(0.260)	
Mother's Age	41.931	41.756	0.000
	(6.756)	(6.333)	
Household Characteristics			
Household Income	46.424	46.702	0.235
	(52.582)	(48.975)	
Number of Siblings in H.H.	1.463	1.475	0.087
	(1.221)	(1.174)	
Single Parent Home	0.317	0.287	0.000
	(0.465)	(0.453)	
Individual Characteristics			
Female	0.507	0.511	0.157
	(0.500)	(0.500)	
Hispanic	0.165	0.146	0.000
	(0.372)	(0.354)	
Black	0.221	0.207	0.000
	(0.415)	(0.405)	
Other	0.086	0.049	0.000
	(0.281)	(0.216)	
White	0.527	0.598	0.000
	(0.499)	(0.490)	
Grade-Level 7	0.136	0.142	0.000
	(0.343)	(0.350)	
Grade-Level 8	0.137	0.138	0.344
	(0.343)	(0.345)	
Grade-Level 9	0.178	0.184	0.001
	(0.383)	(0.388)	
Grade-Level 10	0.196	0.206	0.000
	(0.397)	(0.404)	
Grade-Level 11	0.189	0.188	0.875
	(0.391)	(0.390)	
Grade-Level 12	0.164	0.142	0.000
	(0.370)	(0.349)	
N	19617	12316	

Note: This Table reports summary statistics for the Add Health In-home wave I survey on the key variables and controls used for the primary analysis. The original wave I in-home sample has 20,745 observations. In creating our dependent variable, we dropped those not in school (395), those aged greater than 19 (85), missing in the school trouble scale measures (412), and outliers in our measure of skipped school days (236). Column 1 as full sample references the sample post-construction of the dependent variable. Thus, there are no missing observations in the school-trouble scale. The selected sample in column 2 drops missing observations in mother's involvement (1,106), school-grade-race-gender-mother's education peer mothers' involvement (5,811), parental survey respondent listed as male (324), and parental survey respondent listed as not the biological mother when the biological mother lives in the home (60).

B Supplementary Appendix

B.1 School Trouble and Links to Education and Labor Market Outcomes

We test whether our school trouble scale links to later life outcomes. Primarily, we are interested in establishing that the patterns in our scale and in the picture vocabulary test scores match the patterns found in the literature for noncognitive and cognitive skills. Additionally, we are interested in testing for evidence that our scale has long-term implications. Table B.1 provides summary statistics for variables used this analysis. It also provides a list of the controls we incorporate in addition to school fixed effects.

Table B.1: Summary Statistics for Variables in Logged Income Analysis

	Mean	SD	Min	Max
Logged Income	10.184	1.027	0.693	13.816
School Trouble	-0.029	0.986	-1.652	5.022
ahpvt	0.082	0.947	-5.766	2.040
HS Drop Out	0.058	0.233	0.000	1.000
GED or Certificate Holder	0.036	0.185	0.000	1.000
HS Diploma	0.233	0.423	0.000	1.000
Some College	0.344	0.475	0.000	1.000
College Graduate	0.249	0.432	0.000	1.000
Master's Degree or Better	0.080	0.272	0.000	1.000
Age at Wave IV	28.439	1.753	24.000	34.000
Labor Market Experience	8.074	3.572	0.000	17.000
Any Health Limitations	0.089	0.285	0.000	1.000
Census Tract Unemployment Rate	0.079	0.050	0.000	0.615
Urban Living	0.820	0.385	0.000	1.000
Female	0.535	0.499	0.000	1.000
Hispanic	0.152	0.359	0.000	1.000
Black	0.217	0.412	0.000	1.000
Other	0.076	0.265	0.000	1.000
North East Region	0.119	0.324	0.000	1.000
South Region	0.415	0.493	0.000	1.000
West Region	0.237	0.425	0.000	1.000
Midwest Region	0.229	0.420	0.000	1.000
Ever Married	0.500	0.500	0.000	1.000
Number of Children	0.923	1.138	0.000	7.000
Observations	13746			

Figure B.1 displays kernel density plots for school trouble (top panels) and PVT scores (bottom panels), stratified by sex and completed education level. For both males and females, the distributions of school trouble among those

