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Industrial Composition and Intergenerational Educational Mobility

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1 Introduction

The discussion of whether advanced economies still enable widespread intergenerational upward mobility is central to the public and academic debates of our time. There is concern, especially in the US, that educational progress has stalled and a large share of young people will not be able to exceed, or even match, the socio-economic status of their parents. Inequality in the distributions of education, income, and wealth could ossify and lock much of the population in a permanent underclass. This paper addresses the question of whether or not the industrial composition in a local labor market helps young people take the first step to upward mobility by matching or exceeding their parents' level of education. Specifically, I explore the relationship between the degree attainment of children whose parents have a high school diploma or less and the local shares of manufacturing and industries with a high demand for college-educated workers.

I find that young people in regions with a higher share of manufacturing employment are more likely to finish high school and college. The children of parents who lack a college degree who grow up near college-degree intensive industry clusters are also more likely to attain a college degree themselves. However, the benefits extended to the marginal college students do not help marginal high school students in these regions with more degree-intensive employment. The high school dropout rate among the children of non-graduates does not vary with the share of adults employed in degree-intensive industries. The existing literature has explored the relationship between manufacturing and education during the era of industrialization (Barnhouse Walters and O'Connell, 1988; Goldin and Katz, 2003; Fuller, 1983). Researchers have documented that, in the cross section, manufacturing intensive regions have less educated working age populations, and regions with certain services industries, such as information or finance, have more educated workforces (Berry and Glaeser, 2005; Glaeser and Resseger, 2010; Donaldson and O'Keefe, 2013). However, this could be due to the migration of non-graduates toward manufacturing centers in the last century and the movement of college graduates toward growing technology clusters in recent decades. There is also a literature that looks at the response of educational attainment to economic shocks at the regional or household level (Coelli, 2011; Kalil and Wightman, 2011; Rege, Telle, and Votruba, 2011; Stevens and Schaller, 2011). What is missing from the literature is an exposition of the relationship between industries and education in the era when most regions have lost their manufacturing base and some regions have grown robust clusters in information technology, finance, healthcare, and professional services. This analysis fills that void.

Shifting from the regional level to the household and individual level, the literature has documented the influence of a variety of factors on human capital investments. These include opportunity costs, returns to education, family income, and public subsidies of education. I build on this literature by exploring the relationship between industrial composition, measures of these channels, and individuals' degree attainment. I find evidence for the industries impacting high school attainment by increasing household income, reducing the frequency of single parenting, and increasing mothers' employment. The industries may increase college attainment by raising both household incomes and median or per capita incomes in the region. Regions with greater employment in manufacturing or degree-intensive industries have a lower incidence of single parenting, and youth in single-parent households are less likely to complete college. Finally, regions with greater shares of adults employed in degree-intensive industries tend to have more college and university students. The presence of students indicates greater accessibility and information available to young people in the region, and it is positively associated with upward educational mobility in the form of those young people completing college.

To study industrial composition and intergenerational educational mobility, one needs a data set that combines information about parents, children, and the local labor market conditions during the children's youth. The National Longitudinal Survey of Youth (NLSY) in its 1979 sample provides rich information about women's educational attainment, test scores, and location. All of the children born to women in the NLSY 1979 survey were also followed in periodic surveys. The confidential geo-coded data maintained with the NLSY identifies the county that the mothers and children were living in throughout the children's childhood. Using microdata from the Current Population Survey (CPS), it is possible to create and assign numerous measures of local labor market conditions that the young people would have been exposed to while they were making decisions about whether to complete high school and college (Flood et al., 2020). To focus on intergenerational educational mobility, this analysis is conducted while limiting the sample to children whose parents do not hold a college degree.[1] Parents without college degrees are more likely to be negatively impacted by the loss of manufacturing jobs and to not be able to access higher-paying positions that require college degrees. Diminished employment and earnings opportunities could make it difficult for these parents to provide a stable home environment and make investments in their children's education.

As in many other published studies of intergenerational mobility, caution must be used when making causal statements based on the results of this analysis (Chetty et al., 2014). Minors do not choose the industrial composition of the area they grow up in, so it is exogenous to children's decisions. However, selection effects could bias the estimates if higher-ability parents migrate toward areas with degree-intensive industries or lower-ability parents remain near declining industries to access affordable housing (Glaeser and Gyourko, 2005). This selection concern is ameliorated by controlling for the mother's ability and both parents' years of education. There is also the possibility of a confounding variable that determines both a labor market's industrial composition and the educational attainment of its youth. Long-lagged measures of regional education levels and regional fixed effects are tested. These do not appear to be confounding factors, but the existence of an unmeasured and untested factor cannot be entirely ruled out.

The rest of this paper will proceed as follows. Section 2 will review the existing related literature. Section 3 will describe the data sets and selection and definition of the variables. Sections 4 and 5 will present descriptive statistics and model estimates. A discussion of

[1] Alternate specifications include the children whose parents do have college degrees.

conclusions and implications can be found in section 6.

2 Literature

Despite extensive related literatures that will be described here, no research has yet documented the overall relationship between a region's degree-intensive industry employment and the educational attainment of youth who grow up in the region. One published study has investigated the relationship between manufacturing employment and educational attainment. Donaldson and O'Keefe (2013) use Census microdata and regress educational attainment on the share of the labor force employed in manufacturing in the respondents' metropolitan area. The manufacturing share is lagged by 10 years to better represent what the adults might have experienced as youth. They report a negative relationship between manufacturing share and educational attainment. A major shortcoming of Donaldson and O'Keefe's study is that they attribute adults' educational attainment to the industries they are living near as adults rather than the industries they were exposed to as youth. It is well-documented that interregional migration is positively correlated with education, and approximately half of college graduates no longer live in the state where they were born (Knapp, White, and Wolaver, 2013). Growth of nonmanufacturing industries will force down the manufacturing share of the labor force unless manufacturing is growing at an equal pace. This should introduce bias into Donaldson and O'Keefe's specification because individuals who attain higher levels of education in a manufacturing-intensive area are likely to relocate to places with growing non-manufacturing sectors. Donaldson and O'Keefe do not use any linked information about individuals' parents, so they do not address intergenerational mobility. The analysis presented here introduces parental measures, accurately represents youths' labor market exposure, and expands the line of inquiry to the growing degree-intensive industries.

The topic of intergenerational income mobility and its determinants appears to be more extensively studied than the intergenerational mobility of education levels. A few studies that focus on income mobility include some results with educational attainment as an alternate outcome. Rothwell and Massey (2015), for example, investigate neighborhood and regional effects on intergenerational income mobility using the Panel Survey of Income Dynamics. They include one set of results in which college attainment is the dependent variable. They find a significant relationship between the neighborhood college attainment rate and the respondent's attainment. Several other measures, such as home price appreciation and housing inequality, are included but not found to be significant. Rothwell and Massey do not consider the regional industrial composition or other labor market measures as I do here.

Most intergenerational studies have used national data sets without leveraging geographic or regional information (Lee and Solon, 2009; Wightman and Danziger, 2014). This is beginning to change as large administrative data sets with geographic information become available. Using Internal Revenue Service data, Chetty, et al. (2014) have estimated the relationship between characteristics of the region (county, commuting zone, etc.) in which individuals grow up and the individuals' income mobility. The authors use income tax filings with children's Social Security numbers to place the children in a geographic region in each year in which their parents filed. When the children reach adulthood and file taxes themselves, their earned income is observed. They identify income inequality and family stability among regional characteristics that impact intergenerational mobility. Following Chetty et al.'s approach, this analysis will present a series of individual-observation models with regional measures included as independent variables.

With the exception of the direct employment of young people, most of the mechanisms connecting industries and youths' education would be indirect, working through the parents or local communities. Research on the most recent industrial transition has already documented many of the direct effects on parents and adults generally. Bound and Holzer (1993) presented evidence that the shift away from manufacturing in the 1970s lowered employment and wages for white men, especially those with less education. Acs and Danziger (1993) made the case that declines in low-skilled men's earnings in the 1980s can be attributed to changes in industrial composition. Feenstra and Hanson (1999) examined the relationship between technology changes, trade with low-wage countries, and the growing wage gap between low- and high-skilled workers. Using 1980s data, they attributed 15 percent of the wage gap to outsourcing putting downward pressure on low-skill wages and 35 percent to the increased use of information technology that is complementary to high-skilled labor. More recently, Charles, et al. (2015) argue that manufacturing decline during the 2000s pushed workers into nonemployment, and Gould (2019) found that manufacturing decline decreased wages at the lower end of the income distribution.

Regions that lack the relatively high-wage jobs for non-college-educated men that were provided by manufacturing could experience greater family instability, which in turn inhibits children's educational progress. Black, et al. (2003) used natural experiments provided by cyclicality in the steel and coal industries to estimate the rise in welfare usage that can be attributed to job losses for high-wage, low-skilled men. Welfare usage by a high school student's household, in turn, has been related to lower rates of graduation (Haveman, Wolfe, and Spaulding, 1991). Declines in employment in high-wage manufacturing jobs cause wage declines in other sectors within the affected region (Beeson, Shore-Sheppard, and Shaw, 2001). Non-college-educated men's declines in real wages and attachment to the labor force have coincided with declines in marriage rates, increases in extramarital births, and increases in children living in single-parent households (Wilson, 1999). Family structure has been related to educational outcomes, with children raised by single mothers faring worse (Gruber, 2004; Bjorklund, Ginther, and Sundstrom, 2007; Monserud and Elder, 2011). However, several studies have suggested that selection may account for much of the difference (Manski, 1992; Ginther and Pollak, 2004). The connection between fathers' absence and their children's educational attainment could work through reduced household income limiting the purchase of educational inputs (Crosnoe, Mistry, and Elder, 2002; Han, Huang, and Garfinkel, 2003; Ginther and Pollak, 2004).

