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WORKING PAPER NO. 128

Does Parental Divorce Affect Adolescents' Cognitive Development? Evidence from Longitudinal Data

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November 2004

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Anna Sanz De Galdeano ♦ ***and Daniela Vuri*** ♠

Abstract

In this paper we analyse data from the National Education Longitudinal Study of 1988 to investigate whether experiencing parental divorce during adolescence reduces measured cognitive ability. To account for the potential endogeneity of parental divorce we employ a difference-in-differences model that relies on observing tenagers' outcomes before and after divorce. We find that parental divorce does not negatively affect teenagers' cognitive development. Our results also suggest that cross-section estimates overstate the detrimental effect of parental divorce.

Keywords: Divorce; Difference in differences; Cognitive Development.

JEL Classification: J12.

Acknowledgements: We thank the U.S. Department of Education's National Center for Education Statistics for access to the public use NELS data and Jennifer Thompson for kindly answering our questions about the data files. Seminar participants at the EUI, UNICEF and CSEF gave very helpful comments on earlier drafts. Anna Sanz de Galdeano acknowledges financial support from a Marie Curie Fellowship of the European Community programme *Improving Human Potential* (contract number HPMD-CT-2001-00069). The authors are responsible for information communicated and the European Commission is not responsible for any view or results expressed.

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Contents

1 Introduction

Establishing whether parental divorce has a causal negative effect on children's outcomes is a crucial issue for the evaluation of divorce and family laws. Several states in the U.S. have recently started tightening divorce requirements, reversing the liberalizing trend in divorce laws that began around 1970. [1] The proponents of tightening the divorce regime often argue that making divorce easier has negative consequences for children. However, as pointed out by Gruber (2000), this argument relies on three implicit suppositions. First, that easier divorce regulations cause an increase of divorce rates. Empirical work on this supposition has reached mixed conclusions: while Friedberger (1998) finds that there is an impact of unilateral divorce on divorce rates in the U.S., the evidence presented by Wolfers (2003) indicates that the increase in divorce rates is only transitional, disappearing after a decade. Second, that changes in divorce regulation only have an impact on families and children through their effect on the propensity to divorce. The third supposition that drives criticism of easier divorce regulations, on which this paper focuses, is that divorce has an adverse impact on children.

There is an enormous literature that finds that experiencing parental divorce is negatively related to a wide variety of children's outcomes such as educational attainment, fertility choices (specially non-marital birth during teenage years), future earnings, employment status and welfare recipiency among others (many of these studies are reviewed in Amato and Keith 1991, and Haveman and Wolfe 1995). However, this large literature can hardly be interpreted causally because divorce is associated with socioeconomic characteristics that also determine children's attainments. For instance, there is a negative relationship between divorce and men's earning ability (Sander 1986). Moreover, even if socioeconomic information is available, it is unlikely that these observable variables can fully capture the unobservable differences that may exist between families that choose to divorce and intact families; for example, it may

[1] Unilateral divorce, which requires the willingness of only one spouse to divorce, rather than the consent of both spouses, was rare before the late 1960s but was in place in most states by the mid-1970s.

be the conflict associated with divorce, rather than divorce per se, what leads to children's inferior outcomes. Therefore, it is easy to overstate the detrimental impact of divorce.

Several studies have stressed the difficulties associated with the endogeneity of parental divorce. Manski et al. (1992) present and interpret alternative estimates of the effect of family structure on high school graduation, obtained under differing assumptions about the process generating family structure and high school outcomes. Sandefur and Wells (1997) use sibling data to control for unmeasured characteristics of families that are common to siblings. Corak (2001) assumes that parental loss by death is exogenous and argues that children with a bereaved background offer a benchmark to assess the endogeneity of parental loss through divorce, considering that any difference between the outcomes of individuals from bereaved and divorced backgrounds represents the consequences of an endogeneity bias. In a related paper, Lang and Zagorsky (2001) also consider parental death as an exogenous source of parental absence. Gruber (2000) states that "what is required to appropriately identify the impact of divorce is an exogenous instrument that causes some families to divorce and others not, based on a factor independent of the determinants of their children's outcomes" (p. 10). However, a valid instrument is hard to find in this context and not even changes in divorce laws could be considered as such if, as suggested by Stevenson and Wolfers (2003), changes in divorce regimes may directly affect the nature of intrafamily bargaining, with potential implications for children's outcomes.

In this paper, we expand the existing empirical literature on the consequences of parental divorce in two important ways. First, we use data from the National Education Longitudinal Study of 1988 to examine the causal relation between parental divorce and adolescents' cognitive development as measured on standardized tests. Test scores are often used to evaluate the performance of students, teachers and schools. Moreover, several recent studies have shown that test scores of adolescents are associated with future wages. [2]

[2] See, for example, Murnane et al. (1995), Neal and Johnson (1996), Cawley et al. (1997) and Zax and Rees (2002).

Second, our empirical approach, which is different from methods used in the literature, allows for the possibility that parental divorce is correlated with unobserved family characteristics that may influence children's outcomes. We use a difference-in-differences model that relies on observing children's outcomes before and after divorce.

