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Intergenerational effects of welfare reform

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Abstract

This paper estimates the impact of the fundamental welfare reforms of the 1990s on the educational attainment of children in low-income families. Using data from national surveys of individuals and administrative records of school districts spanning the period from the early 1990s to the mid 2000s, we estimate the net effects of welfare reform in a difference-in-differences framework. We find that low- and higher-income children experience statistically indistinguishable time trends in outcomes prior to reform, whereas in sharp contrast, in the period following welfare reform, low-income children experience significant and growing relative gains in educational attainment. The income gaps in school enrollment and 7-12th grade drop-out rates narrow by more than 20% in the years following welfare reform. These findings are robust to changing the definition of low- and higher-income groups and to controlling for contemporaneous economic and policy changes.

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1. Introduction

It is a widely-held policy belief that raising the schooling of children from low-income families is an essential step towards severing intergenerational links in poverty (Solon 1992) and dependence on public assistance (Pepper 2000). A corollary is that social programs aimed at improving the well-being of low-income families should be evaluated in large part according to their educational effects. This paper evaluates the impact of the welfare reforms of the 1990s – arguably the most dramatic reforms in the history of the US welfare system – on the educational attainment of children from low-income families, an outcome omitted from most prior evaluations.

The dramatic changes to the US welfare system embodied in the state welfare waivers of the early 1990s and the federal Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 were aimed at promoting adult employment and reducing long-term dependence on public assistance. While the details varied across states, common policy innovations include time limits, job subsidies, work requirements, and increased funding for child support. Most of the existing scholarly work in the welfare reform literature has focused on adults, and found substantial increases in the labor force participation of single-mothers and reductions in public assistance caseloads (Blank 2002, Moffitt 2003, and Grogger and Karoly 2005). These observed changes in maternal behavior, along with potential changes in family structure, parenting quality, and self-motivation, can lead to considerable changes in the educational investments and schooling outcomes of children in low-income families.

This paper is the first to measure the impact of welfare reform on the educational attainment of children in low-income families using nationally representative samples. Educational attainment measures spanning the period from the early 1990s to the mid 2000s are drawn from two sources: enrollment rates for youths aged 13-18 from the Current Population Survey (CPS) and grades 7-12 dropout and high school completion rates from the school district universe records of the Common Core of Data (CCD).

We estimate the net effect of welfare reform in a generalized difference-in-differences framework, in which trends in the educational attainment of children in higher-income households are used to impute counterfactual trends for what would have happened to youths in low-income households in the absence of welfare reform. We find

that low- and higher-income children experience statistically indistinguishable time trends prior to the reforms. In sharp contrast, in the period following welfare reform, low-income children experience significant and growing relative gains in educational attainment. This finding is robust to alternative definitions of low- and higher-income groups and to controlling for the adoption of school accountability programs – the most important contemporaneous policy change that likely affected the low- and higher-income students differentially. This new evidence confirms and strengthens the findings of Miller and Zhang (2007) that welfare reform produced intergenerational educational gains.

This paper contributes to the new and growing literature on the intergenerational effects of welfare reform on two fronts. First, we focus on schooling outcomes for older children and provide the first evidence of beneficial effects for adolescents. Prior research on the welfare reform experiments finds evidence of improvements in self- and teacher-reported academic achievement and test scores for young children randomized into the reform groups (Duncan and Chase-Lansdale 2001, Zaslow et al. 2002, Morris et al. 2005).[2] More recently, Miller and Zhang (2007) use data from the National Assessment of Educational Progress (NAEP) and find substantial mathematics test score gains for low-income 4th grade students relative to their higher-income peers in the years following national welfare reform. The causal link to welfare reform is strengthened by cross-state variation in treatment effects: gains are larger in states with greater initial welfare caseloads and greater caseload reductions.

Although childhood gains are important, the benefits from early interventions may not last.[3] Indeed, some experimental studies find that self-reported dropout, expulsion and suspension rates increased for adolescents in the treatment group (Gennetian et al. 2004). The finding of an adverse effect of welfare interventions, however, may be due to the limited schooling outcome measures or other drawbacks of

[2] The welfare experiments are: the Florida Family Transition Program; the National Evaluation of Welfare to Work Strategies in Atlanta (GA), Grand Rapids (MI) and Riverside (CA); the Minnesota Family Investment Program; the Milwaukee New Hope; and the Canadian Self-Sufficiency Project. Studies of child outcomes are still pending for three additional programs: the Connecticut Jobs First Program; the Indiana Welfare Reform Evaluation; and the Iowa Family Investment Program.

[3] Barnett (1995) and Karoly et al. (1998) report evidence that test score gains from the Head Start program dissipate by the third grade. At the same time, Garces et al. (2002) finds significant long-term gains for Whites from Head Start participation, including higher school completion rates.

the experimental studies discussed below. By contrast, this paper uses objective schooling outcome measures for nationally representative samples of adolescents, and thus represents a crucial addition to the understanding of the intergenerational effects of welfare reform.

Our second contribution is methodological. Our educational attainment data span the period from 1991 to 2005 and include multiple pre-reform observations for almost all states. This allows us to study the effects of the actual national and state-wide welfare reforms. In the experimental studies, in contrast, the geographic variation is limited, and the policies under study tended to employ weaker work requirements than the state-wide and national reforms; hence they are likely to miss the general equilibrium effects of the national reforms (Grogger and Karoly 2005). Additionally, the experimental setup prevents researchers from assessing entry and exit effects if welfare reform causes some adults to avoid or curtail their participation. This is particularly problematic for studies focused on adolescents, because they themselves are potential welfare recipients. The low-income group in this paper is defined to include former, current, and potential welfare recipients and to facilitate the capturing of the important entry effects. Miller and Zhang (2007) have a similar research design as the present paper and avoid the same problems related to experimental studies, but their results are weakened due to the lack of pre-reform achievement data. With educational attainment data spanning periods both before and after the reforms, in this paper, we are able to conduct a dynamic event investigation in the difference-in-differences framework. This provides additional justification for a causal interpretation of the beneficial effects associated with welfare reform.

The rest of the paper is organized as follows. Section 2 provides background on welfare reform and educational attainment. Section 3 describes the educational attainment measures used in the analysis. Sections 4 and 5 discuss results. Section 5 concludes.

2. Welfare Reform and Schooling Background

In standard human capital models (Becker 1964; Ben-Porath 1967), utility maximizing individuals invest in schooling up to the point at which the benefit from an additional

year of schooling (higher discounted future earnings, better health, and higher non-pecuniary values) is equal to the cost (forgone earnings, direct monetary costs, and disutility from studying). Optimal schooling varies across individuals as a result of differences in innate ability, family and school inputs, and socio-economic environment that alter the cost or benefits of schooling. Welfare reform led to changes in maternal behavior and family environment that can affect the educational outcomes of low-income individuals through various pathways.

First, increased maternal employment may cause changes in family inputs into children's education. On the one hand, maternal employment can hinder school performance by reducing time available for home production, such as supervising and disciplining children, reading to them, and assisting with homework.[4] Slower learning progress accumulated over time can lead to large skill gaps by adolescence and early dropout decisions.[5] Lagging behind peers in school performance can also lead to greater disutility from schooling and earlier school exit. On the other hand, working mothers may feel more secure and confident, resulting in greater productivity at home. They may also provide their children with improved stability and daily routine, serve as positive role models for their children, and instill a desire for financial independence and greater academic achievement.[6] Increased family income may also boost children's school performance through improved nutrition and reading materials at home. Improved school performance in turn can lead to increased schooling quantity.

Second, improvements in the design of the cash transfer system can reduce the distortions that are otherwise caused by means-tested transfer programs that reduce

[4] Since the Coleman Report (Coleman et al. 1966), a long line of scholars in a variety of disciplines have studied the role of families in children's academic achievement.

[5] In Becker (1964) and Ben-Porath (1967), individuals benefit more from schooling when they are more productive in translating time in school into additional units of human capital, and hence they stay in school longer. There is substantial evidence that students who do better in school, either through grades or scores on standardized achievement tests, tend to go further in school. See, for example, Rivkin (1995) and Hanushek, Rivkin and Taylor (1996).

[6] There is experimental evidence that the children of women assigned to welfare policies that promoted adult education and training showed improved school readiness and fewer academic problems (Magnusen and McGroder 2002). However, our study measures the effects of the national and statewide reforms, which focused more on employment; indeed, Jacobs and Winslow (2003) details how the "work-first" approach of TANF may have reduced higher education enrollment among single-mothers.

incentives for investment in skills.[7] Welfare reform increases the financial returns to schooling for low-income individuals to the extent that it makes long-term dependence on public assistance a less attractive or viable alternative to paid employment. Low-income youths may stay at school longer because of this direct incentive. These different pathways lead to opposing effects, and the net effect of welfare reform on schooling is inherently an empirical question.

We estimate the net effect of welfare reform on low-income children's educational attainment in a difference-in-differences framework:

$$(1) \qquad E_{ist} = \beta_1 \cdot LI_i + \sum_j \beta_2^j \cdot YSR_{st}^j + \sum_j \beta_3^j \cdot LI_i \cdot YSR_{st}^j + \beta_X \cdot X_{ist} + \varepsilon_{ist} ,$$

where *s* indexes state, *t* indexes year, and *i* indexes the unit of observation. *LI* measures *i*'s low income status.[8] YSR_{st}^j is a vector of indicators for j^{th} year since state implementation of welfare reform with negative *j* indicating years before reform. X_{ist} is a vector of control variables.

The timing of welfare reform is defined for each state as the year in which the state first instituted major reforms to its cash-transfer system. Data on welfare policies are from Crouse (1999) and U.S. DHHS (1997). The first two columns of Appendix Table 1A list each state's timing of welfare reform. For states that adopted AFDC waivers, we define the reform date as the earliest state-wide waiver date. For other states, we use the date they switched from AFDC to TANF.

The coefficients of primary interest are in the vector β_3^j, the differential trends in educational attainment between low- and higher-income students surrounding welfare reforms. It measures the treatment effect of welfare reform on low-income students. The assumption underlying the model is that the groups experience otherwise similar changes in educational environment during the period so that the observed trend in educational attainment for higher-income adolescents provides an appropriate counterfactual estimate for what would have happened to low-income adolescents in the absence of welfare

[7] Efficiency concerns embodied in this Samaritan's Dilemma lead Bruce and Waldman (1991) to advocate in-kind transfers.

[8] The unit of observation is an individual in the CPS and a school district in the Common Core of Data (CCD). Low income status is an indicator variable in the CPS and is the share of students in a school district who are low income in the CCD data. Slightly different forms of Equation (1) are estimated in Sections 4 and 5 for the two data sets.

reform. Conditional on covariates,[9] we assume that welfare reform is the only systematic factor that has a differential impact on the poor. Although the assumption is not directly testable during the reform period, it is supported by data prior to welfare reform, as discussed in Sections 4 and 5.

To ensure that we isolate the impact of welfare reform, we control for factors that could independently influence school enrollment and dropout rates. Temporary upward shifts in labor demand can increase the opportunity cost from not working and increase dropout rates.[10] We use state-year macroeconomic indicators – unemployment rate and income per capita – to control for the labor market conditions. Increased school resources may increase the benefit of schooling and reduce dropout rates.[11] We therefore control directly for the educational inputs using spending per pupil and the pupil-teacher ratio.