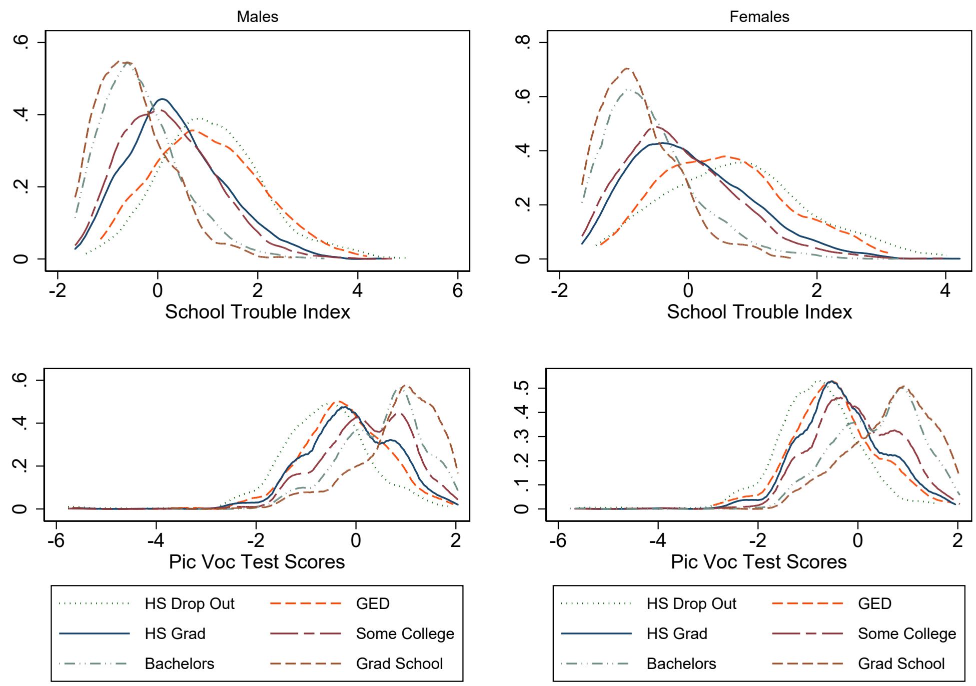

Figure B.1: Density Plots by Education Level and Gender of School-Trouble and Test Scores

who dropped out of high school or received the GED are almost identical. Both groups tend to have higher school-trouble scores than individuals with a high school diploma or higher levels of education. For both males and females, obtaining a bachelor's or graduate degree is associated with the lowest school trouble scores. These results are highly consistent with the distribution of noncognitive skills by education level reported in Heckman et al. (2006) and Heckman et al. (2014).

The bottom panel of Figure B.1 shows that these patterns are reversed for the picture vocabulary test (PVT) scores. The PVT score distributions are similar for GED holders and high school graduates, and both groups tend to have slightly higher scores than high school dropouts. Individuals with a bachelor's or graduate degree tend to have the highest PVT scores. Heckman et al. (2006), estimating the distribution of a cognitive skill factor with different data, find similar patterns.

In Table B.2, we report estimates from a regression of log wages in wave IV on the school trouble measure, PVT scores and a set of controls. All specifications are estimated using wave IV survey weights stratified by region. The specifications in columns 1-5 differ in the sets of covariates included (e.g., with or without school fixed effects). Column 6 contains estimates from a Heckman selection model for log wages. Across specifications the relation between school trouble and wages is consistently negative and highly significant. The estimates omitting the level of education—columns 1 through 3—indicate that a standard deviation increase in school trouble is associated with a wage reduction of 14 to 15 percentage points. Including indicators for completed education level at wave IV (in columns 4 and 5), the negative impact is around 8 percentage points. Finally, the estimate from the selection model in column 6 is slightly smaller in magnitude, but still highly significant.

Heckman et al. (2006) estimate the effect of noncognitive and cognitive skills on wages. Our estimates for school trouble and the picture vocabulary test score are similar in magnitude, suggesting that these two variables are reasonable proxies for noncognitive and cognitive skills.[38]

38. The cognitive factor in Heckman et al. (2006) does appear to account for more wage variation than the test score here, which is to be expected because we only use a single test score.

Table B.2: School-Trouble and Wave IV Income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
School Trouble	-0.149***	-0.136***	-0.133***	-0.065***	-0.067***	-0.047***	-0.050***
	(0.012)	(0.011)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)
PVT Score		0.112***	0.095***	0.040***	0.040***	0.021	0.017
		(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
GED or Certificate Holder				0.006	0.008	-0.027	-0.027
				(0.112)	(0.114)	(0.115)	(0.119)
HS Diploma				0.281***	0.282***	0.151**	0.153**
				(0.067)	(0.068)	(0.064)	(0.066)
Some College				0.394***	0.389***	0.208***	0.202***
				(0.075)	(0.077)	(0.074)	(0.077)
College Graduate				0.762***	0.738***	0.512***	0.485***
				(0.076)	(0.076)	(0.076)	(0.076)
Master's Degree or Better				0.921***	0.887***	0.660***	0.613***
				(0.089)	(0.086)	(0.089)	(0.087)
School Level FE	No	No	Yes	No	Yes	No	Yes
N	11775	11775	11775	11775	11775	13250	13250
R^2	0.118	0.126	0.163	0.165	0.195		