Our main finding is that parental divorce does not adversely affect teenagers' cognitive development. Teenagers from divorced families appear to perform worse than their counterparts from intact families *before* the divorce actually takes place. Our results also suggest that cross-section estimates actually overstate the detrimental effect of parental divorce.

The paper proceeds as follows. The data set used is described in Section 2. Section 3 lays out our empirical strategy for identifying the impact of parental divorce on adolescents' cognitive development and discusses the results. Section 4 offers some concluding comments.

2 Data

The individual data used in this paper are from the National Educational Longitudinal Study of 1988 (NELS:88), a continuing study sponsored by the U.S. Department of Education's National Center for Education Statistics. A nationally representative sample of 24,599 8-th graders were first surveyed in 1988. Many of these same students were re-surveyed through four follow-ups in 1990, 1992, 1994 and 2000. The first follow-up includes responses from approximately 17,500 of the students from the first wave while the second follow-up includes approximately 16,500 students from the original cohort. A unique feature of the NELS:88 data is that who leave high school prior to graduation continue to be interviewed throughout the longitudinal study. It is therefore possible to include in our analyses dropouts who are not represented in other national school-based surveys.

On the questionnaires, students reported on a range of topics including school, work and home experiences. Depending on the year, data were also collected from parents, schools and teachers. In addition, for the three in-school waves of data collection (1988,

1990 and 1992), cognitive tests were administered. The administration of cognitive tests in multiple waves allows us to analyse the impact of changes in teenagers' lives on their cognitive development.

The NELS:88 cognitive test battery consists of multiple choice tests in four subject areas: reading comprehension, mathematics, science and history/citizenship/geography. In the base year, all students received the same set of tests. In order to avoid "ceiling" and "floor" effects, that is, many students getting either all items correct or incorrect, the reading and mathematics tests in the first and second follow-ups were tailored to students' ability levels in the previous wave. Item Response Theory was used to develop scores that are on the same scale and thus can be compared to measure gains in achievement over time. The maximum possible scores that a teenager could achieve are 81 in mathematics, 38 in science, 47 in history and 54 in reading.

We use a number of sample selection criteria for our analyses. We restrict the sample to teenagers who participated and provided test scores in the first three waves of the data. As noted above, this sample includes not only students but also dropouts. To focus on the impact of parental divorce, we exclude teenagers who grew up in a single-parent household for reasons other than parental divorce, such as out-of-wedlock birth or death of a parent. We also lose a number of observations because of missing observation on some of the control variables used in the analyses. This leaves a total of 7,960 teenagers, of which 2,536 experienced parental divorce before 1992.

Figure 1 displays mean test scores for teenagers from intact families and for teenagers whose parents divorced before 1988, between 1988 and 1990 and between 1990 and 1992.[3] A number of features are worth noting. First, cognitive test scores rise with schooling. This is consistent with the findings of Cawley et al. (1997). Second, teenagers with a divorced background perform worse than their counterparts from intact families. Finally, at least part of this gap is visible before the divorce actually takes place. Accordingly, it is possible that the endogeneity of parental divorce is

[3]The NELS:88 information on parental marital status does not allow us to distinguish between separation and divorce. Hence, in what follows we make no distinction between teenagers from divorced and separated family backgrounds.