We also address the potentially confounding effect of a contemporaneous education policy change that may have affected low-income students differentially: school accountability reform. Following Hanushek and Raymond (2005), we define an accountability system as a mechanism for publicly disseminating information on standardized test performance for each school, along with a way to aggregate and interpret the school performance measure. States are classified as "consequential" states if they both report results and attach consequences to school performance or "report card" states if they only provide a public report. Consequential accountability may provide stronger incentives to schools than report-card accountability. States began introducing school accountability systems in the early 1990s, and by 2003, 31 states had consequential accountability. The timing of state accountability program adoption is also reported in Appendix Table 1A.

The passage of No Child Left Behind Act (NCLB) in January of 2002 demanded strong accountability of schools in all states. Between January and June 2003, states submitted their plans for implementing an accountability system under NCLB to the

[9] In some models, the set of covariates includes interaction terms between observable controls and low-income status. Including these additional terms does not alter the estimates of the relative time trends.

[10] Card and Lemieux (2000) found the local unemployment rate to be an important explanatory variable for lower school enrollment rates in the 1970s. Neumark and Wascher (1995) found that increases in the minimum wage reduced the proportion of teenagers enrolled in school, and increased the proportion of teenagers neither enrolled nor employed.

[11] However, the role of spending in improving educational outcomes remains controversial (Hanushek 1986).

Department of Education. By June 2003, all were approved. Therefore, we consider 2003 the year the 19 report-card states and DC introduced consequential accountability. In the analysis that follows, we control for the presence of a consequential accountability system and for the years elapsed since its adoption, and we allow these variables to have different effects on low-income children.[12]

Appendix Table 1B summarizes the timing of state welfare reform and state accountability reform. Two useful facts emerge from the table. First, states did not generally adopt the two reforms simultaneously. Second, early accountability reform states are not early welfare waiver states. These facts enable us to distinguish the effects of two types of reforms.

3. Measures of Educational Attainment

We consider two complementary educational attainment measures: self-reported school enrollment from CPS October files and school dropout and high school completion rates from school district administrative records.

3.1 School Enrollment

School enrollment data for young adults are obtained from the Current Population Survey's October supplement files from 1990 to 2005. The main dataset includes over 168,000 observations of children aged 13-18 for whom schooling and household income information are available.

The primary measure of low-income family status is an indicator of eligibility for subsidized (free or reduced price) school lunches, assigned according to the condition that household income is below 185% of the federal poverty level (SLE).[13] This cutoff is chosen in part for comparability with the analysis in Miller and Zhang (2007). However, the definition is quite broad, and the low-income group includes many children whose families are not eligible for welfare payments and were not directly affected by the

[12] Report-card accountability programs have no significant effects on educational attainment, either alone or added along with consequential programs; nor do they affect estimated effects of welfare reform.

[13] Total household income and number of household members are obtained from the CPS October files. They are compared to the federal poverty level for the given family size in that calendar year to determine income status. Income is not observed continuously in the data, but is reported in ranges. Low-income status is defined conservatively, using the highest point of the income category as reported income. Results do not change if the mid-point or lower-bound of the reported range is used instead.

reforms.[14] This will dilute the measured impact and introduce attenuation bias in the treatment effects. Hence, we test the robustness of the results to alternative, narrower definitions of low-income status: household income below 130% of the poverty level (corresponding to the cutoff for free school lunch eligibility, FLE), income below poverty, and mother has fewer than 12 years of completed schooling. Each of the low-income groups defined above is likely to contain children formerly and currently eligible for welfare assistance, as well as children potentially eligible; therefore, these definitions allow us to avoid the issue of sample selection due to entry into or exit from welfare.

Table 1 shows the basic time pattern of school enrollment rates during the sample period, separately for children aged 13 to 18 in low-income (SLE) and higher-income (SLI – subsidized school lunch ineligible) households based on the 185% poverty level cutoff. The first two columns report school enrollment rates in October of each year using CPS household weights. School enrollment rates for higher-income children show fluctuations, but no clear trend, while those for lower-income children have a tendency to increase. The un-weighted means are very similar, with differences less than 0.1%. Low-income children are about 8% less likely to be enrolled in school, but that gap has narrowed from 9% to 6% over the 16 year sample period. The average annual percentage growth rate is 0.4% for low-income children but only 0.1% for higher-income children. The regression analysis that follows explores the timing of the narrowing relative to state-level adoption of welfare reforms and confirms that the narrowing remains significant after controlling for changes in observables.

Appendix Figure 1 illustrates the raw trends in enrollment rates between 1995 and 2005, separately for children of different ages and family income levels. There is substantial heterogeneity in enrollment rates by age, with near full enrollment for those aged 15 and younger. School enrollment is lower for older children, and gaps between low-income and higher-income children are more pronounced. Over time, enrollment increased for SLE individuals aged 16-18 and for SLI individuals aged 18.

[14] Using data from USDA and the US DHHS, we calculate that the national average ratio between the number of families on welfare and the number of children eligible for free or reduced-price lunches is 0.3 in 1996 and 0.13 in 2005. Additionally, about 85% of students eligible for free or reduced-price lunches are eligible for free school lunches.

In the analysis, we do not distinguish between high school and other school enrollment, but instead use the age cutoff of 18 to define our sample. We impose the upper age limit to ensure that our household income measure captures parental resources. Young adults enrolled in college are counted in the enrolled group.[15] Results using alternative age cutoffs are discussed in Section 4. Although our sample does include some college students (8% of SLI and 4% of SLE students), we are unable to analyze the effects of welfare reform on college decisions in any detail. The results of the paper should be interpreted as largely applying to high school enrollment, while bearing in mind that gains at the secondary level may carry over to later schooling.

3.2 School Dropout and High School Completion Rates

School district panel data for school dropout and high school completion rates are obtained from the Common Core of Data (CCD) survey of the U.S. Department of Education. The survey covers all school districts in the country, but data are only available for districts that satisfy the Department's minimum reporting standards. Dropout rates are available separately by grade and averaged over grades 7 to 12 and 9 to 12 from 1991 to 2003; high school completion rates are available from 1994 to 2003. We aggregate CCD school level data to compute the share of students in each district that is eligible for free lunches through the national school lunch program (household income below 130% of federal poverty level).

The grade G dropout rate for school year T (school year beginning in the fall of year T) is defined as the ratio of the number of students who are enrolled in grade G in school year T but are not enrolled in any grade at the beginning of school year T+1 to the number of students enrolled in grade G in school year T. Students who graduated from high school or transferred to another school are not counted as dropouts.[16] For example, the 7th grade dropout rate for school year 2000 is the percentage of students who were enrolled in grade 7 in school year 2000 but were not enrolled at the beginning of school

[15] The enrolled group includes all respondents who were enrolled in a regular school at the time of the survey. Regular school includes day and night school, public, parochial, and other private school, and includes any schooling that leads to a high school diploma, college degree, or professional degree.

[16] Administrative calculations of dropout and completion rates are flawed, in large part because school districts have limited ability to track student migration. In order to improve data quality for these key educational outcomes, some have proposed that students be assigned unique national ID numbers at school entry that remain with them throughout their schooling careers (Orfield et al. 2004).

year 2001 relative to the number enrolled in grade 7 in school year 2000, and the dropout rate over grades 7 to 12 in school year 2000 is the percentage of students who were enrolled in grades 7 to 12 in school year 2000 but were not enrolled in any grade at the beginning of school year 2001 relative to the number enrolled in grades 7 to 12 in school year 2000. The 7 to 12 dropout rate can be considered an overall measure of a district's effectiveness at keeping students enrolled. High school completers are students who receive a high school diploma or a certificate of attendance/completion at the end of the summer of a school year. General Education Development (GED) recipients are not counted. The high school completion rate is the number of completers divided by the sum of the number of completers, the number of grade 12 dropouts in current year, and the number of dropouts from grades 11, 10, and 9 in the preceding 3 years, respectively.[17]

Table 2 reports summary statistics for the dropout and completion rates over all years and all school districts. We restrict our analytic sample to states with at least four years of valid observations.[18] The dropout rate increases monotonically from grade 7 to grade 12, reflecting to a large part the age distribution of different grades. Overall, 99% of school districts have a dropout rate below 14% for grades 7-12 and below 18% for grades 9-12. On average, the high school completion rate is 86%. The majority of high school completers receive a high school diploma, and only 1.3% complete high school with a certificate. Also reported in Table 2 is a summary of the share of students eligible for free school lunch (*ShFLE*). Averaged across districts, 26% of students are eligible for free school lunches, and the median school district has 22% eligible students. Additionally, the wealthiest 10% of districts have less than 5% eligible students, and the poorest 10% of districts have more than 50% eligible students.

[17] Our high school completion rate measure is closely related to Heckman and LaFontaine (2007)'s preferred estimator with CCD data, which is calculated by dividing the number of diplomas issued in a given year by the number of students enrolled in the 8th grade five years earlier. Our measure sums the dropout counts (effectively, changes in enrollment) from 9th to 12th grades over the previous 4 years, and is thus similar to using an 9th grade enrollment base, but accounting for transfers across districts and excluding students retained at any of grades 9 to 12. Results are unchanged if we use completion rate calculated relative to 8th grade enrollment 5 years earlier or relative to 9th grade enrollment 4 years earlier.

[18] The excluded states (California, Colorado, Indiana, Michigan, New Hampshire and Washington for dropout analysis; Alaska, DC, Florida, Kansas, New Hampshire, North Carolina, Ohio, South Carolina, and Tennessee for completion analysis) mostly appear in the dataset only at the end of the sample period, and hence, can't contribute to the before and after event analysis of welfare reform. Results are qualitatively unchanged if we include all useable observations.

Appendix Figures 2A and 2B display time trends in school dropout and high school completion rates. From 1991 to 2003, there is a general decrease in school dropout rates over all grades, and the 4-year high school completion rate also increases slightly between 1994 and 2003. Additionally, states with larger shares of their student populations classified as low-income have relatively more dropouts and fewer high school completers, as illustrated by Appendix Figures 3A and 3B.

Since welfare reform only directly affects low-income students, we can estimate its impact on schooling by comparing differential trends in outcomes between FLE and non-FLE students around the time of reform. Since our data are aggregated at the school district level, we compare differential trends in outcomes across districts according to their share FLE ($ShFLE_{it}$). The trends in outcomes for 4 groups of school districts with different shares of FLE students are shown in Figure 1. The four groups of districts include two with very low FLE shares (under 10% and under 5%) and two with high shares (over 30% and over 40%). Each line plots the change in the enrollment-weighted average 7th to 12th grade dropout rate for that group of districts relative to its value in 1996, the year PRWORA was passed. Before 1996, dropout rates for the four groups of school districts track each other quite closely, whereas after 1996, there is an unmistakable divergence between the low $ShFLE_{it}$ districts and the high $ShFLE_{it}$ districts. Higher-income districts with under 5% FLE students show stable dropout rates over the entire period. Districts with under 10% FLE students show a flat trend before 1996 and a slight decrease afterwards. In sharp contrast, districts with larger shares of low-income students see an abrupt break from the pre-1996 trend; their dropout rates fall consistently and considerably over the entire post-1996 period. The patterns in the raw data are dramatic, and are confirmed in the formal regression analysis that follows.