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors are in parentheses.
Survey weight gswgt4_2 and strata region are used from the Add Health wave IV weight file.
All specifications include controls for gender, ethnicity, age at wave IV, labor market experience, health limitations, the unemployment rate at the tract level from the 2000 census, an indicator for living in an urban area, and indicators for residence in northeast, south, or west of the US.
Columns 6 and 7 contain estimates from a Heckman selection model with ever married and number of children excluded from the main equation.
5,491 observations are lost from sample attrition.
We condition the sample on those with non-missing observations in all covariates. These are 2 from years of education, 681 from AH PVT, 222 from missing a school indicator, 37 from Hispanic, 18 from black, 15 from other, 26 from labor market experience, 1 from limitations, 6 from unemployment rate, 13 from ever married, and 1 from number of children. Also, we drop 89 observations whose school indicators contained at least less than 15 observations because these proved problematic for the estimation of the selection models with survey weights.

B.2 Baseline Full Results

Table B.3: School Trouble and Mother's Involvement: Full Results

	OLS	First-Stage	2SLS		
	(1)	(2)	(3)	(4)	(5)
Mother's Involvement	-0.086***		-0.509**		
	(0.009)		(0.216)		
Mother's Involvement (All)				-0.589*	
				(0.310)	
Mother's Involvement (Alt.)					-0.383
					(0.242)
Peer Mothers' Involvement		0.072***			
		(0.019)			
HS Diploma	-0.135***	0.085***	-0.096*	-0.075	-0.106**
	(0.045)	(0.029)	(0.049)	(0.060)	(0.053)
Some College	-0.182***	0.159***	-0.109**	-0.057	-0.117*
	(0.037)	(0.032)	(0.054)	(0.088)	(0.069)
College Graduate	-0.344***	0.227***	-0.241***	-0.174	-0.259***
	(0.053)	(0.040)	(0.075)	(0.117)	(0.092)
Post-College Training	-0.428***	0.295***	-0.294***	-0.222	-0.331***
	(0.052)	(0.046)	(0.085)	(0.135)	(0.100)
Mother's Age	-0.004**	-0.000	-0.004**	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of Siblings in H.H.	-0.023**	-0.004	-0.024**	-0.028**	-0.027***
	(0.009)	(0.010)	(0.011)	(0.011)	(0.010)
Household Income	-0.001**	0.000**	-0.000	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Single Parent Home	0.245***	0.097***	0.285***	0.301***	0.269***
	(0.023)	(0.022)	(0.032)	(0.042)	(0.031)
Female	-0.435***	0.065***	-0.405***	-0.236**	-0.278***
	(0.018)	(0.018)	(0.023)	(0.106)	(0.101)
Hispanic	0.039	-0.029	0.025	0.010	0.023
	(0.055)	(0.039)	(0.054)	(0.061)	(0.061)
Black	0.180***	0.037	0.198***	0.149***	0.141***
	(0.046)	(0.039)	(0.056)	(0.058)	(0.050)
Other	-0.112**	-0.038	-0.131***	-0.233***	-0.207***
	(0.045)	(0.040)	(0.047)	(0.082)	(0.078)
Grade-Level 8	0.060	-0.023	0.049	0.073*	0.078*
	(0.040)	(0.039)	(0.040)	(0.042)	(0.041)
Grade-Level 9	0.097*	-0.075	0.063	0.095*	0.117**
	(0.053)	(0.047)	(0.052)	(0.054)	(0.056)
Grade-Level 10	0.003	-0.064	-0.026	-0.007	0.013