An extensive literature exists regarding the relationship between industrialization and education in the United States in the decades between the Civil War and World War II. In this literature, the focus is on the extent to which children could be freed from farm or factory work so that they could attend school (Barnhouse Walters and O'Connell, 1988; Goldin and Katz, 2003). In the era of rapid industrialization of the Northeast and Midwest, school enrollment grew more slowly in urban areas (Fuller, 1983). Youths older than 14 were more likely to be out of school and employed if their region had more manufacturing activity relative to white-collar economic activity (Fuller, 1983). Margo and Finegan (1996) demonstrate using data from the 1900 Census that compulsory schooling laws increased educational attainment if they were paired with laws restricting child labor. Youths in rural areas were more likely to attend school generally because the opportunity cost was lower during seasons of agricultural inactivity. During the expansion of primary education, children were also more likely to attend school if their parents had higher incomes (Horan and Hargis, 1991). This is to be expected if higher wages for the parents enabled subsistence without children's incomes. At the school district and state level, the industrial composition can support educational investments via the tax base. Local economic activity determines local household incomes, and there is an extensive literature on equity in education funding that documents a positive relationship between household income and education expenditures (Fernandez and Rogerson, 2003; Schmidt and McCarty, 2008; Sweetland, 2014).

While compulsory schooling and child labor laws have shifted the school-to-work transition to later ages, industries still interact with schooling through opportunity costs and returns to education (Montmarquette, Viennot-Briot, and Dagenais, 2007; Murnane, 2013; von Simson, 2015; Stinebrickner and Stinebrickner, 2014). The industrial composition of a region could influence youths' education decisions through parental or neighborhood information channels. Parents working in manufacturing could connect their children to work opportunities that increase the children's known opportunity cost (O'Regan and Quigley, 1993; Magruder, 2010). In a study using the NLSY's labor market information supplement, Ludwig (Ludwig, 1999) demonstrates that young males in low-income neighborhoods have inaccurate information about the educational requirements for career paths. Through networks and more frequent interactions, the share of graduates among the adult population should be positively related to young people's information regarding the returns to education and educational requirements (Vartanian and Gleason, 1999). Additionally, the availability and proximity of colleges could increase college attendance and completion (Card, 1995). In each instance when an appropriate variable is available in either the NLSY or the CPS, this analysis will test whether the measure appears to be a factor connecting the industrial composition of the local labor market and educational attainment.

3 Data and Variable Selection

The first step of this analysis involves regressing measures of the industrial composition of a region on indicators of degree attainment. This will return the correlation between industries and educational outcomes, which has not yet been documented. After estimating the correlation between industrial composition and educational attainment, I will investigate several potential mechanisms through which the former could influence the latter. Table 1 lists the mechanisms discussed in the literature review (Section 2) and the measures used to represent them. In the mechanism results below, the coefficients reported on the lefthand side of Table 5 are from models in which the mechanism measures are the dependent variable of interest and the industrial composition measures are independent variables. For a potential mechanism to be feasible, it must be correlated with the measures of industry employment. The final set of coefficients reported in Table 5 is from models in which the mechanism measures are included in place of the industry measures. Again, if a potential mechanism is operating as theorized, it also should have a substantial intuitive correlation with the respondents' educational attainment.

From the CPS, one can calculate high school and college wage premiums. We would expect these to be positively correlated with educational attainment. As a measure of the opportunity cost of continuing in school, I use the share of young people, aged 18 to 24, who are employed in each industrial sector. If, for example, manufacturing provides abundant employment opportunities to young adults, we might observe youths in manufacturing centers working in factories and being less likely to finish high school or college. Another specification will incorporate the percent of the local population that is currently an undergraduate or graduate student. This should provide an indication of school availability as well as information availability and community norms. To measure regional incomes, which serve as the tax base for public subsidies to education, I calculate each region's median and per capita income using the CPS. One specification will introduce a measure of the parents' income. The income values were adjusted for inflation and then averaged over all years available. For the NLSY 1979 children's sample, we observe household income during most years of the child's youth because the mothers have been re-interviewed annually since becoming adults. All available income observations were used because Solon, Mazumber, and others have shown that longer panels reduce measurement error when trying to estimate the household income of parents in intergenerational research (Solon, 1992; Lee and Solon, 2009; Mazumder, 2016).

Using the NLSY, one can also construct an indicator of whether the respondent was living with a single parent at age 17. I hypothesize that the relationship between having a single parent and degree attainment will be negative even after controlling for other observables. Selection can explain much of the negative correlation between single parenting and children's outcomes, but the household structure itself can have negative effects on building human capital if exogenously imposed (Manski, 1992; Ginther and Pollak, 2004). Maintaining separate households taxes the parents' financial and time resources, leaving fewer resources available to assist their children. Forces that reduce the probability that children will be raised by a single parent could raise educational attainment through this mechanism. Industries that provide higher wages and more stable employment to fathers should increase the likelihood of the fathers' maintaining a relationship with the mothers. Finally, both the father's and the mother's attachment to the labor force could increase their children's investment in human capital. The NLSY reports whether each parent was working, and this is tested as a potential mechanism.[2]

The NLSY 1979 was designed to be a nationally representative sample of youth in particular cohorts in the year the sample originated.[3] The Bureau of Labor Statistics provides weights to correct known departures from national representativeness. The survey of children born to the 1979 women survey respondents can be weighted to represent the native-born US population.[4] The participants agreed to respond to annual or biennial surveys. As with all surveys, the responses will have measurement error, and panel surveys will have attrition. Fortunately, most of the individual characteristics used here are static, so they should be accurately measured as long as attrition happens after they are determined. These include educational attainment, parents' educational attainment, gender, race, place of birth, and number of siblings.

The 1979 children's data will be weighted toward less advantaged households because disadvantaged mothers are more likely to have children at younger ages. Some children of the more advantaged mothers were born later, so we cannot yet observe their educational attainment. Children are excluded from the high school analysis if they were less than 19 years old at the date of the 2014 interview. They are excluded from the college attainment analysis if they were less than 25 in 2014. The 1979 surveys include representative samples of immigrant youth, but the 1979 children's sample could include only the children of NLSY 1979 respondents living in the US. In the analysis below, controls are included for the parents' immigrant status and the mother's age at the time of the respondent's birth.

The respondents in the data who are old enough for their educational outcomes to be observed were born between 1970 and 1995, with the bulk of the distribution born between 1978 and 1990. This places their high school years mostly between the late 1980s and 2010.

[2]The parents' occupations are reported in the NLSY, but the variable is sparsely populated, especially for noncustodial parents. The data were not sufficient to be part of the analysis.

[3]For a complete description of the NLSY 1979, see https://www.nlsinfo.org/content/cohorts/nlsy79. Accessed 17 September, 2020.

[4]For a complete description of the NLSY 1979 Children and Young Adults surveys, see http://www.bls.gov/nls/nlsy79ch.htm. Accessed 17 September, 2020.

Steps were taken in the data preparation to preserve observations that were missing fields. If an individual's county of residence was missing in any year, it was replaced with the most recent observed county for the individual. In instances where control variables were missing, the missing value was replaced with a median or mean value, and a missing value indicator was included in the regression.

The Current Population Survey microdata are used to create the labor market measures. An industry is designated as being degree-intensive if the percentage of its employees with a college degree is above the national labor-force average for that year. The category of degree-intensive industries is defined separately for each metro area and year. This approach recognizes that firms may place headquarters and research functions in some cities, while lower-skill operations, such as back-office work and retailing, may occur in other cities. It also allows for within-industry upskilling. The manufacturing and degree-intensive employee counts are exclusive.[5] The regional measures are the ratio of employees to adults in the region. If the denominator were the total number of employees in the region rather than the total number of adults, this could understate the variation if workers leave the labor force when manufacturing employment declines. Again, I report an alternate specification in which the denominator is total employment rather than the adult population. The results are substantially the same.

The preferred geographic area for representing a labor market is the metropolitan area. The values of each measure were calculated for metropolitan areas, counties, and states. If the metro value is available, it is linked to the respondent's record using the individual's reported county of residence.[6] In some years, the CPS identified counties that were not in a metropolitan area, and those values are used when available. Finally, if neither a metro area nor a county measure is available, the individual is assigned values calculated using all CPS respondents in nonmetropolitan counties of the same state. All of the CPS measures

[5] I report an alternate specification with an indicator and interaction for metro areas and years in which the manufacturing industries themselves met the criteria for being degree-intensive.

[6] Metropolitan areas are always defined as combinations of discrete counties. Knowing a respondent's county is sufficient to place him or her in a metro area.

are constructed as a three-year average of the current year and the two previous years. While the CPS samples are large at the state level, they are smaller than would be ideal at the metropolitan level. Averaging three annual samples improves the precision of the measures.