4. Estimation Results for School Enrollment Rates

In this section, we examine the effects of welfare reform on school enrollment using data from the Current Population Survey's October supplement files from 1990 to 2005. The following version of Equation (1) is estimated using individual-level data:

$$(2) \qquad E_{ist} = \alpha_s + \alpha_t + \beta_1 \cdot LI_{it} + \sum_j \beta_2^j \cdot YSR_{st}^j + \sum_j \beta_3^j \cdot LI_{it} \cdot YSR_{st}^j + \beta_X \cdot X_{ist} + \varepsilon_{ist} \ ,$$

where the dependent variable is an indicator equal to 1 if an individual is enrolled in school. α_s and α_t are state and year fixed effects; LI_i is an indicator equal to 1 if an individual is in the low-income group; YSR_{st}^j is a vector of indicators for 7 or more years before reform, 5-6 years before, 3-4 years before, 1-2 years before, 1-2 years after, 3-4 years after, 5-6 years after, 7-8 years after, 9-10 years after, and 11 or more years after. Since all states experienced welfare reform during the sample period, the omitted category is for the year of reform, and β_2^j on years before and after reform should be interpreted as changes relative to the baseline reform year.

The treatment effect of welfare reform exposure is captured by the vector β_3^j that measures changes in the enrollment gap by income, relative to the baseline year of welfare reform. A positive sign on β_3^j for the pre-reform years indicates a relative decline in enrollment for low-income children in the years leading up to welfare reform. A positive sign on β_3^j for the post-reform years indicates a relative increase in enrollment for low-income children in the subsequent years.

The control variables in X_{ist} include individual level characteristics such as race and gender and a series of age fixed effects. They also include changing state-level macro-economic and educational characteristics: the educational attainment of adults in the state, per capita state income, state unemployment, spending per pupil, pupil-teacher ratios in public schools, and school accountability reform. Summary statistics for the key control variables are reported in Appendix Table 3.

The regression estimates of the differential time trends, β_3 in Equation (2), are reported in Table 3. To allow for arbitrary correlations in the ε_{ist} error term across individuals and over time within states, we cluster the standard errors at the state level for all estimation and hypothesis testing.

Column 1 begins with the basic linear probability model, and including child age, state and year fixed effects and the full set of covariates. Estimation is conducted using weighted least squares using the CPS household weights. The definition of low-income status in Column 1 is subsidized lunch eligibility (SLE), 185% of the poverty level. The point estimates for the years after reform are positive, and after 3 years, statistically

significant. They imply that school enrollment increased 2 percentage points more for low-income children in the years following welfare reform. The coefficient estimates for differential pre-trends are neither individually nor jointly significant. This supports the validity of the difference-in-differences approach for estimating the treatment effect from welfare reform. It suggests that the relative gains observed in the post-reform period were not the result of a pre-existing differential trend in school enrollment for the income groups. Figure 2A depicts the β_3 estimates graphically: point estimates are marked with diamonds, surrounded by bars indicating the 90% confidence intervals.

The basic patterns are echoed in the estimation results using alternative definitions of low-income status. Figure 2B shows that when the low-income group is limited to those eligible for free lunches (FLE, income below 130% of poverty), the post-reform effects are larger, over 3 percentage points after a decade, and again significantly different from zero. Using the poverty level as the income cutoff substantially reduces the low-income sample size (over 30 states average fewer than 30 low-income observations per year) and leads to noisier estimates of the treatment effect. Defining the disadvantaged sample as children whose mothers have fewer than 12 years of formal schooling also decreases the sample size, in part as a result of observations missing maternal education information. Figures 2C and 2D show that these estimates confirm the break from trend around the time of welfare reform.

The next columns of the table demonstrate robustness of the findings to changes in the estimation equation and sample. Column 2 shows un-weighted ordinary least squares estimates of the same model. In Column 3, the equation is estimated in a Probit model, and the effects of a discrete change from 0 to 1 are reported. Like the previous column, these un-weighted estimates show significant gains in the post-reform period. Unlike the prior estimates, they also find a statistically significant change in the years leading up to reform: the estimate for 3-4 years before reform is positive and significant. The positive sign implies the presence of a prior trend towards increasing inequality that was reversed following welfare reform. However, the coefficients in the linear model vary in sign in the pre-reform period and an F-test on the joint significance of the pre-trends in the Probit model fails to reject zero. Column 4 includes a full set of interactions between the control variables (X_{ist}) and low-income indicator. Here again, the pre-reform

low-income interactions are statistically insignificant, and the post-reform interactions show relative gains on the order of a 2 percentage point reduction in the enrollment gap after 7 years. This corresponds to a substantial 22% narrowing of the initial gap.

During the sample period, the minimum age for a child to legally drop out of school was at least 16 in all states.[19] Not surprisingly, when the sample is restricted to children aged 16 and older, as in column 5, the point estimates increase substantially in magnitude and remain statistically significant. Additionally, excluding 18 year olds from the sample leaves the results qualitatively unchanged. In separate estimation, no consistent differences in treatment effects are detected for males versus females or whites versus non-whites.[20]

Each column in the table represents a regression that includes the full set of X_{ist} controls and state, year and age fixed effects. The state and time varying controls are generally statistically insignificant, with the notable exception of the interaction term for low-income and years since school accountability reform. The estimates range from negative 0.04 to negative 0.15, which suggests that accountability reforms lead to lower enrollment for low-income adolescents. The estimated effects of welfare reform are insensitive to the exclusion of the accountability reform measures and their interactions with family income.

5. Estimation Results for School Dropout and High School Completion Rates

The following form of Equation (1) is estimated using school district-level panel data:

$$(3) \quad E_{ist} = \alpha_i + \alpha_t + \beta_1 \cdot ShFLE_{it} + \sum_j \beta_2^j \cdot YSR_{st}^j + \sum_j \beta_3^j \cdot ShFLE_{it} \cdot YSR_{st}^j + \beta_X \cdot X_{ist} + \varepsilon_{ist} \ .$$

Each observation is a school district (*i*), located in a state (*s*), for a time period (*t*). The dependent variable is the district's dropout or high school completion rate; α_i and α_t are school district and year fixed effects. Since we are unable to use an individual level

[19] For state compulsory school attendance age, see Digest of Education Statistics, various issues. The oldest age of entry ranges from 5 to 8 and youngest age of exit ranges from 16 to 18.

[20] Coefficients for the interactions between the low-income indicator and indicators for years since waiver are generally, but not always, larger for girls than for boys. When the treatment effect is estimated for the interaction between the low-income indicator and a post-reform indicator, the impact for girls is 1.4% and for boys is 1.1%, each significant at 5% level. The difference in treatment effects is not statistically significant. For whites, the low-income*post-waiver term is 0.7% and for non-whites, it is 0.5%, neither significant at conventional levels.

indicator for low-income status to define the treatment and control groups, we use the share of students in the district who qualify for free school lunches ($ShFLE_{it}$) to measure the intensity of the treatment from welfare reform.[21]

The treatment effect of welfare reform exposure is captured in the series of β_3^j coefficients that measure differential changes in the dropout rate relative to the baseline year of welfare reform between districts with no FLE students and districts with 100% FLE students. A positive sign on β_3 indicates a relatively higher dropout rate for district with a larger FLE share. The control variables in X_{ist} include district level school input variables – pupil-teacher ratio and spending per pupil – and changing state macro-economic and educational characteristics – educational attainment of adults in the state, school accountability reform, state income per capita and the state unemployment rate.

Table 4 presents the results from weighted least squares estimation.[22] The first column shows the time pattern of treatment effects, for dropout rates in grades 7 to 12 around the time of welfare reform, in a specification with no X_{ist} controls. The change in the dropout rate relative to the year of welfare reform appears similar across districts with different FLE shares in the years prior to reform. In the years following welfare reform, however, the dropout rate relative to the base year is significantly lower for districts with larger shares of FLE students. Additionally, as more time elapses between welfare reform and the outcome measurement, districts with large FLE shares experience even greater relative declines in their dropout rates. In Column 2, we add state- and district-level control variables. The results are qualitatively similar, but the magnitudes of treatment effect are larger. For example, in one to two years after the implementation of welfare reform, districts with a 10 percentage point higher *ShFLE* will experience a 0.07 percentage point larger decline in dropout rates relative to the year of welfare reform. These districts will experience a 0.15 percentage point larger decline 5-6 years after

[21] Results are unchanged if we use $ShFLE_{i,t=1990}$ instead of the time-varying $ShFLE_{it}$.

[22] When the unit of observation is an aggregate measure, it is common practice to weight each observation by the number of individual elements it contains (in this case, number of students), in order to improve efficiency because larger cells are subject to less sampling error. However, as Dickens (1990) shows, the method inefficiently over-weights larger cells if there are important cell specific error components. Estimation is conducted using approximately efficient weights derived from Dickens' iterative procedure. The distribution of district sizes is quite skewed, and the efficient weights reduce the undue influence of very large districts, such as New York City, with one million students. Results are qualitatively and statistically identical if estimation is conducted using ordinary least squares instead.

welfare reform and a 0.3 percentage point larger decline 7 or more years after welfare reform, close to 0.1 standard deviation of the dropout rate.[23] This corresponds to an 18% narrowing of the initial gap after 5 years and a 36% narrowing after 7. The F-test that all the pre-reform coefficients are 0 cannot be rejected at conventional significance levels, whereas the F-test that all the post-reform coefficients are 0 rejects the null at 1% significance. The pattern is illustrated in Figure 3A, where we plot the point estimates of the interactive terms and their 90% confidence interval bands. There is a clear break from trend around the time of welfare reform.

The grades 7-12 dropout rate reflects the overall tendency of students in the 6 included grade levels to drop out of school. The remaining columns of Table 4 examine the dropout pattern for each of the grades separately. Similar post-reform patterns appear for grades 7 to 10, and the magnitudes are larger in grades 9 and 10 than grades 7 and 8. For the pre-reform period, while dropout rates for grades 7 and 8 relative the baseline year do not vary with FLE share, the significant estimates for grades 9 and 10 suggest a growing gap in dropout rates between low-income and high-income students leading up to the reform year. The post-reform coefficients are insignificant for grade 11 and grade 12 except for 7 or more years after reform. These results are not driven by outliers; for each grade level, the estimates are unchanged if we exclude the 1% of school districts with highest dropout rates.

If we extrapolate from low-income districts to low-income students, we infer that welfare reform reduces the relative dropout rates of low income students in grades 7 to 10, but does not alter the dropout propensity of students in grades 11 and 12. This is not surprising given that the dropout rate is defined conditional on enrollment in the previous school year. Low income students who plan to drop out before completing high school are likely to have dropped out in earlier grades; those who reach grade 11 or grade 12 reveal themselves, by self-selection, to be more determined and academically more prepared to finish high school.[24] As shown in Table 4, the dropout rates for grade 11 and

[23] The coefficient on the interaction between *ShFLE* and indicator for 7 or more years after reform is identified by 15 early-waiver states that have waivers for 7 or more years by the end of the sample period. Similarly, the coefficients on the interactions between *LI* and indicators for 9-10 years and 11 or more years after reform in Equation (2) are identified by the same group of early waiver states.