continued

Table B.3 – continued

	OLS	First-Stage	2SLS		
	(1)	(2)	(3)	(4)	(5)
	(0.051)	(0.045)	(0.052)	(0.057)	(0.056)
Grade-Level 11	-0.007	-0.043	-0.027	-0.000	0.012
	(0.052)	(0.043)	(0.052)	(0.055)	(0.056)
Grade-Level 12	-0.107*	-0.136***	-0.169***	-0.114**	-0.074
	(0.056)	(0.046)	(0.059)	(0.058)	(0.061)
Missing Mother's Age	0.024	0.212*	0.115	0.120	0.051
	(0.106)	(0.108)	(0.123)	(0.137)	(0.119)
Missing Household Income	-0.026	-0.049	-0.047*	-0.035	-0.021
	(0.022)	(0.030)	(0.027)	(0.029)	(0.024)
Missing Hispanic	-0.100	-0.010	-0.113	-0.161	-0.145
	(0.168)	(0.217)	(0.185)	(0.200)	(0.189)
Missing Other	0.117	-0.176	0.034	-0.034	0.036
	(0.287)	(0.505)	(0.445)	(0.425)	(0.313)
N	12316	12316	12316	12316	12316
K-P F			14.128	8.904	9.724

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. All notes from our baseline table apply here. Missing observations in control variables are set to the mean (if continuous) or zero (if discrete) and we include a missing indicator where applicable.

B.3 Balancing Tests for Selection Checks

In Table B.4, we further check against selection effects via balancing tests on our observable controls that are not part of the peer reference group definition. Under an assumption of no selection effects conditional on school fixed effects we expect peer mothers' involvement to be uncorrelated with these controls. To properly conduct the test, it is important that we control for both the school fixed effects and the variables used in defining the reference group. For example, mother's education is likely correlated with these variables and by definition is correlated with our peer reference group.

We run our balancing tests over single parent homes, number of siblings in the household, logged household income, mother's age, and the cognitive ability control (AH PVT).[39] For all but the cognitive ability variable we find

39. We do not impute for missingness for these variables as when in the control set because they are used here as dependent variables

Table B.4: Selection Robustness Checks: Balancing Tests

	(1) Single Parent Home	(2) Number of Siblings in H.H.	(3) Log H.H. Income	(4) Mother's Age	(5) AH APVT	(6) AH PVT
Peer Mothers' Involvement	-0.007	-0.001	0.012	0.154	0.024*	0.018
	(0.006)	(0.017)	(0.010)	(0.096)	(0.012)	(0.012)
SG Peer Mothers' Involvement						0.547***
						(0.186)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
SG-Peer Mother Inv. Trend	No	No	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	12316	12316	10647	12230	11805	11805

Note: [A]* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
[B]Sample size varies because in baseline regressions we set missing in these variables to the mean or 0 but cannot do that here.
[C]All specifications include school fixed effects, grade-level indicators, race indicators, gender, and mother's education indicators.

peer mothers' involvement to be insignificant and in most cases near zero.

For AH PVT, it is significant, although small in magnitude. Thus, in column 6, we retest AH PVT including the school-grade peer mothers' involvement trend—interactions between it and each school indicator. While we find that school-grade peer mothers' involvement is strongly related to AH PVT, the coefficient estimate on our instrument now falls closer to zero (0.018) and is insignificant. It is worth noting that the estimated standard error does not change between columns 5 and 6, suggesting the loss of significance upon inclusion of the trend control is due to a weakening of the correlation. Moreover, back in column 4 of Table 2 when controlling for AH PVT we find our result remains highly consistent. We find the same when including the school-grade peer mothers' involvement trend control in column 6.

B.4 Mother's Religious Denomination Category Definitions

We draw these categorizations from Fruehwirth et al. (2019) whose primary reference group for defining their instrument is at the same school-grade-race-gender-denomination level. One key difference is that we use the mother's report of her religious denomination since our focus is on mother involvement. In section 5.3, we use mother's religious denomination to redefine our peer reference group at the same school-grade-race-gender-mother's denomination as a robustness check.

Table B.5: Mother's Religious Denomination Category Definitions

	Included Religions	Percent Full Sample
None		6.47%
Catholic	Catholic	30.76%
Liberal Protestant	Episcopal, Friends/Quakers, Methodist, Presbyterian, Unitarian	12.36%
Moderate Protestant	Christian Church (Disciples of Christ), Lutheran, other Protestant	13.91%
Conservative Christian	Adventist, AME, AME Zion, CME, Assemblies of God, Christian Science, Jehovah's Witness, Congregational, Holiness, Latter Day Saints (Mormons), Pentecostal, Baptist	36.50%
Set to missing if	Buddhist, Eastern Orthodox, other religion, Hindu, Islam, Moslem, Muslim, Jewish	3.60%

B.5 Checks with PCA and Factor Score Involvement Scales

Here we compare our baseline estimate from Table 1 against estimates based on using maternal involvement scales from principal components analysis (PCA) and factor analysis (see Table A.4). Column 1 contains our baseline result. Column 2 reports the estimate when the first rotated component (PCA RC1) is used as the maternal involvement scale. This component explains the largest amount of shared variance and closely aligns with our baseline schooling-related scale. Column 3 contains the estimate for the involvement scale based on the factor scores. Finally, columns 4 and 5 report estimates based on the second and third rotated principal components (PCA RC2 and PCA RC3), respectively.