There is a contrast between the two industry measures used in this analysis because manufacturing is defined by a fixed sector of Census industry codes (derived from the North American Industry Classification System (NAICS)), while degree-intensive employment is an evolving collection of subsectors defined by their workers' educational attainment. For consistency, one could reproduce this analysis using only NAICS sectors or similarly defined groups such as high-wage/low-wage, growing/declining, or degree-intensive/non-degree-intensive.[7] However, the classifications used here best reflect the industrial transition as it is usually understood by the public and policymakers. There is a very common narrative that asserts that regional transitions from manufacturing-based economies to knowledge-, information-, or high-technology-based economies are desirable or inevitable (for examples, see Cowell (2013); Porter (2016); Austin (2017)). The decline portion of the narrative focuses on manufacturing (Wilson, 2014; Bernard, Smeets, and Warzynski, 2017). The revitalization portion of the narrative is more open-ended, including a variety of degree-intensive industries such as education, healthcare, information technology, and finance (Bartik and Erickcek, 2007; Gurwitt, 2008; Potts, 2009; Leigh and Blakely, 2016; Neumann, 2016; Cleave, Arku, and Chatwin, 2017). Industries credited with revitalizing regions can be found in at least seven different NAICS sectors.

4 Descriptive Statistics

In Table 1, we observe the variables of interest, controls, and mechanism measures. To be consistent with the focus of the analysis on upward educational mobility, all the descriptive

[7]While it would be interesting to know the impact of agriculture or mining, the NLSY data cannot support that analysis. These activities employ small shares of the total labor force, primarily in nonmetropolitan areas. There is too little geographic variation and too few exposed NLSY respondents to support precise estimates of these industries' impact on education.

statistics are calculated using only the respondents whose parents do not have a college degree. High school attainment is 82 percent in the 1979 children's sample and college degree attainment is 15 percent. These are lower than the attainment rates one finds in the American Community Survey for people of the same birth cohorts, but this is primarily because ACS-based estimates cannot be disaggregated by the parent's level of education. The children of college graduates have higher attainment rates, which raise the population average.

The average manufacturing employment of adults in the respondent's region when he or she was aged 15 to 17 was 10 percent. Adults employed in industries with more college graduates than the labor force overall averaged 22 percent. Table 1 gives the mean and standard deviations of six alternate measures of employment by industry. The alternate measures differ in intuitive ways. The 10-year change in manufacturing is negative and the change in degree-intensive employment is positive. If the industry exposure is measured over the respondent's whole childhood, rather than just at ages 15 to 17, exposure to manufacturing appears slightly higher and exposure to degree-intensive industries slightly lower.

Consistent with the tendency for less-educated women to have children at younger ages, we see that the mother's mean age at the respondent's time of birth is 23.6. African Americans have a higher representation, 24 percent, in the sample than in the general population. Hispanic representation is just 11 percent which reflects the US Hispanic population in 1979. The respondents' mothers had to be living in the US in 1979 to enter the survey, so immigrant children are not represented.

Figure 1 displays the distributions of the industry employment to adult ratios for the respondents. The sample has coverage for most combinations of manufacturing shares between 2 and 20 percent and degree-intensive shares between 10 and 40 percent. Hundreds of respondents are observed in what might be considered manufacturing centers, where manufacturing employs over 10 percent of adults and degree-intensive industries employ less than 20 percent. There are also ample observations in places with above-average degree-intensive employment and below-average manufacturing employment. Finally, there are observations in regions that have below-average shares of both types of employment.

The last section of Table 1 shows the measures of the mechanism variables. The income measures are all inflation adjusted and logged. The household income of the respondent's parents is lower than the median for the region. By the time the respondents reach age 17, a large fraction, 40 percent, are in single-parent homes.

5 Results

5.1 Main Results

Table 2 presents the results of the main high school and college attainment models. The measures of manufacturing and degree-intensive employment are entered individually and then together in a third set of regressions. In labor markets where the manufacturing share is higher by 1 percent of the adult population, another 4 out of 100 children of parents without a college degree complete high school and another 6 complete college. For comparison, a region at the 25th percentile of high school completion sees 74 out of 100 students graduate, while regions at the 75th percentile see 87 out of 100.

In the models of high school and college attainment with the degree-intensive share alone, the coefficients are smaller in magnitude and not statistically significant. However, if the relationship between degree-intensive industries and college graduation is estimated conditional on the share of adults employed in manufacturing, the coefficient rises to .23 and becomes highly significant. The coefficient on the manufacturing share also increases from .59 to .74 when conditioning on degree-intensive employment. With both measures in the model, these coefficients are driven by the contrast in attainment between places that have higher levels of one or the other type of industry, and areas that have neither. Considering the motivating policy narrative, the main results of this analysis suggest that regions are better off retaining manufacturing if the goal is intergenerational upward mobility in education. However, if regional policy efforts are unable to retain manufacturing employment, then growth of degree-intensive employment should be pursued. In areas that lack both types of employment, the children of parents without college degrees are less likely to obtain college degrees. Notably, the same cannot be said for high school attainment. The main results do not suggest that having more degree-intensive employees in a region is positively related to high school completion. These results do not provide a reason to believe that declines in high school attainment due to the loss of manufacturing employment can be offset by gains in degree-intensive employment.

The coefficients on the controls are fairly steady throughout all six models in Table 2, suggesting they act independently from the industries. The mother's ASVAB score is predictive of degree completion even when fixed effects for both the mother's and father's years of schooling are in the model. Female respondents and those with an immigrant parent are more likely to complete high school and college. In Table 3, results from 13 alternate specifications are presented to verify that the positive relationship between manufacturing and degree attainment is robust. In specification 2, state fixed effects are included, forcing the models to identify the relationship using only within-state variation. Relative to the main models, the coefficients decline, the standard errors increase, and statistical significance is lost for the high school models. Specification 3 includes a family fixed effect. Using only the variation between siblings, none of the coefficients are significant at the 5 percent level. In specification 4, exposure is averaged throughout the respondent's childhood, rather than just during the 15th to 17th years. This leads to similar coefficients.

Specification 5 aims to use the variation created by families' migration. For example, if a mother with a 5-year-old and a 10-year-old respondent migrated from a region with no industry concentration to a labor market with high manufacturing employment, the average exposure to manufacturing over the whole childhood should be higher for the younger sibling. This specification tests whether this increased exposure is associated with higher educational attainment by using the all-childhood exposure measure, limiting the sample to families that migrate, and including a family fixed effect. This is very demanding of a sample of this size, resulting in standard errors an order of magnitude larger than those of the main model. The coefficients are also large, but they cannot support any conclusions because of their imprecision.

Specification 6 considers whether the agglomeration of an industry is predictive by measuring the industries using the log of their employment count. Measured this way, manufacturing is not significantly associated with high school attainment but it is positively associated with college attainment. The logged employment counts in manufacturing and degree-intensive industries are highly collinear (.94), so the conditional models assign them coefficients of similar magnitudes and opposite signs. Using a probit specification (specification 8) leads to the same conclusions as in the main model.

The next set of results in specification 8 include long-lagged measures of educational attainment in the region as an additional control. These models address the possibility that the industrial composition and young people's educational attainment are confounded by the fact that the residents of some regions "value education" more than others. This cultural preference may have caused the high school and college graduation rates in some regions to be above the national average for many decades. Higher education levels could have given local firms a productivity advantage and raised the local representation of degree-intensive or manufacturing employment. If we control for the education levels that prevailed before the respondents were born, this should reduce the estimated impact of the industries if this type of confounding is at work.

Before introducing lagged education measures as an additional control, we should consider their correlation with the variables of interest, the industry measures. Both the long-lagged high school and college attainment rates (which are positively correlated with one another at .75) are strongly positively correlated (.46 to .67) with the shares of adults working in degree-intensive industries 20 years later. We may expect that manufacturing firms would prefer regions with a more highly educated workforce if the firms are investing in advanced production processes. However, the overall correlation does not support this. In the merged data, the region's long-lagged high school and college attainment rates are negatively correlated (-.22 to -.35) with the manufacturing share observed 20 years later.[8]

With the lagged education measures added in specification 8, the estimates provide no support for a "valuing education" confounding narrative. The measures of 20-years-prior high school and college attainment are not significantly related to the respondents' degree attainment. Their inclusion as controls leaves the industry measure coefficients unchanged, or shifts them in the wrong direction. Recall that these samples are limited to children whose parents do not have college degrees, so a regional preference favoring education would have to assist these children through public education expenditures or complementary demand for their parents' labor.

Using the share of adults in manufacturing-specific occupations (specification 9) also supports the conclusion that manufacturing is associated with higher educational attainment for children whose parents do not have college degrees. The results are robust to changing the denominator from all adults to all employed persons (specification 10). The coefficients are also not being driven by a few observations with leverage. In specification 11, the observations with the highest and lowest manufacturing shares are dropped, and the relationships suggested by the main model remain.

The change over 10-years models (specification 10) in table 3 uses the variation created by the evolving industrial mixes in the regions. This should reflect how important the future availability of work is for the respondents. For example, falling manufacturing employment and rising degree-intensive employment could motivate students to complete high school and college so they would have lasting earnings potential. None of the coefficients of interest is significant, however.