[24] CPS data confirm that low-income students are more likely to be retained (i.e., report larger differences between their age and grade level in October), and are less likely to be enrolled in 11th grade or higher.

grade 12 do not vary with changes in FLE share, whereas in earlier grades, dropout rates are significantly higher when district *ShFLE* increases.

Having a consequential school accountability system in place reduces dropout rates, but it has a smaller impact on districts with larger FLE shares, consistent with the interaction effect in the previous section. Additionally, in states with higher unemployment rates, dropout rates are lower, especially for grades 10 to 12, suggesting a possible demand side influence.

Table 5 reports results for an alternative educational attainment measure: the high school completion rate. As a comparison, we repeat the results for grades 7-12 dropout rate from Column 2 of Table 4. The result for 4-year high school completion rates, presented in Column 2, is almost a mirror image of that for aggregate dropout rates, as illustrated by Figures 3A and 3B. Prior to welfare reform, high school completion rates relative to the reform year do not vary with FLE share. Following welfare reform, completion rates relative to the base year are significantly higher for districts with larger shares of FLE students; the differences are statistically significant for observations 3-4 or more years after reform. The effect of welfare reform on high school completion is important because of the critical role of a high school diploma in the labor market and because of the option value of completing high school for obtaining further education.

In the last two columns of Table 5, we consider the impact of welfare reform on the educational attainment of low-income students based on an alternative definition of low income: the share of children aged 5 to 17 in poverty in a school district based on 1995 Census data.[25] For both the grades 7-12 dropout rate and the high school completion rate, the basic pattern of estimates is the same as when low income is defined by FLE. However, the magnitude of the post-reform estimates is considerably higher, perhaps suggesting that the impact of welfare reform is more intense for children from welfare-prone families than for other low-income children.[26]

[25] The data source is the U.S. Census Small Area Income & Poverty Estimates (URL: http://www.census.gov/hhes/www/saipe/).

[26] The grades 9-12 dropout rate for boys and girls separately is only available for 1998 to 2001, preventing a full alternative test of direct incentive hypothesis. However, preliminary analysis using the limited range of years suggests that welfare reform has similar positive impacts on boys and girls, as measured by point estimates on the interactive terms. However, because girls have lower average dropout rates than boys, this translates into larger proportional effect for girls – the ratio between the estimate on the interaction between *ShFLE* and indicator for 7 or more years after reform and mean dropout rate in 1998 is 0.44 for boys and

6. Conclusions

This paper presents the first analysis of the impact of the fundamental welfare reforms of the 1990s on the educational attainment of adolescents in low-income families. Educational attainment measures are drawn from two sources spanning the period from the early 1990s to the mid 2000s: enrollment rates for youths aged 13-18 from the CPS and grades 7-12 dropout and high school completion rates from the school district universe records of CCD. We estimate the net effect of welfare reform in a reduced form difference-in-differences framework. We use trends in the educational attainment of youths in higher-income households to impute counterfactual trends for what would have happened to those in low-income households in the absence of welfare reform. The validity of this method is supported by the fact that the groups experience statistically indistinguishable time trends prior to the reforms. In the period following welfare reform, we find significant and growing gains in educational attainment for low-income youths. The result is robust to alternative measures of educational attainment and definitions of the low-income group and to controlling for contemporaneous changes in policy and the economy. This evidence confirms and strengthens the finding of Miller and Zhang (2007) that welfare reform improved the educational outcomes of children in low-income families.

The findings in this paper conflict with those in the experimental literature (Gennetian et al. 2004), which finds a small harmful impact of welfare reform on adolescents. There are several differences between our paper and the experimental studies. First, the experimental studies consider a shorter time horizon. In our data, the gains from welfare reform are not immediate, but increase gradually over years. Second, the experimental studies used less objective measures of schooling outcomes. Third, the experimental studies focused on adolescents whose mothers were on welfare, thus missing the effects of reduced welfare dependence, both by mothers of adolescents and by adolescents themselves. Although the present study cannot disentangle the different channels, it would be fruitful for future research to investigate how adolescents respond directly to changed welfare rules and how they respond to changed parental behavior.

0.62 for girls. This is consistent with low-income girls experiencing an additional direct incentive effect from welfare reform, over and above any changes in family environment.

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Table 1: School Enrollment Rates by Year and Household Income

	Weighted enrollment rate			Percentage growth	
Year	SLI	SLE	Gap	SLI	SLE
1990	93.16	84.14	9.02		
1991	94.12	83.94	10.18	1.0	-0.2
1992	94.20	86.69	7.50	0.1	3.3
1993	94.37	86.30	8.07	0.2	-0.4
1994	94.50	86.36	8.14	0.1	0.1
1995	94.39	84.93	9.46	-0.1	-1.7
1996	93.86	84.53	9.33	-0.6	-0.5
1997	94.82	86.41	8.42	1.0	2.2
1998	94.38	84.45	9.93	-0.5	-2.3
1999	93.79	85.45	8.34	-0.6	1.2
2000	93.57	84.95	8.62	-0.2	-0.6
2001	93.47	85.96	7.52	-0.1	1.2
2002	93.98	87.27	6.71	0.5	1.5
2003	93.56	87.18	6.39	-0.4	-0.1
2004	94.29	88.14	6.14	0.8	1.1
2005	94.80	89.02	5.78	0.5	1.0
Average	94.08	85.95	8.13	0.1	0.4

Source: October CPS Files. Weighted average school enrollment rates (percent currently enrolled) by year and low-income status, averaged over all ages (13-18); SLE (free and reduced price lunch eligible) defined as household income below 185% of the federal poverty level; SLI is subsidized lunch ineligible.

Table 2: Summary Statistics of Dropout and Completion Rates

Variable	Obs.	Mean	Std. Dev.	Median	99th Percentile	Min	Max
Dropout rate							
Grade 7	80976	0.40	2.60	0	6.30	0	100
Grade 8	81545	0.62	2.98	0	8.01	0	100
Grade 9	76131	2.68	4.90	1.20	19.05	0	100
Grade 10	77147	3.64	5.19	2.40	20.00	0	100
Grade 11	77797	4.28	5.35	3.23	20.70	0	100
Grade 12	78181	4.33	5.74	3.20	22.42	0	100
Grades 7-12	74725	2.48	4.09	1.70	13.61	0	100
Grades 9-12	75905	3.72	4.61	2.80	17.70	0	100
Completion rate							
Total	45159	85.68	11.05	87.75	100	0.85	100
Diploma receipt	45145	84.45	12.06	86.96	100	0.85	100
FLE share	83317	0.27	0.19	0.24	0.85	0	1

Source: Common Core of Data (CCD) public school and school district universe surveys. Dropout rates, completion rates, and Share FLE averaged over all years and all districts. Dropout rates are conditional on enrollment in the previous grade in the previous school year; completers do not include General Educational Development (GED) recipients; FLE share is the fraction of free school lunch eligible students in a school district aggregated from school data.

Table 3: Differential Time Trends in Current School Enrollment

	1	2	3	4	5
Model	OLS	OLS	Probit	OLS	OLS
Ages	13-18	13-18	13-18	13-18	16-18
State FE and Year FE	Y	Y	Y	Y	Y
Weights	Y	N	N	Y	Y
Fully interacted	N	N	N	Y	N
SLE*[7 or more years before reform]	-0.001	0.006	0.002	0.004	-0.01
	[0.012]	[0.008]	[0.005]	[0.013]	[0.027]
SLE*[5-6 years before reform]	0.001	-0.002	0.001	0.004	0.002
	[0.007]	[0.007]	[0.004]	[0.007]	[0.015]
SLE*[3-4 years before reform]	0.006	0.011	0.006	0.006	0.006
	[0.007]	[0.005]*	[0.003]*	[0.006]	[0.013]
SLE*[1-2 years before reform]	-0.001	-0.002	0.001	-0.001	-0.009
	[0.006]	[0.006]	[0.003]	[0.006]	[0.011]
SLE*[1-2 years after reform]	0.001	-0.002	0.001	0.003	0.003
	[0.009]	[0.008]	[0.004]	[0.009]	[0.018]
SLE*[3-4 years after reform]	0.016	0.011	0.009	0.018	0.028
	[0.006]*	[0.006]+	[0.003]**	[0.007]*	[0.012]*
SLE*[5-6 years after reform]	0.016	0.012	0.009	0.015	0.026
	[0.007]*	[0.006]+	[0.003]**	[0.007]*	[0.012]*
SLE*[7-8 years after reform]	0.021	0.019	0.01	0.019	0.038
	[0.008]*	[0.007]**	[0.003]**	[0.008]*	[0.015]*
SLE*[9-10 years after reform]	0.017	0.016	0.007	0.014	0.034
	[0.007]*	[0.007]*	[0.004]+	[0.008]+	[0.016]*
SLE*[11 or more years after reform]	0.025	0.02	0.008	0.021	0.047
	[0.009]**	[0.008]*	[0.004]+	[0.009]*	[0.021]*
P-value on all pre-reform terms	0.6891	0.0563	0.2333	0.7284	0.593
P-value on all post-reform terms	0.002	0.009	0.009	0.025	0.001
Observations	168207	168209	168209	168207	80557
(Psuedo) R-squared	0.18	0.18	0.27	0.18	0.16

Note: Standard errors clustered at the state level in brackets; ** significant at 1% level; * significant at 5% level; + significant at 10% level. The dependent variable is an indicator for school enrollment. All columns include race and gender, a series of age fixed effects, and changing state macro-economic and educational characteristics (educational attainment of adults in the state, state income per capita, state unemployment rate, spending per pupil and pupil-teacher ratios in public schools, and school accountability reform). SLE (subsidized lunch eligible) is defined as household income below 185% of the federal poverty level. P-values are for the separate F-tests that all pre-reform and post-reform terms are zero.