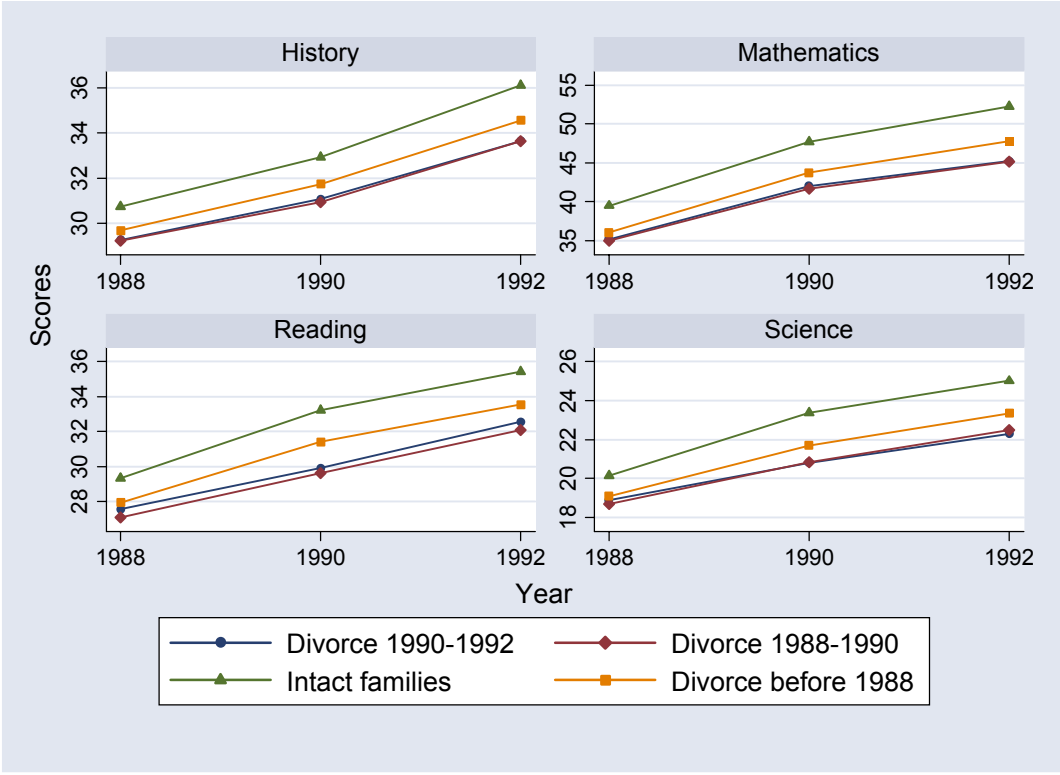

Figure 1: Mean Test Scores by Year

generating this difference. For example, conflict between parents may lead to both divorce and teenagers' worse outcomes. Another possibility is that parents who are less committed to their families may be more likely to divorce and may also invest less time in their children.

Alternatively, it is possible that the difference in test scores is due to background differences between teenagers from divorced and intact families. The NELS:88 questionnaires also provide additional information on family and school characteristics. Table 1 presents the means and standard deviations of the main variables employed in the statistical analyses for the sample of teenagers from intact two-parent families and for those who experienced parental divorce between 1990 and 1992.[4] In line with the idea that children of divorce come from more disadvantaged backgrounds than children from intact families, Table 1 indicates that teenagers from intact families have

[4]Similar differences were observed when comparing teenagers from intact backgrounds with teenagers who experienced parental divorce before 1990.

better educated parents. Moreover, teenagers of divorce come from families at the 51^{th} centile of the socioeconomic distribution (based on the entire NELS sample), while the average in the intact families sample is at the 58^{th} centile.[5] Table 1 also reveals that teenagers from divorced families are more likely to work more than 21 hours per week, be Black or Hispanic, live in the South or in the West and attend public schools and schools located in urban areas.

3 Does Parental Divorce Affect Teenagers' Cognitive Development?

3.1 Estimation and Basic Results

Let $Y(i,t)$ be the outcome of interest (test scores) for individual i at time t. Let us assume that we observe the population in two periods, $t = 1992$ and $t = 1990$. Between these two periods, some fraction of the population experiences parental divorce. We denote $D(i,t) = 1$ if individual i has experienced parental divorce between 1990 and 1992 and $D(i,t) = 0$ if individual i's parents are still married in 1992. Therefore, $D(i,1990) = 0$ for all i by definition and those individuals with $D(i,1992) = 1$ are called treated while those with $D(i,1992) = 0$ are called controls. The following formulation of the difference-in-differences (DID) framework is based on that in Ashenfelter and Card (1985) and Abadie (2003). Suppose that $Y(i,t)$ follows a components-of-variance scheme:

$$Y(i,t) = \delta(t) + \alpha \cdot D(i,t) + \eta(i) + \upsilon(i,t) \tag{1}$$

where $\delta(t)$ is a time-specific component, α is the impact of parental divorce and $\upsilon(i,t)$ is a serially uncorrelated transitory component. Finally, $\eta(i)$ is an individual-specific component that represents unobserved pre-disruption characteristics. If $D(i,t)$ is independent of $\eta(i)$ and $\upsilon(i,t)$, then the difference in test scores between treated and controls in $t = 1992$ will estimate the effect of parental divorce α.

[5] The socioeconomic status variable is based on parental education and occupation and total household income.

As a benchmark for later comparisons, equation (1) is first estimated using 1992 information on test scores. OLS coefficient estimates, reported in Table 2 (column 1, row 1 of each panel), are negative and statistically significant at the 1% level for all four examinations. It is found, for example, that teenagers who experience parental divorce between 1990 and 1992 perform 7 points worse than their counterparts from intact families on the 1992 mathematics test. To assess the magnitude of these effects, we also use the student's 12th-grade percentile rank based on her 12th-grade score in all the tests as dependent variables. The results of these analyses, shown in column 2, suggest that experiencing parental divorce reduces test score ranks in mathematics, science, history and reading by 14, 13, 13 and 8 percentile points, respectively.

It is also interesting to assess the implications of these effects in terms of future wages. To this purpose, we use the results reported in Murnane et al. (1995), which reveal that an increase of approximately one standard deviation in the mathematics test score for male high school seniors increases wages six years later by \$0.57 (in 1988 dollars). Combining this result with our own estimate of the impact of parental divorce on math test scores for males, we find that parental divorce reduces future hourly wages by -0.27\$.[6]

Part of the estimated difference in test scores between teenagers from divorced and intact families may be due to the observed background differences highlighted in Section 2. Hence, we now explore whether these findings are robust to the inclusion of controls.

