The Impact of Local Labor Market Shocks on College Choice: Evidence from Plant Closings in Michigan

Daniel Hubbard*

September 7, 2018

Abstract

Human capital theory suggests that students should pursue more education when the local labor market is struggling, particularly if job losses are disproportionately concentrated among high school graduates, because these circumstances are associated with lower opportunity costs of additional schooling. However, credit constraints and incomplete information about financial aid options can prevent students from receiving their optimal level of education. Using data from the Worker Adjustment and Retraining Notification Act ("WARN Act") on business closings and mass layoffs in Michigan in 2002-2011, I exploit the exogenous variation in local job losses in the year that students graduate from high school, examining changes in college-going rates and substitution between two-year and four-year colleges. A 1-standard deviation increase in per capita job losses is associated with a small but statistically significant 0.2-percentage point (0.3%) increase in the probability of attending college, driven entirely by attendance at two-year colleges; using the WARN job losses as an instrument for local unemployment rates produces similar results with larger magnitudes. The results for the full sample are small, though statistically significant, but effects are larger among some subgroups, such as boys and students with near-median probabilities of attending four-year colleges. This result implies that opportunity costs outweigh credit constraints in guiding students' college-going decisions in the face of a turbulent labor market.

*E-mail: danieldh@umich.edu. Thanks to the Institute of Education Sciences, U.S. Department of Education for providing support through Grant R305E100008 to the University of Michigan. Thanks to our partners at the Michigan Department of Education (MDE) and Michigan's Center for Educational Performance and Information (CEPI). This research result used data structured and maintained by the Michigan Consortium for Education Research (MCER). MCER data are modified for analysis purposes using rules governed by MCER and are not identical to those data collected and maintained by MDE and CEPI. Results, information and opinions are the author's and are not endorsed by or reflect the views or positions of MDE or CEPI. Special thanks to John Bound, Charlie Brown, Sarah Cannon, Celeste Carruthers, Sue Dynarski, Mónica Hernández, Julian Hsu, Brian Jacob, Lance Lochner, Isaac McFarlin, Katherine Michelmore, Philip Oreopoulos, Jeff Smith, Kevin Stange, Lesley Turner, and seminar participants at AEFP, APPAM, MEA, and the University of Michigan for their valuable ideas throughout the writing of this paper.

1 Introduction

Students who face a weak local labor market when they graduate from high school are left with a daunting decision to make. If they choose to acquire additional education, they gain credentials that will help them get higher-paying work when they finish and they do not forgo lucrative immediate employment options, but they incur heavy costs at a time when their families' financial situations are at their most precarious. If they instead choose to enter the labor market immediately, they avoid burdening themselves and their families with high costs and debt when unemployment is prevalent, but they may have trouble finding work in the weak labor market and they will have fewer opportunities for higher-paying work without a college degree.

Economic justification exists for both choices. Human capital theory dating back to Becker (1975) and Rosen (1977) suggests that when the local labor market is in a recession, students should respond by acquiring more education. If there are no credit constraints, then a substantial negative shock to local employment opportunities should actually induce an increase in college attendance; students will be less able to acquire a job with only a high school diploma, making additional credentials more valuable. Furthermore, the opportunity cost of attending college will be much lower when the local job market is in bad shape, as high school graduates' expected wages if they enter the job market (including zero as a possible value if they are unable to find work) will be low. Empirical studies such as Black, McKinnish, and Sanders (2005) and Cascio and Narayan (2015) validate this theory in the case of public high school education, which has no cost to the student except the opportunity cost of the time spent in school. Barr and Turner (2013) find that the countercyclicality of college enrollment extends beyond local labor markets and into national ones, finding a particularly sharp rise in enrollment during the late-2000s U.S. recession. However, many studies, most famously including Lochner and Monge-Naranjo (2011), have indicated that students are heavily influenced by their current resources when deciding whether or not to enter college, indicating that students are sufficiently credit-constrained that they cannot always fully borrow the cost of college. Therefore, the shock to family resources resulting from a local economic downturn (particularly if a parent becomes unemployed) may well diminish or even outweigh the positive response to the reduced opportunity cost.[1]