To address the possibility that the manufacturing industries have become degree-intensive

[8] This relationship is approximately linear. Areas with the lowest education levels retained higher concentrations of manufacturing than medium-attainment regions that should not have had any issues with manufacturers being priced out.

industries themselves, either through geographic dispersion of the production processes or up-skilling, specification 13 was estimated with an indicator if manufacturing in that region had a higher college degree share than the national labor market average that year. The indicator is then interacted with the manufacturing share. With this specification, the noninteracted manufacturing share represents lower-skilled manufacturing and the interaction term measures whether the slope is significantly different for regions with higher-skilled manufacturing. The coefficients representing lower-skilled manufacturing are similar to the coefficients in the main model. The differential slopes are positive (.26 and .26) in the unconditional models, and negative in the conditional models, but the difference is not statistically significant. This suggests that the main results for manufacturing are not driven by high-skilled manufacturing.

The remainder of Table 3 contains 12 disaggregations. From these, we learn that the manufacturing share is more positively associated with high school attainment for female respondents and those living in smaller metropolitan areas. The relationship between manufacturing and college attainment is positive and significant in non-metro areas, stronger in small metros, and stronger yet in the most populous metros (specifications 16, 17, 18). The positive relationships between manufacturing and degree attainment are largest for non-Hispanic whites (21), and positive but not significant for Hispanic high school students (20) and African American college students (19). There is a marginally significant negative coefficient in the conditional high school model in specification 19, suggesting African Americans are disadvantaged in manufacturing centers. Finally, the positive relationship between manufacturing and degree attainment is strongest for the children of high school graduates (23) and negative but not significant for the children with one or two college-educated parents (24).

Table 4 presents the same alternate specifications and disaggregations for the conditional and unconditional models with degree-intensive industry shares. In the high school models, the relationship between degree-intensive employment and degree attainment is usually negative but not significantly so. In the unconditional models relating degree-intensive employment to college completion by respondents whose parents lacked undergraduate degrees, the coefficients are mostly positive but not significant. In specification 8, the 20-year lagged college attainment rate is collinear with the degree-intensive industry measure, resulting in offsetting coefficients. In the main results (specifcation 1) the only significant coefficient on the degree-intensive employment measure is in the conditional model of college completion. This result is robust to the probit specification (7), the alternate measurement (9, 10), and trimming (11). As with the manufacturing measure, no results are found if there is a family fixed effect included (3, 5). The coefficient is significant if the degree-intensive industry share is measured by its change over the proceeding decade (12), but not if it is averaged over the respondent's childhood (4).

Among the disaggregations in Table 4, the conditional college attainment models suggest the degree-intensive employment matters for both females (specification 14) and males (15), residents of small metro areas (17), non-Hispanic whites (21), and respondents whose parents have a high school diploma but no college degree (23).

5.2 Mechanisms

The results presented so far have been representing a reduced-form relationship between industrial composition on educational attainment. As discussed in Section 2, there are reasons to believe an industry could have either a positive or negative impact on educational attainment depending on how the industry impacts a variety of mechanisms. To illuminate these processes, Table 5 presents the results of models exploring eight potential mechanisms. For a potential mechanism to be feasible, it must be correlated with both the industry measures and educational attainment. The left-hand section of Table 5 presents the coefficients from regressing educational outcomes on the mechanisms. The results of regressing the mechanism measure on the industry employment measures are presented in the right-hand section. If there are significant coefficients in both regressions for a mechanism, that is consistent with that mechanism being one of the channels through which an industry is influencing educational attainment. If the coefficients are insignificant or counterintuitive, then it is less likely that the mechanism is consequential.

The first four sets of results in Table 5 are unable to confirm the relationship we would hypothesize between wage premiums and degree attainment. Three of the four coefficients on the wage premium measures are negative and all are imprecisely measured. The regressions with the wage premiums as dependent variables have positive and significant coefficients on the industry measures, suggesting that returns to education are higher in areas with more degree-intensive industry employment or more manufacturing employment. However, the students in the sample did not respond to the premiums available in their regions by obtaining more degrees. Similarly, the coefficients on the measures of youth employment in manufacturing are not consistent with an opportunity cost hypothesis. In labor markets where more young people work in manufacturing, more of them finish high school instead of dropping out (.31). Youth employment in degree-intensive industries is significantly positively associated with college completion (.18), which would not be consistent with youth employment raising the opportunity cost of continuing in college. While their are direct and indirect costs for young people in degree-intensive industries continuing in school, obtaining a college degree is a necessary step for career advancement in these industries. Also, their work experience is more likely to be complementary to their academic work than would be the case for youth working in manufacturing. For both manufacturing and degree-intensive industries, the share of adults employed in the industry in the local labor market is strongly positively related to the youth employment in the same industries.

The presence of undergraduate and graduate students in the local area is positively associated with college degree completion by the NLSY respondents whose parents were not graduates themselves. The presence of these students is significantly positively associated with the measure of degree-intensive employment in the region, so this is a feasible mechanism through which degree-intensive industries could be supporting upward educational mobility.

It is not a feasible mechanism for manufacturing because manufacturing is negatively correlated with the presence of college students.

When conditioning on individual characteristics such as gender, race, and parents' education, incomes in the local labor market do not have a significant relationship with high school graduation. There is, however, a positive relationship between a labor market's median or per capita income and upward educational mobility to college attainment. Higher shares of adults employed in degree-intensive industries are associated with higher income distributions, which suggests this is another channel through which those industries could be supporting college attainment. For manufacturing, the share of adults it employs is only positively associated (1.34, 0.90) with the income distribution if manufacturing centers are contrasted with places that have low degree-intensive industry shares as in the models with both industry measures.

If income is measured in the respondent's household, it has a highly significant positive relationship with both high school and college attainment, even after conditioning on the mother's test scores and both parents' years of education. As with incomes measured at the labor market level, household incomes are higher where there is more degree-intensive industry employment. For manufacturing, a positive relationship is only visible when conditioning on degree-intensive employment. Together, these results suggest degree-intensive industries assist children whose parents do not have college degrees by raising the parents' income. Respondents that grew up in areas with more manufacturing did not have household incomes distinguishable from the distribution of all respondents, but they did have higher household incomes than respondents in areas without higher degree-intensive employment shares.

The household-level mechanisms in Table 5 are more intuitively related to educational outcomes. Living in a single-parent household is negatively correlated with high school and college completion, and the coefficients are significantly different from zero. Respondents living in labor markets with greater shares of adults employed in manufacturing are less likely to be living in single-parent households. Unlike the income models, the coefficient on the manufacturing share is large and significant without conditioning on the degree-intensive industry share. Having a nonworking mother or a nonworking father both also had a significant negative relationship with high school completion. A higher manufacturing share is associated with fewer mothers not working, but the relationship loses significance when the degree-intensive industry share is also in the model. Neither industry share is significantly associated with the probability of the respondent's father not working. These results suggest both manufacturing and degree-intensive employment could contribute to both high school and college attainment by increasing the likelihood that students benefit from having two adults in the household. For the respondents' mothers who do not have college degrees, it appears the respondents are more likely to finish high school if the mother is in the labor force, and the mothers are more likely to be in the labor force if there is more manufacturing employment in the region.

6 Conclusion

Based on the experiences of the children of the NLSY 79 mothers, it appears that living in a local labor market in which a greater share of adults is employed in manufacturing is supportive of high school and college completion. Living in a labor market with a greater share of adults are employed in degree-intensive industries is associated with upward educational mobility in the form of children finishing college when their parents did not. The conditional college model (Table 2) suggests that a child in the Boston metro area (degree-intensive share 30.1) would be 3.8 percentage points more likely to earn a college degree relative to a child in Chicago (degree-intensive share 24.9).[9] This is promising because it suggests that local labor markets that lose manufacturing jobs can maintain first-in-family-to-go-to-college intergenerational mobility if they can grow their degree-intensive employment. However, the results are much less promising with regard to high school attainment. None of the specifications returns a significant positive relationship between degree-intensive employment and

[9]The Chicago and Boston metro areas have similar manufacturing shares at 7.4 and 7.1, respectively.

high school completion. This should raise concerns for policymakers in regions that have concentrations of degree-intensive industries but still have large populations of students who are not completing high school.

Manufacturing appears to have a net positive impact on both high school and college completion. This is consistent with manufacturing employment supporting a wider distribution of parents, including both parents of marginal high school students and parents of marginal college students. The conditional high school model suggests that a child of parents without college degrees in Detroit, with a manufacturing share of 14.1 percent, is 4 percentage points more likely to finish high school than the child of high school graduates in Miami, which has a manufacturing share of 3.7 percent. Both of these metro areas have a 22 percent share in degree-intensive industries. Children in the Cincinnati and Austin metro areas were near similar concentrations of manufacturing employment at approximately 10 percent of each region's adults. However, degree-intensive industry employment is 24.8 percent in Cincinnati and 34.8 percent in Austin. The conditional model of college attainment suggests the child of a noncollege graduate is 2.3 percentage points more likely to complete college after growing up in Austin rather than Cincinnati.