First, consider the coefficients on some of the explanatory variables, reported in Table 3. There are statistically significant and negative impacts on the mathematics score from being Black or Hispanic, having a working mother and working more than 21 hours per week. On the other hand, having highly educated parents, coming from families with high socioeconomic status, attending schools located in urban areas and not living in the South appear to increase the mathematics score.[7]

[6] This figure has been computed as (-6.88/14.04)*0.57, where 14.04 is the standard deviation of the 1992 math score and -6.88 is the unconditional estimate for 1992 math test scores for the sample of males.

[7] We obtain qualitatively very similar results for the other three examinations, with the notable

Regarding the impact of parental divorce, conditional estimates for all four examinations are also reported in Table 2 (columns 3 and 4, row 1 of each panel). It is found that parental divorce is associated with a decrease of approximately 7 points in the mathematics, science and history percentile ranks, while the reading rank is only reduced by 3.5 percentile points. The results suggest that conditional coefficient estimates are substantially smaller in absolute value than the unconditional estimates displayed in columns 1 and 2. However, they are are still negative and statistically significant at standard levels and the associated percentage effects range between 7% (mathematics score) and 3% (reading score). [8]

The estimated negative effects so far obtained are generally in line with previous studies on the implications of parental divorce. However, they may overstate the detrimental impact of divorce if they measure both the effect of parental divorce and the effect of unobserved family characteristics, $\eta(i)$, associated with divorce. In fact, when equation (1) is estimated using 1990 (10th-grade grade) test scores information (Table 2, row 2 of each panel), it is found that, *prior* to parental divorce, teenagers whose parents will divorce between 1990 and 1992 perform worse than their counterparts from intact families. This is consistent with the results of Piketty (2003), which reveal that pre-separation children do as bad at school as single-parent children in France.

Given that there are pre-divorce and post-divorce data available, it is possible to control for $\eta(i)$ by comparing the scores of teenagers from divorced families with the scores of these same teenagers before the divorce occurs. However, this comparison is likely to be contaminated by temporal variation in test scores that is not due to parental divorce. Since not all the individuals in the population experience parental divorce, teenagers from intact families can be used to identify temporal variation in the outcome that is not due to divorce. This is the main idea behind the DID estimator.

exception of the statistically significant and negative impact on the reading score from being male.

[8] An alternative way of assessing the magnitude of the effects is to compute the percentage variation of test scores due to parental divorce as $\frac{\sum_{i=1}^{N}[(\hat{Y}_{1i}-\hat{Y}_{0i})/\hat{Y}_{0i}]}{N} * 100$, where N is the total number of observations and $\hat{Y}_{1i}$ and $\hat{Y}_{0i}$ denote the predicted value of test scores for individual i when experiencing parental divorce and when coming from an intact family, respectively. These results, not reported, lead to essentially the same conclusions.

Differencing (1) with respect to t we obtain:

$$Y(i,1992) - Y(i,1990) = \delta + \alpha \cdot D(i,1992) + (\upsilon(i,1992) - \upsilon(i,1990)) \qquad (2)$$

where $\delta = \delta(1992) - \delta(1990)$ The parameters of interest are identified under the condition $P(D(i,1992) = 1|\upsilon(i,t)) = P(D(i,1992) = 1)$ for $t = 1990, 1992$. Under this restriction, the least square estimator of α is the sample counterpart of the following equation:

$$\begin{aligned} \alpha &= \{E[Y(i,1992)|D(i,1992) = 1] - E[Y(i,1992)|D(i,1992) = 0]\} \\ &\quad - \{E[Y(i,1990)|D(i,1992) = 1] - E[Y(i,1990)|D(i,1992) = 0]\} \end{aligned}$$

Note that $P(D(i,1992) = 1|\upsilon(i,t)) = P(D(i,1992) = 1)$ for $t = 1990, 1992$ implies that $(\upsilon(i,1992) - \upsilon(i,1990))$ is mean independent of $D(i,1992)$ and therefore that, in absence of parental divorce, the average test scores for the treated would have experienced the same variation as the average test scores for the controls. This assumption may be implausible if treated and controls are unbalanced in covariates that are thought to be associated with the dynamics of the outcome variable. Hence, we introduce covariates linearly in equation (2):[9]

$$\begin{aligned} Y(i,1992) - Y(i,1990) &= \delta + \alpha \cdot D(i,1992) + X'(i)\pi + Z'(i,1992)\tau(1992) \\ &\quad - Z'(i,1990)\tau(1990) + (\upsilon(i,1992) - \upsilon(i,1990)) \end{aligned} \qquad (3)$$

where $\pi = \pi(1992) - \pi(1990)$ and $X(i)$ and $Z(i,t)$ are two vectors of time-invariant and time-variant observed characteristics, respectively, that are assumed uncorrelated with $\upsilon(i,t)$. Note that the model is now identified under the conditional restriction $P(D(i,1992) = 1|X(i), Z(i,t), \upsilon(i,t)) = P(D(i,1992) = 1|X(i), Z(i,t))$ for $t = 1990, 1992$. In other words, if non-parallel outcome dynamics for the treated and the controls can be explained by including covariates, then model 3 is identified. Accordingly, the plausibility of this condition relies on the inclusion of a rich set of covariates. [10]

[9] Heckman et. al. (1997) and Abadie (2003) propose DID estimators based on conditional identification restrictions which treat covariates non parametrically.