For mother's involvement based on PCA RC 1, we find an estimate that is close to our baseline estimate. The result for the factor score scale are also qualitatively similar: the point estimate is somewhat larger in magnitude compared to the baseline but so is its standard error. Using the second rotated component as the involvement scale, again leads to a similar estimate of the impact of involvement on school-trouble (column 4). This component loads strongly on activities that take place outside of the home and are not related to school (see Table A.4). For this component, however, the first-stage relationship between the mother and the peer group is weaker (K-P F of 8.263) than for our baseline, schooling-related involvement scale. Finally, in column 5, we find no evidence for a relationship between the third rotated principal component and school trouble. While involvement in terms of activities outside of the home may indeed be relevant, the results here overall suggest that our focus on schooling-related involvement is warranted.

Table B.6: Checking Involvement Construction: PCA and Factor Score Scales

	School-Trouble				
	(1)	(2)	(3)	(4)	(5)
Mom Inv. (Baseline)	-0.509**				
	(0.216)				
Mom Inv. (PCA RC 1)		-0.488**			
		(0.197)			
Mom Inv. (Factor 1)			-0.590**		
			(0.258)		
Mom Inv. (PCA RC 2)				-0.471**	
				(0.235)	
Mom Inv. (PCA RC 3)					-0.142
					(0.274)
N	12316	12316	12316	12316	12316
K-P F	14.128	16.451	13.196	8.263	7.105

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. All specifications include the full set of controls and school fixed effects.
PCA RC is the involvement score generated from the principle component rotated scores reported in table A.4. RC 1 matches closely with our baseline scale of schooling-related involvement.
Factor 1 represents the involvement factor generated from the factor analysis reported in table A.4.

B.6 Alternative Forms of Mother's Involvement

We aim to examine whether peer mothers' schooling-related involvement affects alternative forms of maternal involvement. If this is the case, the exclusion restriction may be violated. In Table B.7, we report the first-stage estimates from regressing alternative forms of mother's involvement on the peer mothers' average schooling-related involvement. For the first three columns, the peer average is calculated using our main schooling-related involvement scale (namely, the sum of 3 indicators for schooling-related activities). For comparison purposes, we also use the peer average of the first rotated principal component (RC 1), and relate it to other forms of maternal involvement (RC 2 and RC 3).[40] These estimates are shown in the final two columns.

Table B.7: First-Stage: Schooling-Related IV and Alternative Scales

	Schooling-Related Scale	Full Scale	Alternative Scale	Mom PCA RC 2	Mom PCA RC 3
Peer Mothers' Involvement	0.072***	0.045***	0.012	0.013	0.007
	(0.019)	(0.017)	(0.016)	(0.014)	(0.016)
N	12316	12316	12316	12316	12316

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level.
Peer mother involvement is held at the average of schooling-related scale amongst the same school-grade-race-gender-mother's education reference group.
All specifications include school fixed effects, our base set of controls, and missing indicators for missingness in control variables.
The schooling-related scale corresponds to our preferred involvement scale we focus on throughout. The full scale corresponds to that used in column 5 of table 1 and the alternative scale to that used in column 6 of table 1.
In columns 4 and 5, we report the first-stage for mother involvement of RC 2 and 3 with the instrument as the same school-grade-race-gender-mother's education (SGRGE) of RC 1 (see table B.6). This repeats the analysis in columns 1-3 with the rotated component generated scales.

Column 1 of Table B.7 reiterates that peer mothers' schooling-related involvement shifts a mother's schooling-related involvement. Column 2 shows that when we combine the schooling-related involvement with all other in-

40. As shown in Table B.6, the 3 indicators that comprise our main scale are heavily weighted in RC 1, making it a suitable alternative measure for schooling-related involvement. Similarly, RC 2 and RC 3 are suitable measures of other types of maternal involvement.

volvement measures (see Table A.3 in the appendix), the first-stage estimate is still significant but smaller in magnitude. In column 3, we find that peer mothers' schooling-related involvement is unrelated to the involvement scale based on indicators that are *not* related to school. The same conclusion applies to the last two columns, where schooling-related involvement is now measured by RC 1 and other types of involvement are measured by RC 2 and RC 3. Thus, it appears that mothers respond to peer mothers by increasing their own schooling-related involvement but not other forms of involvement, which further helps alleviate potential concerns about the exclusion restriction.