The negative relationship that Goldin and Katz and others have identified between manufacturing and educational attainment may have persisted through the peak of manufacturing employment in the middle of the last century (Goldin and Katz, 2003). However, we can see that the relationship between manufacturing and degree attainment appears to have been evolving. By the 1990s, the decline of manufacturing in former manufacturing regions was clearly evident. The manufacturing employment that remained was more likely to be technologically advanced and to demand more education (Voigtlander, 2014). In the models estimated with data from the 1990s and 2000s, the impact of manufacturing employment on college attainment appears to be more positive than the impact of degree-intensive employment. Going forward, the public and policymakers need not think of manufacturing as a force discouraging education.

In this analysis, there is almost no evidence for the industries working through wage premiums or opportunity costs. While the measures of industry employment are highly correlated with both premiums and youth employment, the correlation between these mechanisms' measures and the respondents' degree attainment run counter to traditional theoretical predictions in most instances.

Among the mechanisms through which industries might influence education, this analysis finds evidence for family structure, household income, the regional income distribution, and the presence of post-secondary institutions. Both manufacturing and degree-intensive industries support the children of parents without college degrees by raising incomes and making it more likely that parents stay together. Relative to areas that lack both, degree-intensive industries and manufacturing are associated with higher household incomes and more dual-parent families among parents without college degrees. Household income is predictive of degree completion even while conditioning on the mother's ability and the parents' education.

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References

Acs, Gregory and Sheldon Danziger (1993). "Educational attainment, industrial structure, and male earnings through the 1980s." *Journal of Human Resources*, 28(3), pp. 618–648. URL https://doi.org/10.2307/146163.

Austin, John (2017). "A tale of two Rust Belts: Diverging economic paths shaping community politics." URL https://www.brookings.edu/blog/the-avenue/2017/06/30/a-tale-of-two-rust-belts-diverging-economic-paths-shaping-community-politics/.

Barnhouse Walters, Pamela and Philip J. O'Connell (1988). "The family economy, work, and educational participation in the United States, 1890-1940." *American Journal of Sociology*, 93(5), pp. 1116–1152. URL https://doi.org/10.1086/228866.

Bartik, Timothy J. and George Erickcek (2007). "Higher education, the health care industry, and metropolitan regional economic development: What can "Eds & Meds" do for the economic fortunes of a metro area's residents?" Technical Report 08-140, W. E. Upjohn Institute for Employment Research. URL https://doi.org/10.17848/wp08-140, publisher: ERIC.

Beeson, Patricia, Lara Shore-Sheppard, and Kathryn Shaw (2001). "Industrial change and wage inequality: Evidence from the steel industry." *Industrial and Labor Relations Review*, 54(2A), pp. 466–483. URL https://doi.org/10.1177/001979390105400225.

Bernard, Andrew B., Valerie Smeets, and Frederic Warzynski (2017). "Rethinking deindustrialization." *Economic Policy*, 32(89), pp. 5–38. URL https://doi.org/10.1093/epolic/eiw016.

Berry, Christopher R. and Edward L. Glaeser (2005). "The divergence of human capital levels across cities." *Papers in Regional Science*, 84(3), pp. 407–444. URL https://doi.org/10.1111/j.1435-5957.2005.00047.x.

Bjorklund, Anders, Donna K. Ginther, and Marianne Sundstrom (2007). "Family structure and child outcomes in the USA and Sweden." *Journal of Population Economics*, 20(1), pp. 183–201. URL https://doi.org/10.1007/s00148-006-0094-7.

Black, Dan A., Terra G. McKinnish, and Seth G. Sanders (2003). "Does the availability of high-wage jobs for low-skilled men affect welfare expenditures? Evidence from shocks to the steel and coal industries." *Journal of Public Economics*, 87(9-10), pp. 1921 – 1942. URL https://doi.org/10.1016/S0047-2727(02)00014-2.

Bound, John and Harry J. Holzer (1993). "Industrial shifts, skills levels, and the labor market for white and black males." *Review of Economics and Statistics*, 75(3), pp. 387–396. URL https://doi.org/10.2307/2109452.

Card, David (1995). "Using geographic variation in college proximity to estimate the return to schooling." In Loizos Nicolaou Cristofides, John Vanderkamp, E. Kenneth Grant, and Robert Swidinsky, editors, *Aspects of Labour Market Behaviour: Essays in Honour of John Vanderkamp*, pp. 201–222. University of Toronto Press.

Charles, Kerwin Kofi, Erik Hurst, and Matthew J. Notowidigdo (2015). "Housing booms and busts, labor market opportunities, and college attendance." Working Paper 21587, National Bureau of Economic Research. URL https://doi.org/10.3386/w21587.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez (2014). "Where is the land of opportunity? The geography of intergenerational mobility in the United States." *Quarterly Journal of Economics*, 129(4), pp. 1553–1623. URL https://doi.org/10.1093/qje/qju022.

Cleave, Evan, Godwin Arku, and Merlin Chatwin (2017). "Cities' economic development efforts in a changing global economy: Content analysis of economic development plans in Ontario, Canada." *Area*, 49(3), pp. 359–368. URL http://doi.org/10.1111/area.12335.

Coelli, Michael B. (2011). "Parental job loss and the education enrollment of youth." *Labour Economics*, 18(1), pp. 25–35. URL https://doi.org/10.1016/j.labeco.2010.04.015.

Cowell, Margaret M. (2013). "Bounce back or move on: Regional resilience and economic development planning." *Cities*, 30, pp. 212–222. URL https://doi.org/10.1016/j.cities.2012.04.001.

Crosnoe, Robert, Rashmita S. Mistry, and Glen H. Elder (2002). "Economic disadvantage, family dynamics, and adolescent enrollment in higher education." *Journal of Marriage and Family*, 64(3), pp. 690–702. URL https://doi.org/10.1111/j.1741-3737.2002.00690.x.

Donaldson, Caitlin Cullen and Suzanne O'Keefe (2013). "The effects of manufacturing on educational attainment and real income." *Economic Development Quarterly*, 27(4), pp. 316–324. URL https://doi.org/10.1177/0891242413490794.

Feenstra, Robert C. and Gordon H. Hanson (1999). "The impact of outsourcing and high-technology capital on wages: Estimates for the United States, 1979-1990." *Quarterly Journal of Economics*, 114(3), pp. 907–940. URL https://doi.org/10.1162/003355399556179.

Fernandez, Raquel and Richard Rogerson (2003). "Equity and resources: An analysis of education finance systems." *Journal of Political Economy*, 111(4), pp. 858–897. URL https://doi.org/10.1086/375381.

Flood, Sarah, Miriam King, Renae Rodgers, Steven Ruggles, and J Robert Warren (2020). "Integrated public use microdata series, current population survey: Version 7.0 [dataset]." *Minneapolis, MN: IPUMS*. URL https://doi.org/10.18128/D030.V7.0.

Fuller, Bruce (1983). "Youth job structure and school enrollment, 1890-1920." *Sociology of Education*, 56(3), pp. 145–156. URL https://doi.org/10.2307/2112383.

Ginther, Donna K. and Robert A. Pollak (2004). "Family structure and children's educational outcomes: Blended families, stylized facts, and descriptive regressions." *Demography*, 41(4), pp. 671–696. URL https://doi.org/10.1353/dem.2004.0031.

Glaeser, Edward L. and Joseph Gyourko (2005). "Urban decline and durable housing." *Journal of Political Economy*, 113(2), pp. 345–375. URL https://doi.org/10.1086/427465.

Glaeser, Edward L. and Matthew G. Resseger (2010). "The complementarity between cities and skills." *Journal of Regional Science*, 50(1), pp. 221–244. URL https://doi.org/10.1111/j.1467-9787.2009.00635.x.

Goldin, Claudia and Lawrence F. Katz (2003). "Why the United States led in education: Lessons from secondary school expansion, 1910 to 1940." In David Eltis, Frank D. Lewis, and Kenneth L. Sokoloff, editors, *Human Capital and Institutions: A Long-Run View*, pp. 143–178. Cambridge University Press., New York, NY. URL https://doi.org/10.1017/cbo9780511605390.007.

Gould, Eric D. (2019). "Explaining the unexplained: Residual wage inequality, manufacturing decline and low-skilled immigration." *The Economic Journal*, 129(619), pp. 1281–1326. URL https://doi.org/10.1111/ecoj.12611.

Gruber, Jonathan (2004). "Is making divorce easier bad for children? The long-run implications of unilateral divorce." *Journal of Labor Economics*, 22(4), pp. 799–833. URL https://doi.org/10.1086/423155.

Gurwitt, Rob (2008). "Eds, meds, and urban revival: In many cities, a big university is becoming the economic engine that a big corporation used to be." *Governing*, pp. 44–50. URL https://community-wealth.org/content/eds-meds-and-urban-revival-many-cities-big-university-becoming-economic-engine-big.

Han, Wen-Jui, Chien-Chung Huang, and Irwin Garfinkel (2003). "The importance of family structure and family income on family's educational expenditure and children's college attendance: Empirical evidence from Taiwan." *Journal of Family Issues*, 24(6), pp. 753–786. URL https://doi.org/10.1177/0192513X03254518.

Haveman, Robert, Barbara Wolfe, and James Spaulding (1991). "Childhood events and circumstances influencing high school completion." *Demography*, 28(1), pp. 133–157. URL https://doi.org/10.2307/2061340.