[10] We discuss a way to relax this identifying condition below.

DID estimates without and with covariates (equations (2) and (3), respectively) are displayed in row 3 of each panel of Table 2. The evidence suggests that parental divorce is associated with a very modest decrease in the mathematics and history ranks of less than 2 percentile points, respectively. Moreover, even if these estimates are statistically significant, they translate into negligible percentage effects (not reported).

For the science and reading examinations, parameter estimates are very small in magnitude and statistically insignificant at conventional levels of testing. We have also used the sum of test scores as the outcome of interest, finding that the parameter estimate for the parental divorce variable is very close to zero and statistically insignificant at standard levels. We have also replicated the previous analyses using teenagers whose parents were divorced by 1988 as the comparison groups. The results associated with this alternative comparison group are remarkably similar and therefore not reported. In sum, the evidence based on the DID estimates suggests that parental divorce does not adversely affect teenagers' cognitive development. Thus the earlier cross-section results actually overestimate the detrimental impact of parental divorce.

As previously discussed, the DID model used so far is identified if non-parallel test scores dynamics for the teenagers from divorced and intact families can be explained by including covariates. However, if the dynamics of test scores depend on unobservables, or, in other words, if the unobserved variation associated with divorce is not fixed over time, identification breaks down.[11] One way to assess the plausibility of the identifying condition is to use data on more than one pre-divorce period to apply the DID estimator to periods 1988 and 1990 and test that α is equal to zero:

$$\begin{aligned} Y(i,1990) - Y(i,1988) &= \delta + \alpha \cdot D(i,1992) + X'(i)\pi + Z'(i,1990)\tau(1990) \\ &\quad - Z'(i,1988)\tau(1988) + (\upsilon(i,1990) - \upsilon(i,1988)) \end{aligned} \tag{4}$$

While the results are not reported the evidence is suggestive that the assumption that unobservables are time-invariant may not always apply, since the estimates of α are negative and in some cases statistically significant at standard levels of testing. Alternatively to the DID model, we apply a difference-in-difference-in-differences

[11] Or, more generally if it does not grow at the same rate on average for the treated and the control groups.

(DIDID) estimator to periods 1988, 1990 and 1992.[12] The DIDID model is identified under the more general condition that unobserved factors jointly influencing cognitive development and the probability of divorce grow at a constant rate.[13]

DIDID estimates with and without covariates are reported in Table 4. Parental divorce appears to have a less detrimental impact on math and history scores than implied by the corresponding DID estimates presented in Table 2. For the science and reading examinations, DIDID coefficient estimates are positive and bigger in absolute value than the corresponding DID estimates displayed in Table 2. However, all estimates are negligible and statistically insignificant at the 10% level, supporting the previous conclusion that parental divorce does not negatively affect teenagers' cognitive development. This finding is in line with Corak (2001), who uses Canadian administrative data and concludes that, with respect to labor market outcomes such as earnings and use of social programs, the causal impact of divorce is relatively "mild or insignificant"(p. 712). Along the same lines, Lang and Zagorsky (2001) use data from the NLSY and find little evidence that a parent's presence during childhood affects educational and labor market outcomes.

3.2 The Impact of Parental Divorce by Adolescent Characteristics

Although our analyses mainly focus on the entire sample of adolescents, we also evaluate the impact of parental divorce for teenagers with specified characteristics in Table 5.

The results in Table 5 reveal that the effect of parental divorce is very small for all the categorizations of the data examined. We find that coefficient estimates are never statistically significant at standard levels and we cannot reject the hypothesis that the effects are equal for the mutually exclusive groups considered. For the sake of brevity, Table 5 only displays results for the mathematics score. However, an examination of the corresponding findings for the science, history and reading scores indicated that

[12] The DIDID model with covariates is obtained by substracting equation 4 from equation 3.

[13] Note that this growth rate can differ between the treated and the control group.

they were remarkably similar. This suggests that the impact of parental divorce does not significantly differ across groups of adolescents.

3.3 Age at Time of Parental Divorce

We have so far analysed the effect of experiencing parental divorce for the population of teenagers whose parents divorced while they were between the 10-th and 12th-grade grade. However, the impact of parental divorce may be greater if the divorce occurs when children are younger. Moreover, to the extent that regulations that tighten the divorce regime do not avoid divorce but delay it by a few years, it is also interesting to explore the differences between children whose parents divorced while they were between the 10th-grade and 12th-grade grade with children whose parents divorced at earlier ages. Given that cognitive tests were also administered in the 1988 wave of the NELS:88, some evidence on this issue can be provided by estimating the effect of experiencing parental divorce between 1988 and 1990 on the 1990 (10th-grade grade) test scores. The results of this analysis are reported in Table 6.[14]

All DID coefficient estimates are now negative, including those corresponding to the reading examination, which are positive in Table 2. However, the estimated effects remain very small and statistically insignificant at standard levels. Moreover we cannot reject the hypothesis that these effects equal those reported in Table 2. This indicates that parental divorce is not more detrimental if it occurs when children are younger, at least as long as they are between the 8-th and 12th-grade grade.