B.7 Heterogeneity Results

In the left panel of Figure B.2, we report the average marginal effect of peer mothers' involvement on a mother's involvement at each grade-level. The confidence intervals are quite wide because the sample sizes by grade-level are relatively small. Nevertheless, we see no clear heterogeneity across grades. In the right panel we report similar results stratified by the mother's education level. The pattern provides no evidence that the baseline first-stage estimate is driven by mothers with greater education levels. If anything, the point estimates suggest that mothers with less education respond more to peer mothers' involvement.

In Table B.8, we explore heterogeneity in the effect of mother's involvement across grade level and mother's education. In column 1, we interact mother's involvement with a grade-level variable and instrument this interaction with the interaction between our main instrument and grade level. The interaction effect is not significant. In this specification, however, the instruments are weak: we find a small value of the K-P F statistic (4.177), although we do pass the AR weak instrument robust test that the effects of mother's involvement and its interaction are jointly equal to zero. To probe this question further, we restrict the sample by dropping middle schoolers.

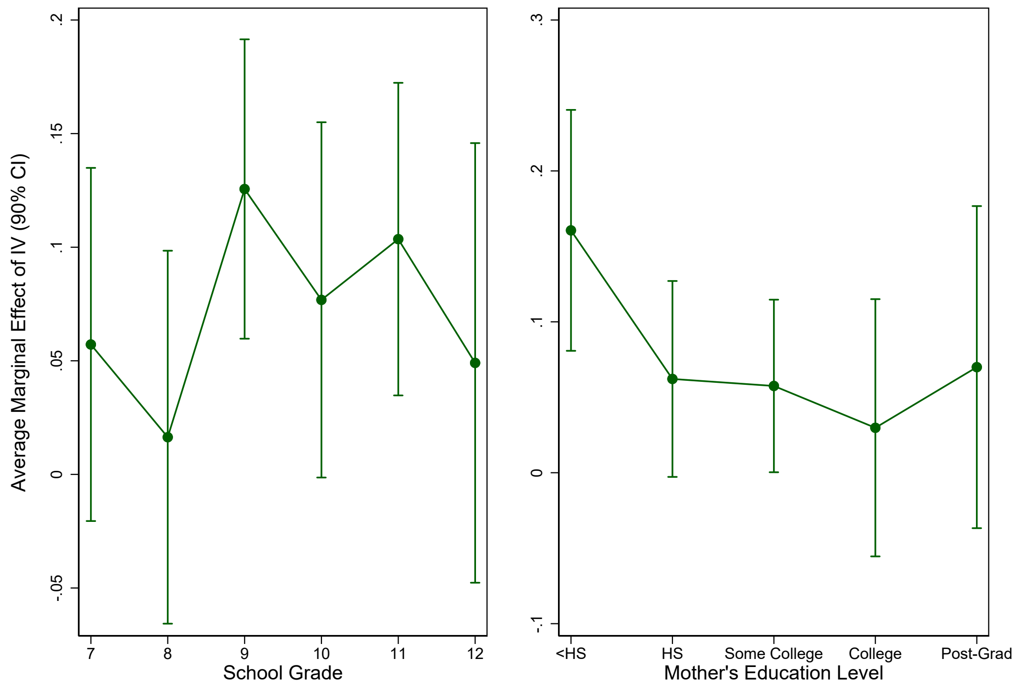

Figure B.2: Mother's Involvement and Peer Mother's Involvement Heterogeneity

In column 2, we find that the effect of mother's involvement is again very similar to the baseline result. Thus, our results are at least not driven by the 7th and 8th graders in the data.

In columns 3 and 4, we turn to test for heterogeneity by mother's education-level. In column 3, we interact mother's involvement with mother's education and again instrument it with the interaction of our instrument and mother's education. The results here suggest a strong effect of involvement that declines as mother's education increases. In other words, a substantial part of our baseline estimate may be driven by mothers with less than a completed college education. Weak instruments, however, may again be a problem and we caution against drawing strong conclusions.