Horan, Patrick M. and Peggy G. Hargis (1991). "Children's work and schooling in the late nineteenth-century family economy." *American Sociological Review*, 56(5), pp. 583–596. URL https://doi.org/10.2307/2096081.

Kalil, Ariel and Patrick Wightman (2011). "Parental job loss and children's educational attainment in black and white middle-class families." *Social Science Quarterly*, 92(1), pp. 57–78. URL https://doi.org/10.1111/j.1540-6237.2011.00757.x.

Knapp, Thomas A., Nancy E. White, and Amy M. Wolaver (2013). "The returns to migration: The influence of education and migration type." *Growth and Change*, 44(4), pp. 589–607. URL https://doi.org/10.1111/grow.12022.

Lee, Chul-In and Gary Solon (2009). "Trends in intergenerational income mobility." *Review of Economics and Statistics*, 91(4), pp. 766–772. URL https://doi.org/10.1162/rest.91.4.766.

Leigh, Nancy G. and Edward J. Blakely (2016). *Planning local economic development: Theory and practice*. SAGE Publications. URL https://books.google.com/books?id=LQicDQAAQBAJ, pages: 460-463.

Ludwig, Jens (1999). "Information and inner city educational attainment." *Economics of Education Review*, 18(1), pp. 17–30. URL https://doi.org/10.1016/S0272-7757(97)00054-X.

Magruder, Jeremy R. (2010). "Intergenerational networks, unemployment, and persistent inequality in South Africa." *American Economic Journal: Applied Economics*, 2(1), pp. 62–85. URL https://doi.org/10.1257/app.2.1.62.

Manski, Charles F. (1992). "Alternative estimates of the effect of family structure during adolescence on high school graduation." *Journal of the American Statistical Association*, 87(417), pp. 25–37. URL https://doi.org/10.1080/01621459.1992.10475171.

Margo, Robert A. and T. Aldrich Finegan (1996). "Compulsory schooling legislation and school attendance in turn-of-the century America: A 'Natural experiment' approach." *Economics Letters*, 53(1), pp. 103–110. URL https://doi.org/10.1016/S0165-1765(96)00882-8.

Mazumder, Bhashkar (2016). "Estimating the intergenerational elasticity and rank association in the United States: Overcoming the current limitations of tax data?" In *Inequality: Causes and Consequences*, pp. 83–129. Emerald Group Publishing Limited. URL https://doi.org/10.1108/S0147-912120160000043012.

Monserud, Maria A. and Glen H. Elder (2011). "Household structure and children's educational attainment: A perspective on coresidence with grandparents." *Journal of Marriage and Family*, 73(5), pp. 981–1000. URL https://doi.org/10.1111/j.1741-3737.2011.00858.x.

Montmarquette, Claude, Nathalie Viennot-Briot, and Marcel Dagenais (2007). "Dropout, school performance, and working while in school." *Review of Economics and Statistics*, 89(4), pp. 752–760. URL https://doi.org/10.1162/rest.89.4.752.

Murnane, Richard J. (2013). "U.S. high school graduation rates: Patterns and explanations." *Journal of Economic Literature*, 51(2), pp. 370–422. URL https://doi.org/10.1257/jel.51.2.370.

Neumann, Tracy (2016). *Remaking the rust belt: The postindustrial transformation of North America*. University of Pennsylvania Press. URL https://doi.org/10.9783/9780812292893.

O'Regan, Katherine M. and John M. Quigley (1993). "Family networks and youth access to jobs." *Journal of Urban Economics*, 34(2), pp. 230–248. URL https://doi.org/10.1006/juec.1993.1035.

Porter, Eduardo (2016). "The mirage of a return to manufacturing greatness." *The New York Times*. URL https://www.nytimes.com/2016/04/27/business/economy/the-mirage-of-a-return-to-manufacturing-greatness.html?mcubz=0.

Potts, Jason (2009). "Why creative industries matter to economic evolution." *Economics of Innovation and New Technology*, 18(7), pp. 663–673. URL http://doi.org/10.1080/10438590802564592.

Rege, Mari, Kjetil Telle, and Mark Votruba (2011). "Parental job loss and children's school performance." *The Review of Economic Studies*, 78(4), pp. 1462–1489. URL https://doi.org/10.1093/restud/rdr002.

Rothwell, Jonathan T. and Douglas S. Massey (2015). "Geographic effects on intergenerational income mobility." *Economic Geography*, 91(1), pp. 83–106. URL https://doi.org/10.1111/ecge.12072.

Schmidt, Stephen J. and Therese A. McCarty (2008). "Estimating permanent and transitory income elasticities of education spending from panel data." *Journal of Public Economics*, 92(10-11), pp. 2132–2145. URL https://doi.org/10.1016/j.jpubeco.2008.03.005.

Solon, Gary (1992). "Intergenerational income mobility in the United States." *American Economic Review*, 82(3), pp. 393–408. URL https://www.jstor.org/stable/2117312.

Stevens, Ann Huff and Jessamyn Schaller (2011). "Short-run effects of parental job loss on children's academic achievement." *Economics of Education Review*, 30(2), pp. 289–299. URL https://doi.org/10.1016/j.econedurev.2010.10.002.

Stinebrickner, Ralph and Todd Stinebrickner (2014). "Academic performance and college dropout: Using longitudinal expectations data to estimate a learning model." *Journal of Labor Economics*, 32(3), pp. 601–644. URL https://doi.org/10.1086/675308.

Sweetland, Scott R. (2014). "An exploratory analysis of the equity of Ohio school funding." *Journal of Education Finance*, 40(1), pp. 80–100. URL https://www.muse.jhu.edu/article/553210.

Vartanian, Thomas P. and Philip M. Gleason (1999). "Do neighborhood conditions affect high school dropout and college graduation rates?" *Journal of Socio-Economics*, 28(1), pp. 21–41. URL https://doi.org/10.1016/S1053-5357(99)00011-6.

Voigtlander, Nico (2014). "Skill bias magnified: Intersectoral linkages and white-collar labor demand in U.S. manufacturing." *Review of Economics and Statistics*, 96(3), pp. 495–513. URL https://doi.org/10.1162/REST_a_00390.

von Simson, Kristine (2015). "Explaining upper secondary school dropout: New evidence on the role of local labor markets." *Empirical Economics*, 48(4), pp. 1419–1444. URL https://doi.org/10.1007/s00181-014-0829-3.

Wightman, Patrick and Sheldon H. Danziger (2014). "Multi-generational income disadvantage and the educational attainment of young adults." *Research in Social Stratification and Mobility*, 35, pp. 53–69. URL https://doi.org/10.1016/j.rssm.2013.09.004.

Wilson, Reid (2014). "Watch the U.S. transition from a manufacturing economy to a service economy, in one gif." *Washington Post*. URL https://www.washingtonpost.com/blogs/govbeat/wp/2014/09/03/watch-the-u-s-transition-from-a-manufacturing-economy-to-a-service-economy-in-one-gif?utm_term=.517e53d566c9, September 3.

Wilson, William Julius (1999). "When work disappears: New implications for race and urban poverty in the global economy." *Ethnic and racial studies*, 22(3), pp. 479–499. URL https://doi.org/10.1080/014198799329396.

	Variable	Mean	SD
Educational Outcomes	High school completion	0.82	0.38
	College completion	0.15	0.36
Industrial Composition Measures	Manufacturing industry employees/Adults	0.10	0.05
	Degree-intensive industry employees/Adults	0.22	0.09
	Average childhood exposure to manufacturing	0.11	0.04
	Average childhood exposure to DI industries	0.21	0.07
	Movers' exposure to manufacturing	0.11	0.04
	Movers' exposure to DI industries	0.20	0.06
	Agglomeration (log manufacturing employees)	10.72	1.85
	Agglomeration (log DI industry employees)	11.56	2.18
	Manufacturing occupation employees/Adults	0.06	0.03
	Degree-intensive occupation employees/Adults	0.21	0.06
	Manufacturing industry employees/employees	0.16	0.07
	Degree-intensive industry employees/employees	0.35	0.12
	10-year change in local manufacturing employment	−0.02	0.03
	10-year change in local degree-intensive employment	0.02	0.05
Controls in all models	Mother's Armed Forces Qualification Test (AFQT)	−0.35	0.92
	Mother's years of education	12.19	1.60
	Father's years of education	12.23	1.46
	Respondent's year of birth	1984.67	4.86
	Mother's age at respondent's birth	23.63	4.61
	Female	0.49	0.50
	African American	0.24	0.43
	Hispanic	0.11	0.31
	Number of siblings	2.90	1.22
	Spoke foreign language in parent's home	0.00	0.06
	Immigrant parent(s)	0.05	0.22
Additional controls	Long lagged (20-year) high school attainment	0.70	0.08
	Long lagged (20-year) college attainment	0.15	0.05
Mechanisms			
Returns to education	High school diploma wage premium	0.09	0.01
	College degree wage premium	0.10	0.00
	High school diploma wage premium, workers 18-24	0.08	0.02
	College degree wage premium, workers 25-30	0.09	0.02
Opportunity costs	Share of 18- to 24-year-olds employed in manufacturing	0.07	0.05
	Share of 18- to 24-year-olds employed in degree-intensive industries	0.14	0.07
College accessibility & salience	College and graduate students/Adults	0.04	0.01
Public education investment	Labor market median income	10.15	0.20
	Labor market per capita income	10.50	0.19
Private education investment	Parents' income	9.79	0.68
Parental time investment	Single parent	0.40	0.49
Role model and network	Nonworking mother	0.41	0.49
	Nonworking father	0.03	0.17

Table 1: Descriptive Statistics. Source: National Longitudinal Surveys of Youth and Current Population Survey.