This finding is consistent with Cherlin et al. (1995) and Piketty (2003). Cherlin et al. (1995) use British data and find that the timing of parental divorce (ages 7 to 11 versus ages 11 to 16) in a child's life does not make a difference for young adult outcomes. Piketty (2003) obtains analogous results by anaysing French data on school performance.

[14]Note that in this case it is not possible to use a DIDID model because the NELS:88 did not administer cognitive tests before 1988.

3.4 "Long" Run Effects of Parental Divorce

Thus far, we have estimated the impact of parental divorce on cognitive development in a relatively short interval after the divorce occurs. However, long run effects of parental divorce may differ from the short run effects previously estimated. Insight into the long run effects of parental divorce can be found by examining the impact of divorce between 1988 and 1990 on cognitive test scores in 1992, ensuring at least a two-year lag between the dates of the divorce and the examination.[15] Table 7 reports the results of this analysis.

For the math, history and reading examinations, it is found that the long run estimated effects of parental divorce appear to be more detrimental than the short run effects displayed in Table 6. However, both the short run and the long run effects are very modest and we cannot reject the hypothesis that they are equal. This suggests that the long run and the short run effects of parental divorce do not significantly differ.

4 Summary and Conclusions

This paper examines whether parental divorce reduces teenagers' measured cognitive ability. The negative association between parental divorce and children's outcomes has been documented extensively. However, this negative relationship may be reflecting unobserved family differences between teenagers from divorced and intact families. In order to account for the endogeneity of parental divorce we employ a difference-in-differences methodology which controls for the family specific effects operating through the parental divorce decision.

Our empirical work identifies several important results. First, parental divorce does not have a negative causal effect on teenagers' cognitive development. Our evidence also suggests that the impact of parental divorce is almost invariant across groups of adolescents.

[15] It is not possible to analyse a longer time interval because the NELS:88 did not administer cognitive tests after 1992.

Second, we report that teenagers from divorced families perform worse than their counterparts from intact families *before* the divorce actually takes place. Our empirical analysis strengthens the evidence that cross-section estimates actually overstate the adverse impact of parental divorce.

Third, parental divorce does not appear to be more detrimental in the long run than in the short run. Finally, we find that parental divorce is not more adverse for teenagers if it occurs when they are younger, at least as long as they are in grades 8-12.

Overall, our findings suggest that the impact of parental divorce is much less adverse than is suggested by earlier studies based on cross-section analyses that do not control for endogeneity. However, due to data limitations our analysis focuses exclusively on teenagers and we cannot exclude the possibility that parental divorce may be more detrimental for younger children.

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Table 1: Student, Family and School Characteristics by Parental Divorce Status

	Parental Divorce 1990-1992		Intact Families	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
White	0.769	0.423	0.829	0.379
Hispanic	0.097	0.296	0.068	0.252
Black	0.110	0.313	0.053	0.225
Other/non-white	0.024	0.153	0.049	0.217
Catholic	0.255	0.436	0.335	0.472
Protestant	0.562	0.496	0.498	0.500
Other Christian Religion	0.126	0.332	0.108	0.311
Other Religion	0.025	0.157	0.038	0.191
No Religion	0.031	0.172	0.020	0.140
Male	0.460	0.499	0.493	0.500
Weekly Hours of Work:				
0	0.337	0.473	0.301	0.459
1-10	0.149	0.357	0.203	0.402
11-20	0.236	0.425	0.293	0.455
21+	0.277	0.448	0.203	0.402
Mother's Education:				
Missing	0.133	0.340	0.102	0.303
Less than High School	0.137	0.344	0.090	0.286
High School	0.362	0.481	0.328	0.469
College Degree	0.385	0.452	0.378	0.485
Graduate Degree	0.081	0.273	0.102	0.302
Father's Education:				
Missing	0.182	0.386	0.102	0.302
Less than High School	0.184	0.389	0.103	0.304
High School	0.283	0.451	0.273	0.446
College Degree	0.255	0.436	0.366	0.482
Graduate Degree	0.095	0.293	0.156	0.363
Mother Working	0.927	0.260	0.927	0.264
Mother not Working	0.073	0.260	0.075	0.264
Father Working	0.924	0.265	0.949	0.221
Father not Working	0.076	0.265	0.051	0.221
Socioeconomic Status Percentile	46.50	27.83	57.80	26.62
North East	0.150	0.358	0.230	0.421
Mid West	0.299	0.459	0.327	0.469
West	0.217	0.412	0.154	0.361
South	0.334	0.472	0.289	0.453
Public School	0.940	0.237	0.876	0.330
Private School	0.060	0.237	0.124	0.330
School in Urban Area	0.241	0.428	0.223	0.417
School in Suburban Area	0.412	0.492	0.431	0.495
School in Rural Area	0.347	0.476	0.345	0.476
N. Obs.	698		5424	

Note: All statistics are weighted. All time-varying variables refer to 1992. Additional explanatory variables used in the analyses are parental age dummies and dummies for the number of siblings in the household.