Table B.8: Heterogeneity by Grade Level and Mother's Education

	(1)	(2)	(3)	(4)
Mother's Involvement	-0.419	-0.458**	-0.773***	-0.669**
	(1.222)	(0.197)	(0.245)	(0.294)
Mother's Involvement X Grade	-0.009			
	(0.119)			
Mother's Involvement X Education			0.202*	
			(0.109)	
N	12316	8866	12316	9810
K-P F	4.177	17.276	3.135	9.558
AR Weak IV Test	0.019	0.016	0.001	0.002

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. All specifications include the full set of controls and school fixed effects.
In column 1, the instruments are peer mother involvement and its interaction with grade-level. We instrument both mother involvement and its interaction with grade-level. In column 3, we follow a similar approach for mother's education level.
In column 2, we restrict the sample to those in 9th grade or above (in high school).
In column 4, we restrict the sample to observations with mother's who have less than a college degree.

In column 4, we restrict the sample to mothers with less than a completed college education.Here the K-P F is near 10 and the effect of mother's involvement remains somewhat higher than the baseline effect at -0.669. Overall, these results suggest that for mothers with less education, schooling-related involvement can indeed be effective.

Finally, we examine heterogeneity across gender. Figure B.3 shows that males in general exhibit much more school trouble. To test for heterogeneity by gender, we interact gender with mother's involvement and instrument the interaction with an interaction between our instrument and gender. One concern is that the interaction instrument may be too correlated with peer mothers' involvement itself to effectively identify the gender-specific effects of involvement on school trouble. Also, because our instrument is not very strong, splitting the sample by gender may reduce the sample size too much. Thus, we explore the interaction of mother's involvement with a female indicator for different constructions of the peer reference group. First, we keep our original reference group definition. Second, we drop gender, defining the reference group by school, grade, race (SGR) and mother's education. Third, we refine the SGR peer group further, by matching on the mother's religious denomination. This further reduces the sample size ($N = 11,299$). And, fourth, we use the SGR and mother's religious denomination reference group and the instrument at our original definition to obtain multiple instruments and overidentification.

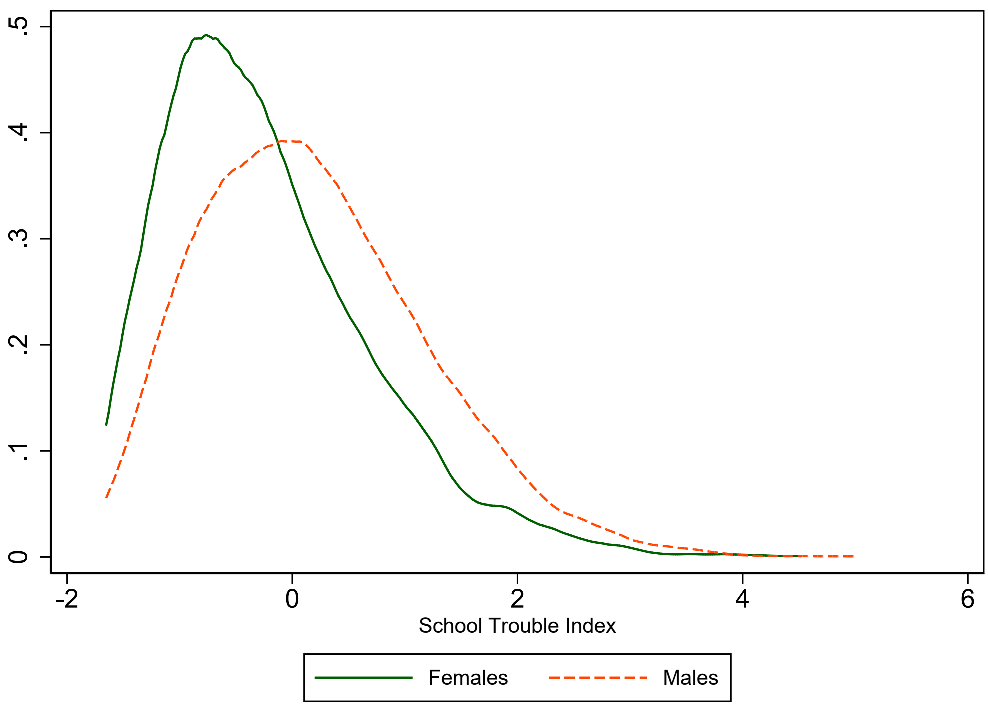

Figure B.3: School-Trouble Empirical Density Plots by Gender

In Table B.9, we report the results. In column 1, using our instrument and its interaction with a female indicator, we find no evidence for a differential effect. In column 2 and 3, we redefine the peer reference group and find similar results. The estimated effects of involvement are similar in magnitude but less precise. The interactions are not significant and the K-P F statistics remain small. Finally, in column 4 we use the SGR-mother's religious denomination reference group and its interaction with female as instruments, in addition to our baseline instrument (and its interaction with gender). The estimates are again similar to the baseline results.