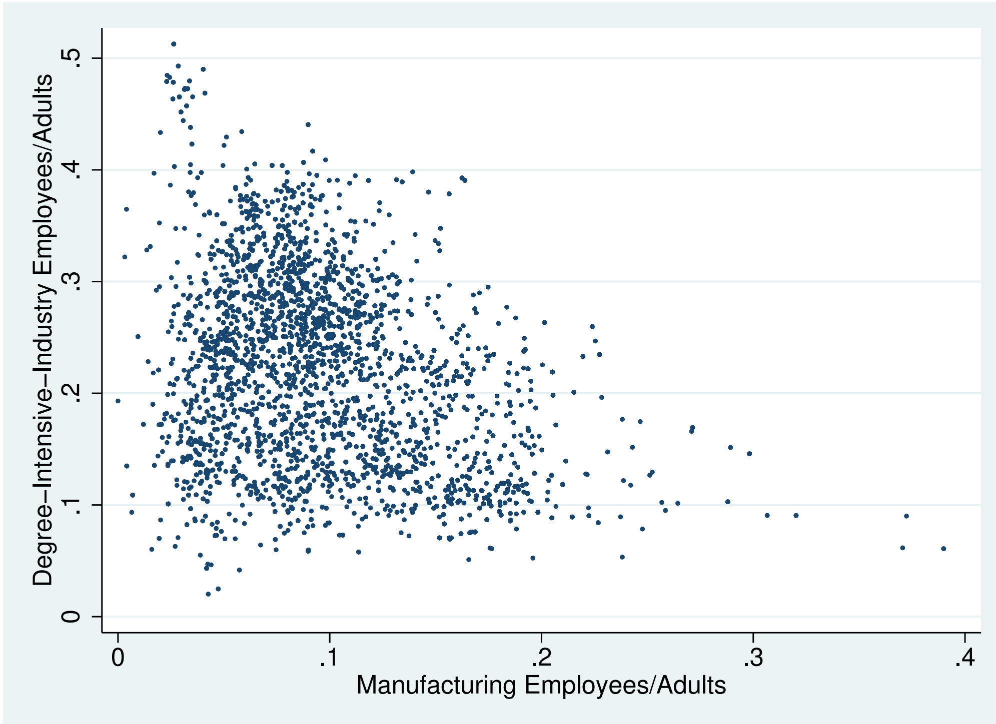

Figure 1: Exposure to industry employment in the region during NLSY respondents' late teens. Sources: National Longitudinal Surveys of Youth and Current Population Survey.

	Earned High School Diploma					
	Coef	SE	Coef	SE	Coef	SE
Manufacturing	0.40 * **	(0.13)			0.38 * **	(0.14)
Degree Intensive			−0.11	(0.07)	−0.04	(0.07)
Mother's ASVAB	0.05 * **	(0.01)	0.05 * **	(0.01)	0.05 * **	(0.01)
Female	0.09 * **	(0.01)	0.09 * **	(0.01)	0.09 * **	(0.01)
African American	0.03 * *	(0.02)	0.03 * *	(0.02)	0.03 * *	(0.02)
Hispanic	−0.01	(0.02)	−0.02	(0.02)	−0.01	(0.02)
Siblings	−0.03 * **	(0.01)	−0.03 * **	(0.01)	−0.03 * **	(0.01)
Foreign language	−0.03	(0.09)	−0.03	(0.09)	−0.03	(0.09)
Immigrant parent(s)	0.09 * **	(0.02)	0.09 * **	(0.02)	0.10 * **	(0.02)
Mother's years of education FE	Yes		Yes		Yes	
Father's years of education FE	Yes		Yes		Yes	
Mother's age at respondent's birth FE	Yes		Yes		Yes	
Birth cohort FE	Yes		Yes		Yes	
Constant	0.79 * **	(0.12)	0.86 * **	(0.12)	0.80 * **	(0.12)
R^2	0.10		0.10		0.10	
N	5,348		5,348		5,348	
	Earned College Degree					
Manufacturing	0.59 * **	(0.14)			0.74 * **	(0.15)
Degree Intensive			0.09	(0.07)	0.23 * **	(0.08)
Mother's ASVAB	0.08 * **	(0.01)	0.08 * **	(0.01)	0.08 * **	(0.01)
Female	0.05 * **	(0.01)	0.05 * **	(0.01)	0.05 * **	(0.01)
African American	0.00	(0.01)	−0.00	(0.01)	−0.00	(0.01)
Hispanic	−0.02	(0.01)	−0.04 * **	(0.01)	−0.03*	(0.01)
Siblings	−0.01	(0.00)	−0.00	(0.00)	−0.01	(0.00)
Foreign language	0.00	(.)	0.00	(.)	0.00	(.)
Immigrant parent(s)	0.12 * **	(0.03)	0.11 * **	(0.03)	0.11 * **	(0.03)
Mother's years of education FE	Yes		Yes		Yes	
Father's years of education FE	Yes		Yes		Yes	
Mother's age at respondent's birth FE	Yes		Yes		Yes	
Birth cohort FE	Yes		Yes		Yes	
Constant	0.87 * **	(0.09)	0.95 * **	(0.08)	0.83 * **	(0.08)
R^2	0.10		0.10		0.10	
N	4,518		4,518		4,518	

Table 2: Regression of respondents' educational attainment on measures of industry employment in the local labor market when the respondents were 15 to 17 years old. Dependent variables are indicators that the respondent completed high school or college. Observations are limited to children of parents who do not have a college degree. The standard errors are clustered by the county and appear to the right in parentheses. BLS-provided weights are applied in all regressions. The data sources are the National Longitudinal Surveys of Youth and the Current Population Survey. Significance key: * for p<.1, ** for p<.05, and *** for p<.01.

		Earned High School Diploma				Earned College Degree			
		Unconditional		Conditional		Unconditional		Conditional	
		Coef	SE	Coef	SE	Coef	SE	Coef	SE
1.	Main models (Table 2)	0.40***	(0.13)	0.38***	(0.14)	0.59***	(0.14)	0.74***	(0.15)
2.	State fixed effects	0.30	(0.20)	0.21	(0.21)	0.43**	(0.19)	0.57***	(0.21)
3.	Family fixed effects	0.46	(0.44)	0.45	(0.44)	0.61	(0.42)	0.73*	(0.44)
4.	Exposure since birth	0.45***	(0.14)	0.43***	(0.16)	0.57***	(0.15)	0.64***	(0.16)
5.	Exposure for movers w/ family fixed effects	1.10	(1.49)	1.35	(1.56)	−0.76	(1.29)	−1.17	(1.40)
6.	Agglomeration (log employment count)	−0.000	(0.003)	0.025**	(0.010)	0.008**	(0.004)	0.035***	(0.010)
7.	Probit	1.81***	(0.57)	1.75***	(0.60)	2.96***	(0.61)	3.63***	(0.68)
8.	Include lagged degree attainment	0.37***	(0.13)	0.39***	(0.14)	0.61***	(0.15)	0.73***	(0.15)
9.	Occupations measure	0.61***	(0.20)	0.66***	(0.21)	0.69***	(0.21)	0.96***	(0.23)
10.	Share of employment	0.25***	(0.08)	0.23**	(0.10)	0.36***	(0.09)	0.54***	(0.10)
11.	Trim top/bottom 5 pct of industry measure	0.34*	(0.19)	0.41**	(0.20)	0.47***	(0.18)	0.74***	(0.20)
12.	Change over previous 10 years	−0.09	(0.19)	−0.11	(0.19)	0.15	(0.22)	0.24	(0.22)
13.	Manufacturing as degree-intensive indicator	−0.05	(0.03)	−0.05	(0.03)	0.07**	(0.03)	0.06	(0.03)
	Man. employees/adults (Man. share in markets with non-DI man.)	0.30**	(0.14)	0.32**	(0.15)	0.73***	(0.16)	0.83***	(0.16)
	Interaction (Man. share in markets with DI man.)	0.26	(0.29)	0.26	(0.29)	−0.48	(0.35)	−0.49	(0.35)
14.	Females	0.52***	(0.16)	0.45**	(0.18)	0.50**	(0.22)	0.72***	(0.23)
15.	Males	0.25	(0.19)	0.25	(0.20)	0.69***	(0.19)	0.80***	(0.20)
16.	Non-Metro	0.22	(0.24)	0.09	(0.27)	0.52**	(0.25)	0.66**	(0.27)
17.	Metro population <2M	0.48***	(0.17)	0.52***	(0.17)	0.68***	(0.20)	0.81***	(0.20)
18.	Metro population >2M	0.56	(0.40)	0.49	(0.43)	1.02**	(0.48)	0.95*	(0.50)
19.	African American	−0.16	(0.22)	−0.43*	(0.25)	0.20	(0.18)	0.20	(0.19)
20.	Hispanic	0.44	(0.37)	0.46	(0.37)	0.08	(0.23)	0.08	(0.23)
21.	White, non-Hispanic	0.59***	(0.17)	0.59***	(0.17)	0.74***	(0.20)	0.93***	(0.21)
22.	Less than high school parent(s)	−0.42	(0.62)	−0.70	(0.65)	0.36	(0.30)	0.38	(0.34)
23.	High school graudate parent(s)	0.41***	(0.13)	0.41***	(0.14)	0.62***	(0.15)	0.77***	(0.16)
24.	College graduate parent(s)	−0.09	(0.16)	−0.08	(0.17)	−0.23	(0.37)	−0.13	(0.37)
25.	All respondents	0.27***	(0.10)	0.25**	(0.11)	0.45***	(0.14)	0.59***	(0.14)

Table 3: Regression of respondents' educational attainment on measures of manufacturing employment in the local labor market. Dependent variables are indicators that the respondent completed high school or college. Except where indicated, observations are limited to children of parents who do not have a college degree. Controls as listed in Table 1 are included in all models. The standard errors are clustered by the county and appear to the right in parentheses. BLS-provided weights are applied in all regressions. The data sources are the National Longitudinal Surveys of Youth and the Current Population Survey. Significance key: * for p<.1, ** for p<.05, and *** for p<.01.