Table 4: Differential Time Trends in Dropout Rates in Different Grades

Grades	7-12	7-12	7	8	9	10	11	12
FLE share	0.5725	0.5602	0.3096	0.3284	1.5997	0.7513	-0.2786	-0.5156
	[0.2271]*	[0.2339]*	[0.1878]+	[0.2194]	[0.3952]**	[0.3865]+	[0.4084]	[0.3959]
FLE share*[5 or more years before reform]	-0.2891	-0.1852	0.0069	0.3248	-1.2648	-1.2324	-0.1331	1.428
	[0.4091]	[0.4198]	[0.2597]	[0.4522]	[0.6735]+	[0.5390]*	[0.4845]	[0.5957]*
FLE share*[3-4 years before reform]	-0.5169	-0.4433	0.0068	-0.191	-2.0696	-1.4601	0.0525	-0.4235
	[0.2940]+	[0.2978]	[0.2540]	[0.2384]	[0.4416]**	[0.4199]**	[0.4512]	[0.4643]
FLE share*[1-2 years before reform]	-0.1286	-0.17	0.2049	0.1288	-0.3281	-0.1974	0.1069	-0.57
	[0.1881]	[0.1921]	[0.1768]	[0.1707]	[0.2946]	[0.3013]	[0.3038]	[0.3106]+
FLE share*[1-2 years after reform]	-0.363	-0.6821	-0.4619	-0.7127	-1.1087	-0.5839	-0.3118	-0.0442
	[0.1695]*	[0.1792]**	[0.1593]**	[0.1897]**	[0.2998]**	[0.2749]*	[0.2561]	[0.2989]
FLE share*[3-4 years after reform]	-1.022	-1.4944	-0.9026	-1.033	-2.4663	-1.3406	-0.6799	-0.2171
	[0.1772]**	[0.2200]**	[0.2097]**	[0.2324]**	[0.3302]**	[0.3075]**	[0.2971]*	[0.3399]
FLE share*[5-6 years after reform]	-0.8243	-1.5224	-0.9116	-1.5157	-3.297	-1.7884	-0.4136	0.3226
	[0.1911]**	[0.2241]**	[0.1944]**	[0.2578]**	[0.4028]**	[0.3693]**	[0.3369]	[0.4079]
FLE share*[7 or more years after reform]	-2.2576	-3.0007	-1.311	-2.5815	-6.2201	-4.7701	-2.2185	-1.8707
	[0.4051]**	[0.4204]**	[0.3237]**	[0.4468]**	[0.6673]**	[0.6248]**	[0.5035]**	[0.6393]**
Accountability		-0.4366	-0.2861	-0.3123	-0.3026	-0.216	-0.2067	-0.6447
		[0.0939]**	[0.0643]**	[0.0711]**	[0.0902]**	[0.0844]*	[0.0899]*	[0.1030]**
Years of Accountability		0.0137	-0.0137	-0.0287	0.0419	0.0682	0.0639	0.0457
		[0.0116]	[0.0079]+	[0.0114]*	[0.0192]*	[0.0187]**	[0.0193]**	[0.0220]*
FLE share*Accountability		1.0762	0.5755	0.6616	0.7941	0.4984	0.5974	1.9864
		[0.2705]**	[0.1911]**	[0.2196]**	[0.3519]*	[0.3017]+	[0.3131]+	[0.3471]**
FLE share*Years of Accountability		0.0212	0.0529	0.0986	0.0511	0.0549	0.0189	-0.1788
		[0.0404]	[0.0312]+	[0.0408]*	[0.0647]	[0.0600]	[0.0598]	[0.0679]**
P-value on all pre-reform terms	0.31	0.47	0.61	0.48	0	0	0.97	0.01
P-value on all post-reform terms	0	0	0	0	0	0	0	0
District FE and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	Y	Y	Y	Y	Y
Observations	73084	73043	79724	80341	74975	76021	76717	77177

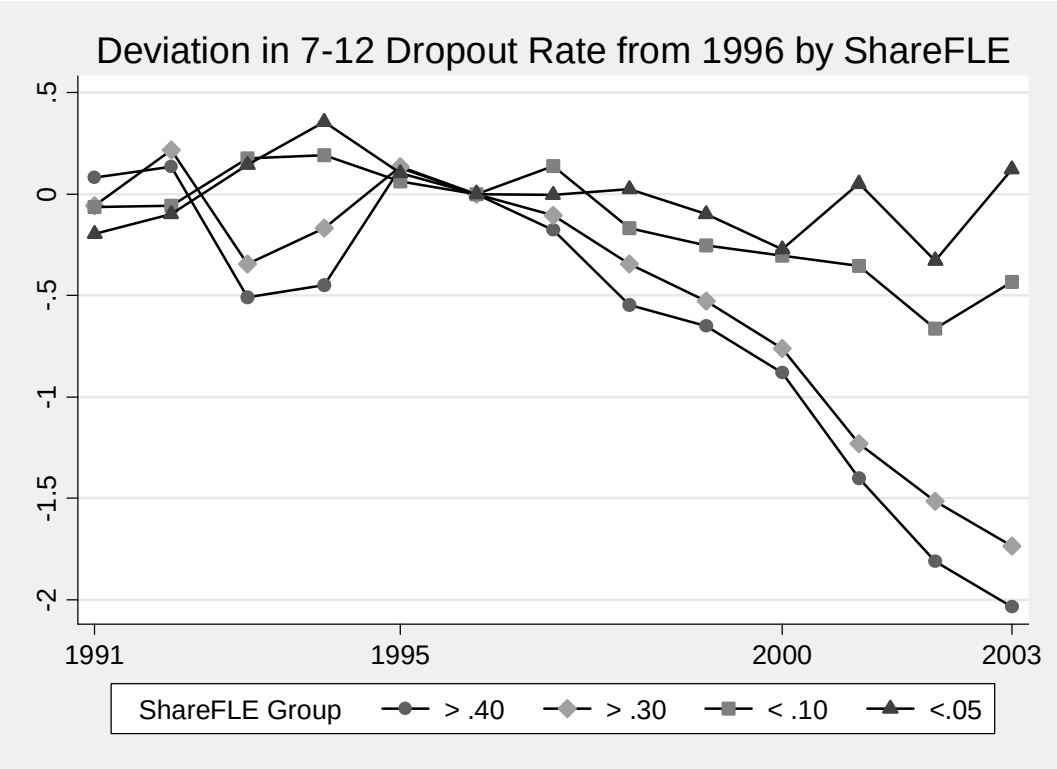
Note: Standard error clustered at the state level in brackets; ** significant at 1% level; * significant at 5% level; + significant at 10% level. Dropout percent is from CCD school district files. All columns include district fixed effects. Control variables are state macro-economic (adult educational attainment, income per capita, unemployment rate) and district educational (spending per pupil and pupil-teacher ratios in public schools) characteristics. FLE share is the fraction of free school lunch eligible students in a school district aggregated from school data. P-values are for the separate F-test that all pre-reform and post-reform terms are zero.

Table 5: Differential Time Trends in Dropout and Completion Rates for Different Low-Income Definitions

Dependent Variable	Dropout Rate Grades 7-12	HS Completion Rate	Dropout Rate Grades 7-12	HS Completion Rate
Low income measure	FLE	FLE	95pov5-17	95pov5-17
Low income share*[5 or more years before reform]	-0.1852		-0.0673	
	[0.4198]		[0.5945]	
Low income share*[3-4 years before reform]	-0.4433	1.2202	-0.0346	1.8115
	[0.2978]	[0.8009]	[0.5663]	[1.4397]
Low income share*[1-2 years before reform]	-0.17	0.0984	-0.2631	-0.6966
	[0.1921]	[0.6893]	[0.2817]	[1.1599]
Low income share*[1-2 years after reform]	-0.6821	0.8692	-0.9327	1.5727
	[0.1792]**	[0.5699]	[0.2866]**	[1.0793]
Low income share*[3-4 years after reform]	-1.4944	2.6319	-2.116	5.3202
	[0.2200]**	[0.6470]**	[0.3414]**	[1.1354]**
Low income share*[5-6 years after reform]	-1.5224	2.15	-2.0451	3.0259
	[0.2241]**	[0.7820]**	[0.3943]**	[1.4511]*
Low income share*[7 or more years after reform]	-3.0007	5.229	-4.7353	7.169
	[0.4204]**	[1.0016]**	[0.7607]**	[2.1617]**
P-value on all pre-reform terms	0.47	0.31	0.81	0.33
P-value on all post-reform terms	0	0	0	0
Observations	73043	44635	72657	44494

Note: Standard error clustered at the state level in brackets; ** significant at 1% level; * significant at 5% level; + significant at 10% level. Dropout and completion rates (between 0 and 100) are from CCD school district files. All columns include district fixed effects. Control variables are state macro-economic (adult educational attainment, income per capita, unemployment rate), district educational (spending per pupil and pupil-teacher ratios in public schools) characteristics, and state school accountability reform. FLE share is the fraction of free school lunch eligible students in a school district aggregated from school data; "95pov5-17" is share of children aged 5 to 17 in poverty in a school district based on 1995 survey. P-value is for the F-test that all pre-reform (post-reform) terms are zero.

Figure 1



Source: US Department of Education, Common Core Data, 1991-2003. School districts are grouped according to their share of students who are low-income (*ShFLE*). Averages are weighted by district enrollment.