With multiple instruments, the K-P F increases but only slightly. We also report a range of weak instrument robust tests and find that in general we can reject that null that mother's involvement and its interaction with female are jointly equal to zero. Thus, overall the evidence here consistently points to a lack of heterogeneity by gender in the effect of involvement.

Table B.9: Heterogeneity by Gender

	(1) Original IV	(2) SGR-Mother's EDU IV	(3) SGR-Mother's RD	(4) Multiple IVs
Mother's Involvement	-0.512***	-0.511*	-0.531	-0.598**
	(0.195)	(0.297)	(0.328)	(0.251)
Mother's Involvement X Female	0.016	0.095	0.126	0.132
	(0.269)	(0.184)	(0.211)	(0.218)
Female	-0.406***	-0.412***	-0.407***	-0.401***
	(0.028)	(0.029)	(0.034)	(0.028)
N	12316	12316	11299	11299
K-P F	2.342	3.392	3.456	4.766
AR Weak IV Test	0.009	0.103	0.212	0.058
CLR Weak IV Test				0.014
Lagrange K Weak IV Test				0.029
Over-ID p-value				0.758

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the school level. All specifications include the full set of controls and school fixed effects. Each specification includes two endogenous variables: mother's involvement and its interaction with female.

Column headers indicate the instrument employed. In each case, the instrument set is the main IV and its interaction with female.

Original IV is the average of mother's involvement at our primary reference group level: the same school-grade-race-gender-mother's education.

SGR-Mother's EDU cuts gender from the reference group definition and is the same school-grade-race-mother's education level.

SGR-Mother's RD defines the reference group at the same school-grade-race-mother's religious denomination. Some additional observations are lost using this reference group.

Multiple IVs employs the SGR-Mother's RD, its interaction with female, and our original reference group definition to obtain overidentification.

Weak IV robust tests are tests of that the effect of mother's involvement and its interaction with female are jointly equal to zero. CLR is the conditional likelihood ratio test. Lagrange K is the Lagrange Multiplier test.

B.8 Variable Definitions for Mechanism Section

Table B.10: Variable Definitions for Aspirations and Mental Health

Variable definitions for college attitudes and mental health	
College Attitudes	Construction: Normalized sum of scales
Scale: (1-5) higher is better. 1. How much do you want to go to college? 2. How likely is it that you will go to college?	
CES-D	Construction: Normalized sum of scales
How often was each of the following things true during the past week? Scale: (0-3) Higher is more often. Positive feelings recoded to keep scale consistent 1. You were bothered by things that usually don't bother you. 2. You didn't feel like eating, your appetite was poor. 3. You felt that you could not shake off the blues, even with help from your family and your friends. 4. You felt that you were just as good as other people. 5. You had trouble keeping your mind on what you were doing. 6. You felt depressed. 7. You felt that you were too tired to do things. 8. You felt hopeful about the future. 9. You thought your life had been a failure. 10. You felt fearful. 11. You were happy. 12. You talked less than usual. 13. You felt lonely. 14. People were unfriendly to you. 15. You enjoyed life. 16. You felt sad. 17. You felt that people disliked you. 18. It was hard to get started doing things. 19. You felt life was not worth living.	
Self-Esteem	Construction: Normalized sum of scales
Four item scale (1-6 each variable). Higher values indicate higher esteem. 1. You have a lot of good qualities. 2. You have a lot to be proud of. 3. You like yourself just the way you are. 4. You feel like you are doing everything just about right.	
Suicidal Ideation	Binary (Yes, No)
During the past 12 months, did you ever seriously think about committing suicide?	

Table B.11: Variable Definitions for Parenting Style Variables

Family Warmth	Construction: Normalized sum of scales
Scale: (1-5) higher is better. 1. How much do you feel that your parents care about you? 2. How much do you feel that you and your family have fun together? 3. How much do you feel that your family pays attention to you?	
Control	Sum of Yes, No questions then normalized
Scale: flipped ordering so that =1 implies more control 1. Do your parents let you make your own decisions about the time you must be home on weekend nights? 2. Do your parents let you make your own decisions about the people you hang around with? 3. Do your parents let you make your own decisions about what you wear? 4. Do your parents let you make your own decisions about how much television you watch? 5. Do your parents let you make your own decisions about which television programs you watch? 6. Do your parents let you make your own decisions about what time you go to bed on week nights? 7. Do your parents let you make your own decisions about what you eat?	
Autonomy Granting	Scale: 1-5 (5 is higher) and standardized
1. Your mother encourages you to be independent	