Table 2: Effect of Parental Divorce between 1990 (10th-grade grade) and 1992 (12th-grade grade) on Test Scores

	No Covariates		With Covariates	
Examination	Score	Percentile Rank	Score	Percentile Rank
A. Math				
(1) 1992	-7.03**	-14.37**	-3.57**	-7.37**
	(0.92)	(1.91)	(0.65)	(1.33)
(2) 1990	-5.71**	-12.38**	-2.64**	-5.99**
	(-0.90)	(1.86)	(0.57)	(1.22)
(3) DID: (1)-(2)	-1.32**	-1.99*	-0.93**	-1.38*
	(0.50)	(0.94)	(0.32)	(0.59)
B. Science				
(1) 1992	-2.72**	-13.02**	-1.35**	-6.71**
	(0.29)	(1.36)	(0.26)	(1.31)
(2) 1990	-2.57**	-12.89**	-1.31**	-6.69**
	(0.34)	(1.74)	(0.26)	(1.20)
(3) DID: (1)-(2)	-0.15	-0.12	-0.04	-0.02
	(0.31)	(1.42)	(0.22)	(0.99)
C. History				
(1) 1992	-2.47**	-13.20**	-1.36**	-7.13**
	(0.32)	(1.76)	(0.27)	(1.41)
(2) 1990	-1.84**	-10.94**	-0.88**	-5.46**
	(0.25)	(1.61)	(0.22)	(1.31)
(3) DID: (1)-(2)	-0.63**	-2.27*	-0.48**	-1.66∼
	(0.20)	(1.03)	(0.18)	(0.94)
D. Reading				
(1) 1992	-2.87**	-8.49**	-1.20*	-3.50*
	(0.58)	(1.58)	(0.52)	(1.41)
(2) 1990	-3.31**	-9.79**	-1.31**	-3.96**
	(0.65)	(1.91)	(0.49)	(1.38)
(3) DID: (1)-(2)	0.45	1.30	0.11	0.46
	(0.88)	(2.48)	(0.55)	(1.54)

Note: Robust standard errors given in parentheses with p<0.1=˜, p<0.05=* and p<0.01=**. N. Obs.=6,112. DID stands for difference-in-differences.

Table 3: 1992 (12th-grade grade) Mathematics Test Score. OLS Coefficient Estimates

Independent Variable	Coeff.	Std. Error
Parental Divorce 1990-92	-3.569**	(0.654)
Hispanic	-1.867*	(0.804)
Black	-6.256**	(0.960)
Other/non-white	1.722∼	(0.927)
Protestant	-0.435	(0.479)
Other Christian Religion	0.416	(0.726)
Other Religion	1.791∼	(1.014)
No Religion	1.032	(1.202)
Male	1.742**	(0.390)
Weekly Hours of Work:		
1-10	-0.047	(0.553)
11-20	-0.576	(0.502)
21+	-4.594**	(0.602)
Mother's Education:		
Missing	-1.318	(1.313)
High School	-0.641	(0.849)
College Degree	1.468	(0.926)
Graduate Degree	1.397	(1.083)
Father's Education:		
Missing	1.355	(1.148)
High School	1.696*	(0.819)
College Degree	3.372**	(0.875)
Graduate Degree	4.448**	(1.040)
Mother Working	2.418**	(0.710)
Father Working	-0.373	(0.906)
Socioeconomic Status Percentile	0.140**	(0.012)
North East	2.505**	(0.598)
Mid West	2.153**	(0.504)
West	1.285*	(0.643)
Public School	-0.864	(0.722)
School in Urban Area	1.30*	(0.586)
School in Suburban Area	0.617	(0.452)
Constant	38.661**	(1.986)
N. Observations	6,122	

Note: Robust standard errors given in parentheses with p<0.1=˜, p<0.05=* and p<0.01=**. In addition to the variables shown the regression includes parental age dummies and dummies for the number of siblings in the household.

Table 4: Effect of Parental Divorce between 1990 (10th-grade grade) and 1992 (12th-grade grade) on Cognitive Test Scores. DIDID Estimates

	No Covariates		With Covariates	
Examination	Score	Percentile Rank	Score	Percentile Rank
A. Math	-0.09	-0.27	-0.20	-0.21
	(1.09)	(2.07)	(0.68)	(1.30)
B. Science	1.15~	5.05	0.73	3.45
	(0.67)	(3.67)	(0.44)	(2.47)
C. History	-0.26	-0.92	-0.19	-0.02
	(0.29)	(1.78)	(0.28)	(1.71)
D. Reading	1.98	5.06	0.93	2.78
	(1.60)	(4.74)	(0.99)	(2.97)

Note: Robust standard errors given in parentheses with p<0.1=~, p<0.05=* and p<0.01=**. N. Obs.=6,122. DIDID stands for difference-in-difference-in-differences.