Figure 2: Trends in School Enrollment for Different Low-Income Definitions

Figure 2A

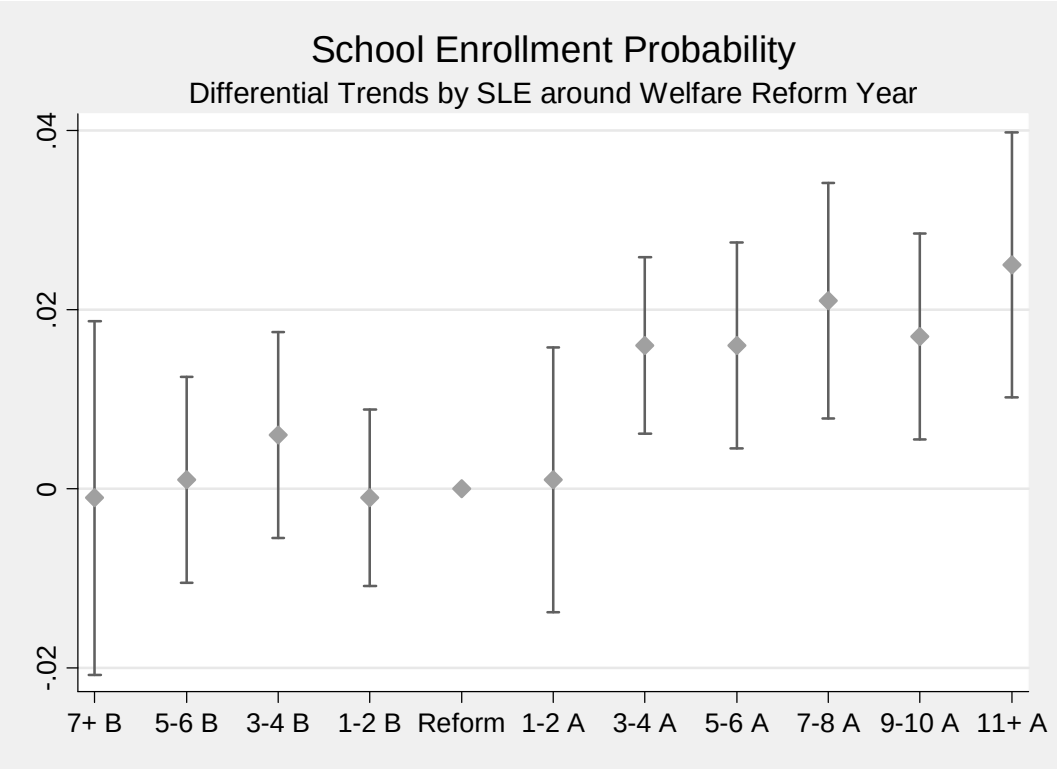


Figure 2B

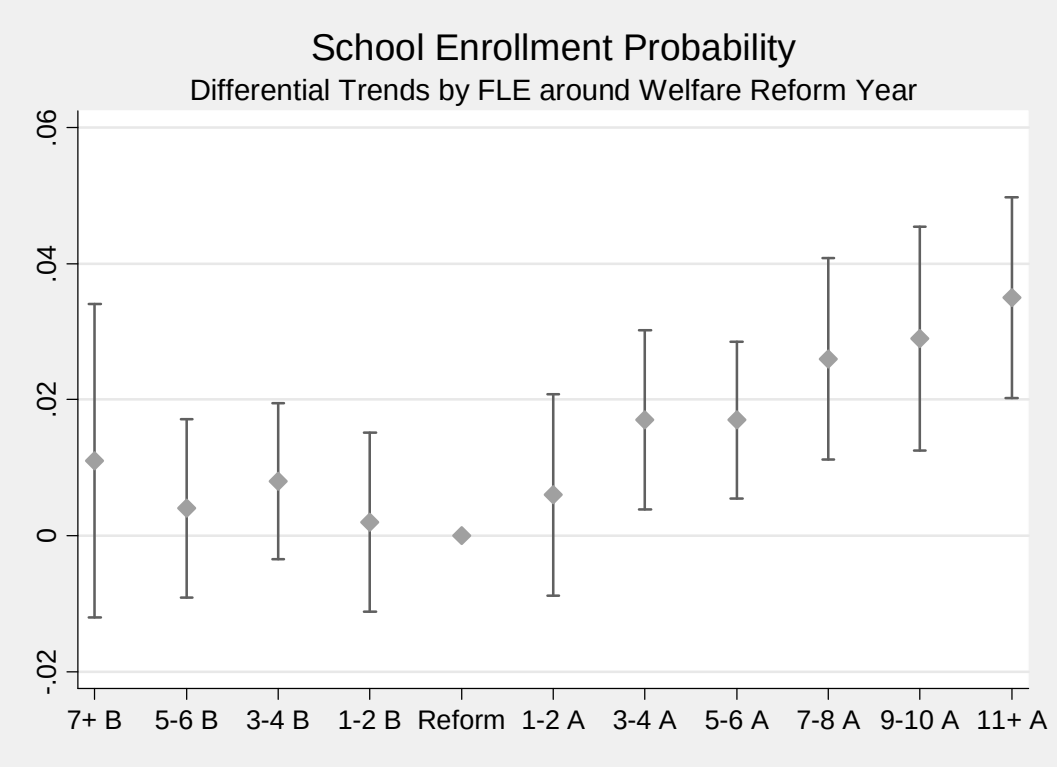


Figure 2C

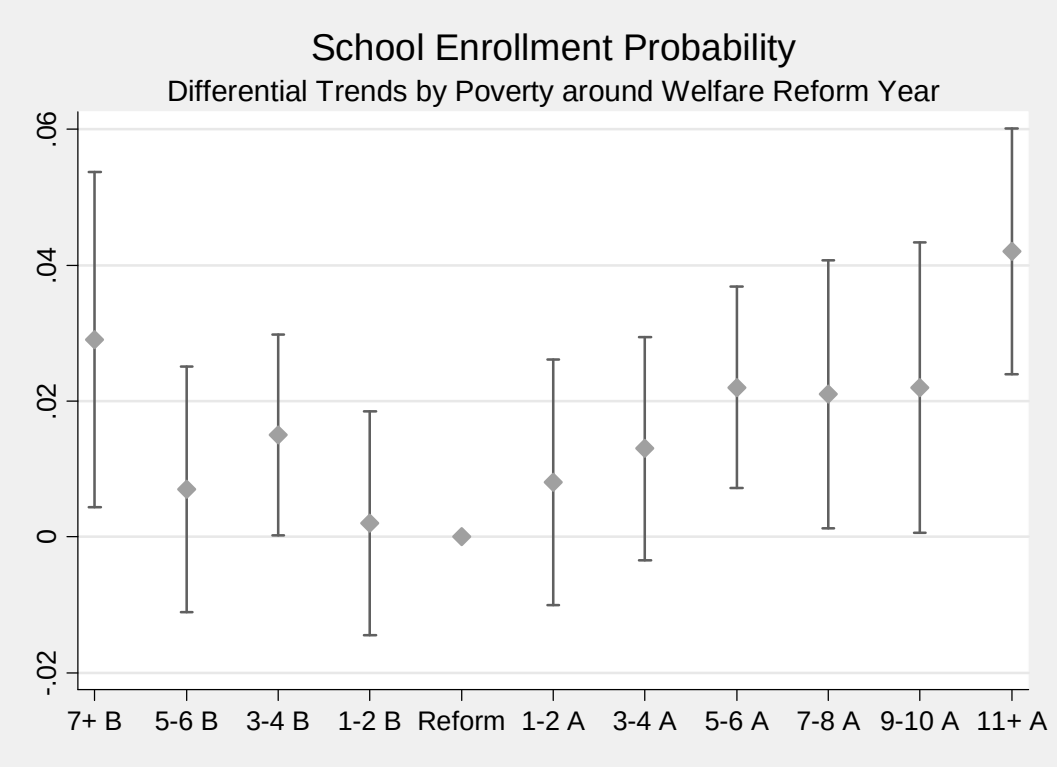


Figure 2D

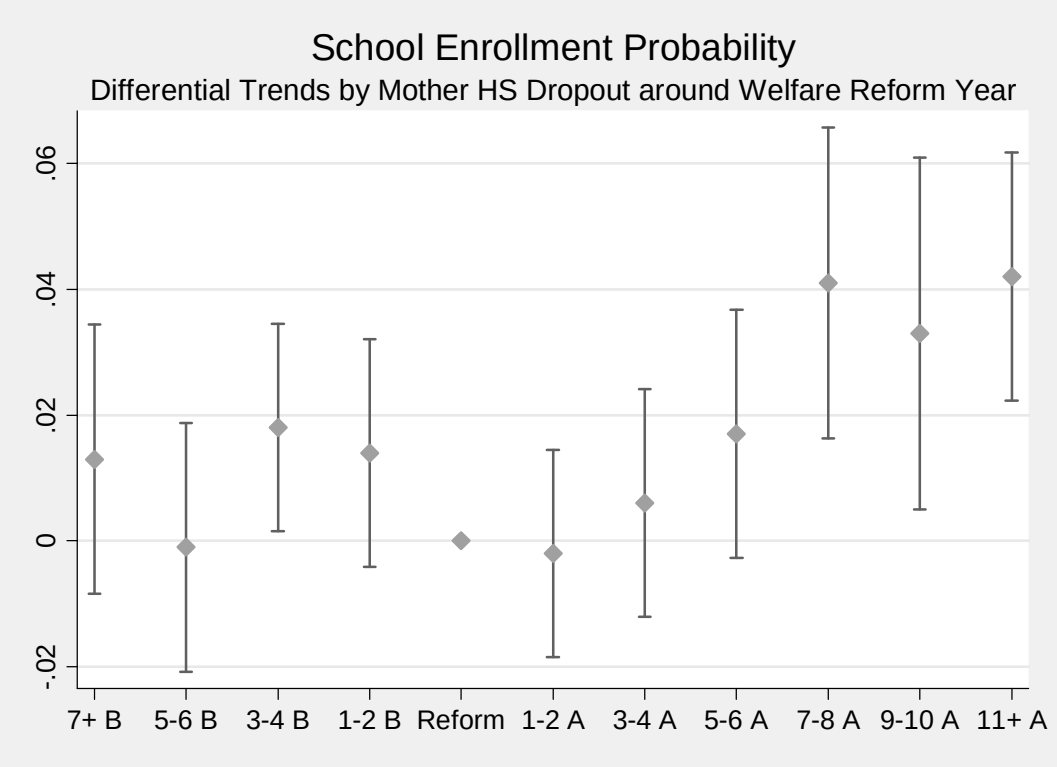


Figure 3: Trends in School Dropout and Completion Rates

Figure 3A

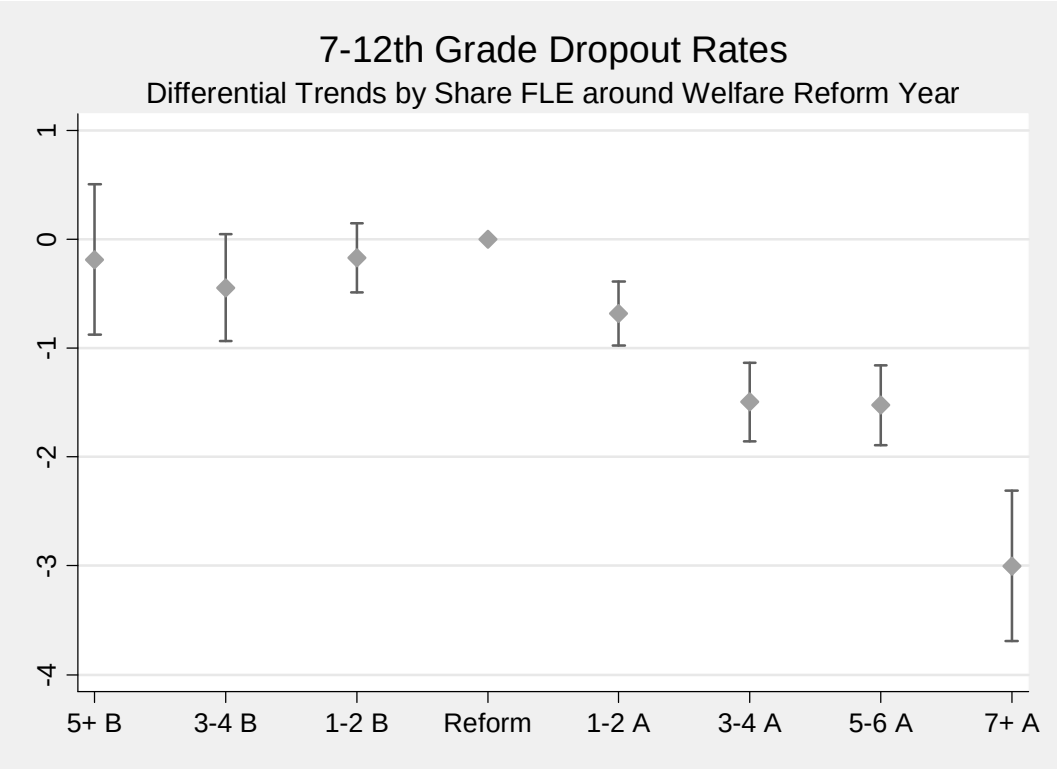
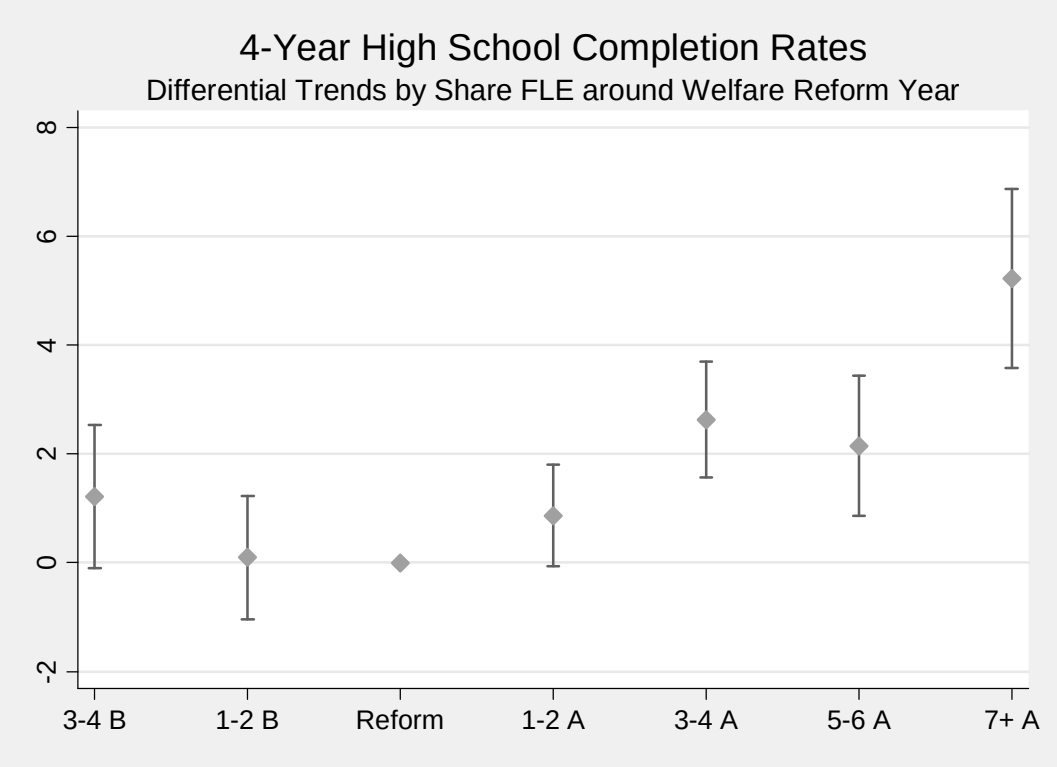


Figure 3B



Appendix Table 1: Welfare Reform and School Accountability Data

A.