		Earned High School Diploma				Earned College Degree			
		Unconditional		Conditional		Unconditional		Conditional	
		Coef	SE	Coef	SE	Coef	SE	Coef	SE
1.	Main models (Table 2)	−0.11	(0.07)	−0.04	(0.07)	0.09	(0.07)	0.23 * **	(0.08)
2.	State fixed effects	−0.14	(0.09)	−0.11	(0.09)	0.08	(0.08)	0.16*	(0.09)
3.	Family fixed effects	−0.07	(0.22)	−0.03	(0.22)	0.24	(0.20)	0.32	(0.21)
4.	Exposure since birth	−0.12	(0.09)	−0.02	(0.10)	−0.02	(0.10)	0.12	(0.10)
5.	Exposure for movers w/ family fixed effects	0.18	(0.65)	0.38	(0.68)	−0.31	(0.54)	−0.51	(0.58)
6.	Agglomeration (log employment count)	−0.003	(0.003)	−0.023***	(0.009)	0.004	(0.003)	−0.025***	(0.009)
7.	Probit	−0.39	(0.29)	−0.09	(0.31)	0.24	(0.34)	0.98 * **	(0.37)
8.	Include lagged degree attainment	−0.05	(0.08)	0.02	(0.08)	0.19 * *	(0.09)	0.31 * **	(0.09)
9.	Occupations measure	−0.08	(0.11)	0.06	(0.12)	0.15	(0.12)	0.36 * **	(0.12)
10.	Share of employment	−0.09*	(0.05)	−0.02	(0.06)	0.06	(0.05)	0.22 * **	(0.06)
11.	Trim top/bottom 5 pct of industry measure	−0.08	(0.09)	−0.00	(0.10)	0.14	(0.09)	0.33 * **	(0.10)
12.	Change over previous 10 years	−0.05	(0.12)	−0.06	(0.12)	0.24 * *	(0.11)	0.26 * *	(0.11)
13.	Manufacturing as degree-intensive indicator	−0.05	(0.05)	−0.04	(0.05)	0.02	(0.05)	0.03	(0.05)
	DI employees/adults (DI share in markets with non-DI man.)	−0.05	(0.09)	0.02	(0.09)	0.07	(0.09)	0.23 * *	(0.10)
	Interaction (DI share in markets with DI man.)	0.08	(0.17)	0.05	(0.17)	−0.05	(0.18)	−0.08	(0.18)
14.	Females	−0.18 * *	(0.09)	−0.09	(0.09)	0.16	(0.11)	0.30 * *	(0.12)
15.	Males	−0.05	(0.11)	−0.00	(0.11)	0.05	(0.10)	0.19 * *	(0.09)
16.	Non-Metro	−0.18	(0.14)	−0.15	(0.16)	−0.00	(0.14)	0.19	(0.16)
17.	Metro population <2M	0.02	(0.12)	0.11	(0.12)	0.26*	(0.13)	0.39 * **	(0.13)
18.	Metro population >2M	−0.18	(0.16)	−0.12	(0.17)	−0.23	(0.18)	−0.12	(0.20)
19.	African American	−0.15	(0.10)	−0.25 * *	(0.12)	−0.05	(0.08)	0.00	(0.09)
20.	Hispanic	−0.13	(0.15)	−0.14	(0.15)	0.05	(0.12)	0.05	(0.12)
21.	White, non-Hispanic	−0.12	(0.10)	−0.01	(0.11)	0.17	(0.11)	0.34 * **	(0.11)
22.	Less than high school parent(s)	−0.17	(0.31)	−0.33	(0.32)	−0.06	(0.14)	0.03	(0.15)
23.	High school graudate parent(s)	−0.09	(0.07)	−0.01	(0.08)	0.10	(0.08)	0.24 * **	(0.08)
24.	College graduate parent(s)	0.02	(0.08)	0.01	(0.08)	0.16	(0.17)	0.13	(0.17)
25.	All respondents	−0.07	(0.05)	−0.02	(0.06)	0.11	(0.07)	0.21 * **	(0.07)

Table 4: Regression of respondents' educational attainment on measures of degree-intensive industry employment in the local labor market. Dependent variables are indicators that the respondent completed high school or college. Except where indicated, observations are limited to children of parents who do not have a college degree. Controls as listed in Table 1 are included in all models. The standard errors are clustered by the county and appear to the right in parentheses. BLS-provided weights are applied in all regressions. The data sources are the National Longitudinal Surveys of Youth and the Current Population Survey. Significance key: * for p<.1, ** for p<.05, and *** for p<.01.

Independent Variable: Channel	Dependent Variable: Earned High School Diploma	Dependent Variable: Earned College Degree	Independent Variable: Industry Measures	Dependent Variable: Channel	Dependent Variable: Channel	Dependent Variable: Channel
High school wage premium	0.14		Man.	0.01		0.03***
	(0.90)			(0.01)		(0.01)
			DI		0.02***	0.03***
					(0.00)	(0.00)
College wage premium		−0.23	Man.	−0.01***		0.01*
		(1.31)		(0.00)		(0.00)
			DI		0.02***	0.02***
					(0.00)	(0.00)
High school wage premium, 18-24	−0.44		Man.	0.02		0.05***
	(0.41)			(0.01)		(0.01)
			DI		0.03***	0.04***
					(0.00)	(0.00)
College wage premium, 25-30		−0.33	Man.	−0.03**		0.02
		(0.38)		(0.01)		(0.01)
			DI		0.06***	0.06***
					(0.01)	(0.01)
Youth employed in manufacturing	0.31***	0.20	Man.	0.83***		0.75***
	(0.12)	(0.13)		(0.03)		(0.03)
			DI		−0.26***	−0.12***
					(0.01)	(0.01)
Youth employed in DI industries	−0.15*	0.18**	Man.	−0.46***		0.05*
	(0.08)	(0.09)		(0.04)		(0.03)
			DI		0.75***	0.76***
					(0.01)	(0.01)
College and graduate students/adults		1.44***	Man.	−0.04***		0.00
		(0.45)		(0.01)		(0.01)
			DI		0.06***	0.06***
					(0.00)	(0.00)
Median Income	−0.02	0.08***	Man.	0.12		1.34***
	(0.03)	(0.03)		(0.13)		(0.09)
			DI		1.60***	1.84***
					(0.04)	(0.04)
Per capita income	−0.03	0.08**	Man.	−0.34***		0.90***
	(0.03)	(0.03)		(0.12)		(0.08)
			DI		1.71***	1.87***
					(0.03)	(0.03)
Parents' income	0.09***	0.07***	Man.	−0.09		0.54***
	(0.01)	(0.01)		(0.19)		(0.20)
			DI		0.84***	0.94***
					(0.11)	(0.12)
Single parent	−0.06***	−0.08***	Man.	−0.42***		−0.56***
	(0.01)	(0.01)		(0.16)		(0.17)
			DI		−0.11	−0.21**
					(0.08)	(0.09)
Nonworking mother	−0.03**	0.00	Man.	−0.34**		−0.26
	(0.01)	(0.01)		(0.17)		(0.17)
			DI		0.17*	0.12
					(0.09)	(0.09)
Nonworking father	−0.08**	−0.02	Man.	−0.03		−0.05
	(0.04)	(0.02)		(0.07)		(0.07)
			DI		−0.02	−0.03
					(0.03)	(0.03)

Table 5: On the left, coefficients are from regressions of respondents' educational attainment on measures of potential mechanisms. On the right, coefficients are from regressions of potential mechanisms on measure of industry employment in the respondents' labor markets. The standard errors are clustered by the county and appear underneath in parentheses. Observations are NLSY respondents (N=5,348 or 4,518), and BLS-provided weights are applied. Controls as listed in Table 1 are included in all models. The data sources are the National Longitudinal Surveys of Youth and the Current Population Survey. Significance key: * for p<.1, ** for p<.05, and *** for p<.01.