Table 5: Effect of Parental Divorce between 1990 (10th-grade grade) and 1992 (12th-grade grade) on Math Test Scores by Adolescent Characteristics. DIDID Estimates with Controls

	Math Score	Math Percentile Rank
A. By Gender		
(1) Females	-0.80	-1.21
	(0.98)	(1.86)
(2) Males	0.62	1.13
	(0.76)	(1.44)
B. By Religion		
(1) Catholic	0.35	0.59
	(0.70)	(1.45)
(2) Non-catholic	-0.31	-0.36
	(0.83)	(1.58)
C. By Type of School		
(1) Public	-0.37	-0.50
	(0.80)	(1.37)
(2) Non-public	0.59	0.81
	(0.93)	(2.43)
C. By Socioeconomic Status		
(1) 1st Quartile	1.47	2.71
	(1.16)	(1.71)
(2) 4th Quartile	0.39	0.96
	(0.90)	(2.04)
D. By Father's Education		
(1) College or Graduate Degree	-0.26	-0.45
	(0.67)	(1.45)
(2) High School or Less	1.05	1.75
	(0.87)	(1.40)
E. By Mother's Education		
(1) College or Graduate Degree	-0.01	-0.34
	(0.65)	(1.39)
(2) High School or Less	0.35	0.84
	(0.69)	(1.29)

Note: Robust standard errors given in parentheses with p<0.1=˜, p<0.05=* and p<0.01=**. N. Obs.=6,122. DIDID stands for difference-in-difference-in-differences. All specifications include the control variables listed in Table 1.

Table 6: Effect of Parental Divorce between 1988 (8-th grade grade) and 1990 (10th-grade grade) on Test Scores

	No Covariates		With Covariates	
Examination	Score	Percentile Rank	Score	Percentile Rank
A. Math				
(1) 1990	-6.03**	-12.84**	-2.91**	-6.27**
	(1.03)	(2.12)	(0.68)	(1.46)
(2) 1988	-4.50**	-11.06**	-2.23**	-5.35**
	(0.70)	(1.73)	(0.72)	(1.82)
(3) DID: (1)-(2)	-1.53∼	-1.78	-0.68	-0.92
	(0.79)	(1.53)	(0.49)	(0.97)
B. Science				
(1) 1990	-2.55**	-12.60**	-1.41**	-7.05**
	(0.37)	(1.93)	(0.30)	(1.48)
(2) 1988	-1.46**	-8.94**	-0.75*	-4.65*
	(0.34)	(2.22)	(0.31)	(1.95)
(3) DID: (1)-(2)	-1.09**	-3.66	-0.66**	-2.40
	(0.42)	(2.57)	(0.24)	(1.54)
C. History				
(1) 1990	-1.98**	-11.93**	-0.86**	-5.61**
	(0.29)	(1.80)	(0.26)	(1.52)
(2) 1988	-1.51**	-10.11**	-0.56*	-3.89**
	(0.25)	(1.68)	(0.24)	(1.49)
(3) DID: (1)-(2)	-0.47*	-1.82	-0.31	-1.72
	(0.21)	(1.34)	(0.21)	(1.21)
D. Reading				
(1) 1990	-3.60**	-10.63**	-1.24*	-3.74*
	(0.72)	(2.08)	(0.55)	(1.55)
(2) 1988	-2.23**	-7.44**	-0.64	-2.04
	(0.56)	(1.91)	(0.49)	(1.67)
(3) DID: (1)-(2)	-1.37∼	-3.19	-0.60	-1.70
	(0.82)	(2.63)	(0.49)	(1.58)

Note: Robust standard errors given in parentheses with p<0.1=˜, p<0.05=* and p<0.01=**. N. Obs.=6,019. DID stands for difference-in-differences.

Table 7: "Long Term" Effect of Parental Divorce between 1988 (8-th grade grade) and 1990 (10th-grade grade) on 1992 Test Scores. DID Estimates.

	No Covariates		With Covariates	
Examination	Score	Percentile Rank	Score	Percentile Rank
A. Math	-2.58**	-3.29**	-1.32**	-1.87∼
	(0.66)	(1.28)	(0.48)	(0.97)
B. Science	-1.08**	-3.19*	-0.28	-0.61
	(0.24)	(1.52)	(0.23)	(1.33)
C. History	-0.97**	-2.94∼	-0.66**	-2.18∼
	(0.28)	(1.59)	(0.21)	(1.20)
D. Reading	-1.09**	-2.51*	-0.79*	-2.27*
	(0.34)	(1.11)	(0.33)	(0.91)

Note: Robust standard errors given in parentheses with p<0.1=˜, p<0.05=* and p<0.01=**. N. Obs.=6,019. DID stands for difference-in-differences.