State FIPS	State Name	Date Earliest State-Wide Waiver Implemented	Date TANF Implemented	Year Introducing Consequential Accountability	Year Introducing Report-Card Accountability
1	Alabama		November-96	1997	
2	Alaska		July-97		2001
4	Arizona	November-95	October-96		2000
5	Arkansas	July-94	July-97	1999	
6	California	December-92	January-98	1999	
8	Colorado		July-97		2002
9	Connecticut	January-96	October-96	1993	
10	Delaware	October-95	March-97	1998	
11	DC		March-97		1997
12	Florida		October-96	1999	
13	Georgia	January-94	January-97	2000	
15	Hawaii	February-97	July-97		2001
16	Idaho		July-97		1997
17	Illinois	November-93	July-97		1999
18	Indiana	May-95	October-96		1995
19	Iowa	October-93	January-97	2003	
20	Kansas		October-96		1995
21	Kentucky		October-96	1995	
22	Louisiana		January-97	1999	
23	Maine		November-96		1999
24	Maryland	March-96	December-96	1999	
25	Massachusetts	November-95	September-96	1998	
26	Michigan	October-92	September-96	1998	
27	Minnesota		July-97		1996
28	Mississippi	October-95	July-97		1994
29	Missouri	June-95	December-96		1997
30	Montana	February-96	February-97		1998
31	Nebraska	October-95	December-96		2001
32	Nevada		December-96	1996	
33	New Hampshire		October-96		1993
34	New Jersey	October-92	July-97	1997	
35	New Mexico		July-97	2003	
36	New York		November-97	1998	
37	North Carolina	July-96	January-97	1993	
38	North Dakota		July-97	2003	
39	Ohio	July-96	October-96	1997	
40	Oklahoma		October-96	1996	
41	Oregon	February-93	October-96	2000	
42	Pennsylvania		March-97		1999
44	Rhode Island		May-97	1997	
45	South Carolina		October-96	1999	
46	South Dakota	June-94	December-96		1997
47	Tennessee	September-96	October-96	1996	
48	Texas	June-96	November-96	1994	

49	Utah	January-93	October-96	2003	
50	Vermont	July-94	September-96	1999	
51	Virginia	July-95	February-97	1998	
53	Washington	January-96	January-97		1998
54	West Virginia	February-96	January-97	1997	
55	Wisconsin	January-96	September-97	1993	
56	Wyoming		January-97		1999

B.

	Welfare Reform				
		92-93	94-95	96-97	
Accountability Reform	92-93			Connecticut	
				North Carolina	
				Wisconsin	
	94-95			Kentucky	
				Texas	
	96-97	New Jersey		Alabama	DC
				Idaho	Nevada
				Ohio	Oklahoma
				Rhode Island	Tennessee
				West Virginia	
	98-99	California	Arkansas	Florida	
		Michigan	Delaware	Louisiana	
			Massachusetts	Maryland	
			Vermont	New York	
			Virginia	South Carolina	
	00-01	Oregon	Georgia	Hawaii	
	02-03	Illinois	Arizona	Alaska	Colorado
		Iowa	Indiana	Kansas	Maine
		Utah	Mississippi	Minnesota	Montana
			Missouri	New Hampshire	New Mexico
			Nebraska	North Dakota	Pennsylvania
			South Dakota	Washington	Wyoming

Sources: Crouse (1999) and U.S. DHHS (1997) for the dates of state-wide waiver implementation and TANF implementation. Hanushek and Raymond (2005), Fletcher and Raymond (2002), Goertz and Duffy (2001), and various state Department of Education websites for the introduction dates of state accountability systems.

Appendix Table 2: Average Cell Sizes by State and Low-Income Definition (Ages 13-18)

State FIPS	State Name	All	HH Income ≤ 185% FPL	HH Income ≤ 130% FPL	HH Income ≤ 100% FPL	Mother HS Dropout
1	Alabama	153	67	51	38	25
2	Alaska	174	44	29	19	13
4	Arizona	148	59	43	29	27
5	Arkansas	139	65	47	31	21
6	California	818	344	255	178	185
8	Colorado	156	42	26	17	17
9	Connecticut	125	23	15	11	10
10	Delaware	98	25	17	13	11
11	DC	70	32	23	17	13
12	Florida	394	142	95	66	50
13	Georgia	155	58	43	32	25
15	Hawaii	101	33	21	14	7
16	Idaho	170	59	38	25	19
17	Illinois	406	127	89	65	53
18	Indiana	148	40	24	15	14
19	Iowa	163	41	23	15	10
20	Kansas	169	50	29	20	10
21	Kentucky	132	52	37	28	17
22	Louisiana	135	66	51	40	23
23	Maine	136	43	26	17	7
24	Maryland	122	25	16	10	10
25	Massachusetts	242	64	43	30	23
26	Michigan	391	111	75	53	35
27	Minnesota	172	38	25	18	10
28	Mississippi	141	77	58	44	24
29	Missouri	141	45	28	18	15
30	Montana	160	65	43	29	14
31	Nebraska	168	53	33	20	10
32	Nevada	142	39	22	12	19
33	New Hampshire	126	22	12	7	6
34	New Jersey	308	68	43	29	26
35	New Mexico	153	77	59	43	30
36	New York	570	211	150	116	84
37	North Carolina	296	114	78	55	44
38	North Dakota	161	54	32	22	10
39	Ohio	406	118	81	56	38
40	Oklahoma	143	57	36	26	17
41	Oregon	131	41	27	17	12
42	Pennsylvania	385	112	73	48	34
44	Rhode Island	116	34	21	16	15
45	South Carolina	138	54	39	29	22
46	South Dakota	185	72	47	33	15
47	Tennessee	126	47	32	24	18
48	Texas	534	245	181	129	119

49	Utah	202	57	32	18	11
50	Vermont	106	31	18	11	8
51	Virginia	155	38	25	18	16
53	Washington	143	38	24	16	11
54	West Virginia	127	58	41	29	19
55	Wisconsin	179	42	27	18	14
56	Wyoming	159	50	31	20	11
	Total	10,517	3,566	2,432	1,707	1,292

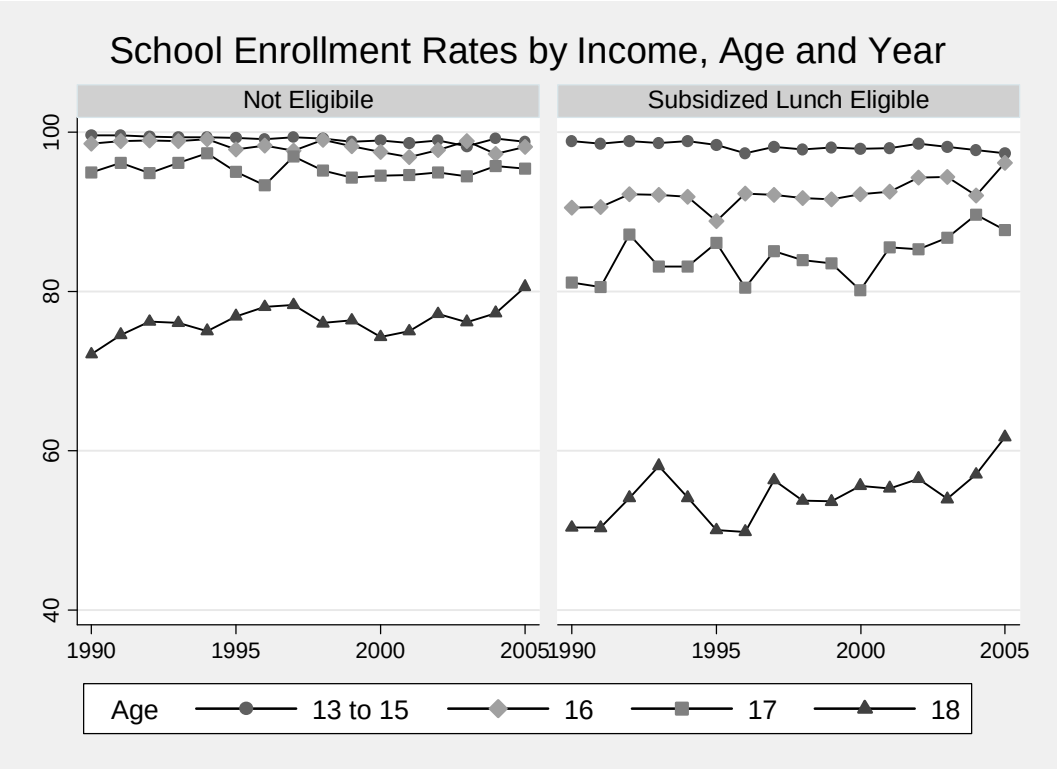
Source: CPS October files for 1990-2005. Values in the table represent the annual average (un-weighted) number of sample observations within each state and income category. Total is the annual average number of observations across all states. FPL stands for Federal Poverty Level.

Appendix Table 3: Control Variable Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
State Level Controls					
Expenditures per pupil	168207	3,958	922.12	2,087.9	7,416.3
Pupil-teacher ratio	168207	17.038	2.65	11.3	25.0
Share adults HS graduates	168207	81.535	4.97	63.2	92.8
Share adults college graduates	168207	23.869	4.56	11.1	46.4
Average state income	168207	15,798	2,303.15	9,974.5	27,470.9
State unemployment rate	168207	5.564	1.38	2.2	11.4
Individual Characteristics					
Age	168207	15.406	1.69	13	18
White	168207	0.794		0	1
Free or reduced price lunch (FLE)	168207	0.347		0	1
Free lunch eligible	168207	0.240		0	1
Poverty	168207	0.170		0	1
Mother HS dropout	157827	0.203		0	1

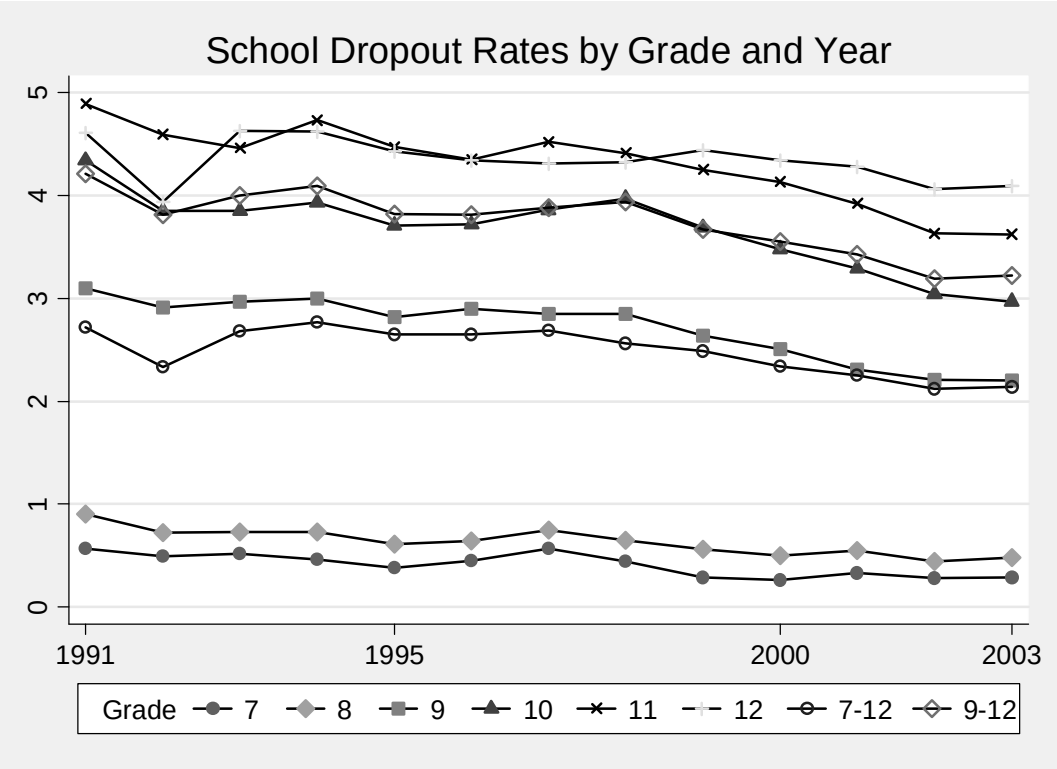
Source: State level controls are calculated based on data from U.S. Census and the U.S. Department of Education. Dollar values are in constant 1983 dollars. Individual characteristics are calculated from CPS October files.

Appendix Figure 1

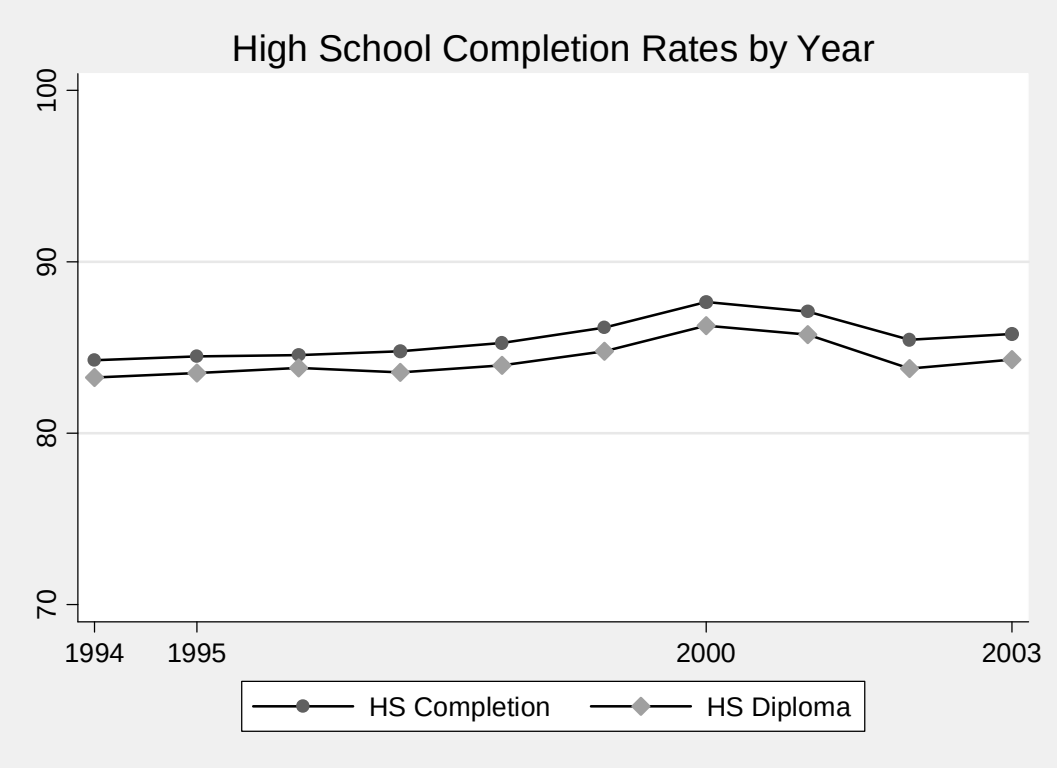


Source: October CPS Files. Weighted average school enrollment percents by age, year and low-income status. Subsidized lunch eligible is defined as household income below 185% of the federal poverty level.

Appendix Figure 2A

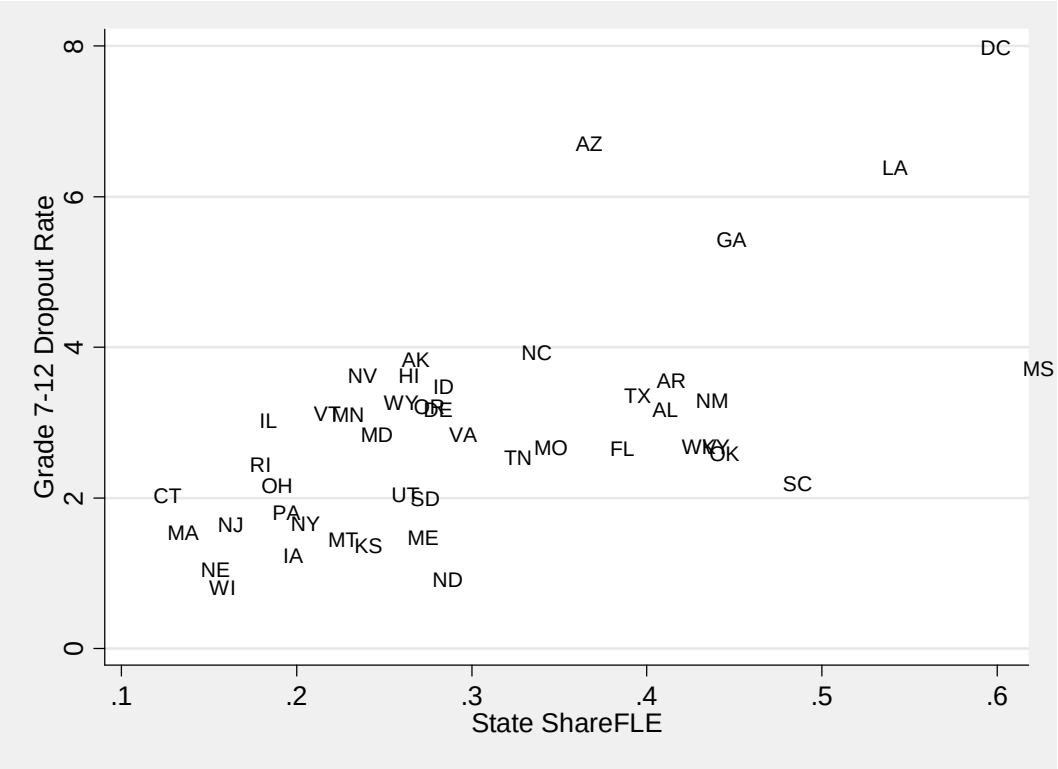


Appendix Figure 2B

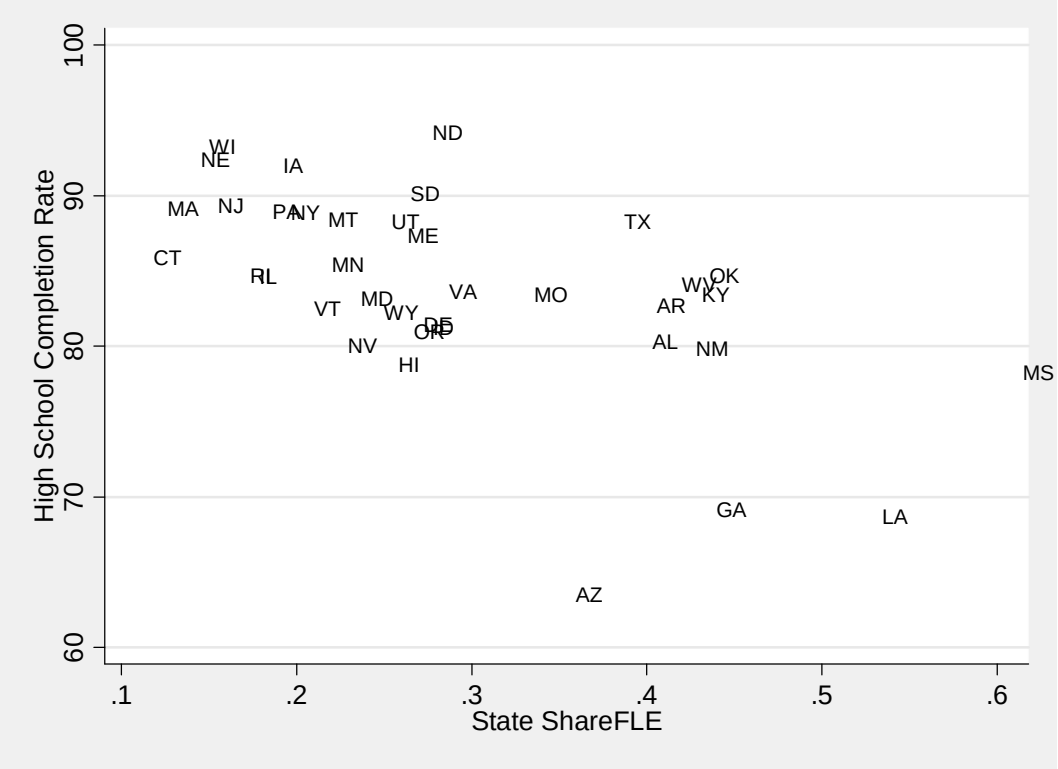


Source: US Department of Education, Common Core Data, 1991-2003.

Appendix Figure 3A



Appendix Figure 3B



Source: Common Core Data. Dropout rates averaged by state for 1991-2003; Completion rates are for 1994-2003.