In this study, I evaluate the effects of local job losses on several measures of students' postsecondary education choice. To do this, I take advantage of the reporting requirements of the WARN Act of 1988, which requires employers to post public notices and send written notifications to city and state officials if they lay off more than 50 workers or close a facility with over 50 employees. Controlling for students' academic backgrounds and demographics, I determine whether students alter their choices of whether to attend college (and if so, what type of college to attend) as they see larger percentages of people in their local areas lose their jobs in these plant closings[2] and mass layoffs. In order to create some context for the

[1]Additionally, students who attend college under shocks to family resources may be more likely to work increased hours while enrolled, which may diminish academic performance (Stinebrickner and Stinebrickner 2003).

[2]Not all events categorized as "plant closings" involve factories. A supermarket, a restaurant, a bank branch, or a car dealership could close; as long as an entire physical location is shut down, it is counted as a plant closing. The term is commonly used to avoid confusion with firm shutdowns (a term referring to

college findings, I also examine the effects of these events on 8^{th}-grade test scores, following a similar approach to Ananat, Gassman-Pines, and Gibson-Davis (2009); this separates the effects of psychological and school resource shocks from the changes in relative costs that are assumed to drive much of the college results.

The results suggest a significant role for credit constraints in driving students' postsecondary education decisions. In OLS specifications, a 1-standard deviation increase in the fraction of the local population losing jobs in a year is associated with a 0.2-percentage-point (0.3%) increase in the probability of attending college. This effect is composed entirely of a 0.3-percentage-point (1.2%) increase in the probability of attending a two-year college, implying that many of the students who move into attending two-year colleges would have otherwise skipped college; a few students who otherwise would attended a four-year college do attend community college instead. These results imply that one additional student will enter college for each 6.51 jobs lost. Using per capita WARN Act job losses as an instrument for the county unemployment rate leads to a substantively similar result: a 1-percentage point increase in the local unemployment rate is associated with a 3.2-percentage point (4.5%) increase in the probability of attending college, again driven by a large (3.8 percentage points, 15.3%) increase in the probability of attending community college.

In any specification, the overall number of students in college increases slightly in response to an adverse labor market shock, even as there is a slight (usually not statistically significant) decrease in the probability of attending a four-year college. As some students are responding to labor market shocks by acquiring less education, which is opposite to their best interest in the labor market, credit constraints are likely to be a factor, but not enough to outweigh the opportunity cost aspect of the decision. I also examine the results for different subgroups, dividing students according to factors such as race, gender, eligibility for subsidized lunch, and predicted probability of attending a four-year college. The results are broadly consistent, particularly the effect on two-year attendance, but they are most pronounced among white students, male students, students in the middle (particularly the upper middle) of the distribution of predicted attendance, and students not eligible for free or reduced-price lunch.

2 Literature Review

The theoretical literature that provides context for this study centers around Lochner and Monge-Naranjo (2011). The authors model the college attendance decision, imposing a framework of credit constraints and determining how theoretical students will act. The constraints are similar to the designs of federal and private student loan programs; students must spend all of their federal loan money on education, subject to a fixed dollar maximum, and private lenders will not provide loans greater than the amount that they can expect to be able to garnish from the student's wages after graduation in the event of a default. These constraints are incorporated into a life cycle model and calibrated using observed parameter values. As expected, an increase in the cost of education along with an increase in the return to education, both of which have occurred in the United States in recent years, is associated with a much higher number of students being constrained out of being able to afford education.

the closure of an entire company, rather than a single location; a firm shutdown implies one or more plant closings but the reverse is not true) and I use it throughout this paper.

As stated in the previous section, this result is essentially a prerequisite for students to respond to a negative labor market shock by reducing their educational investment rather than increasing it; otherwise, the opportunity cost effects from Becker (1975) and Rosen (1977) predominate. Manoli and Turner (working) find evidence that these credit constraints are relaxed by tax refunds.

This study falls at the intersection of two empirical literatures. The first focuses on the effect of shocks to family resources on college attendance and other educational outcomes, providing context for students' reaction to a job loss or an income loss in their families. Hilger (2016) matches fathers to their children in U.S. tax data and studies the impact of any job loss (not just those that result from plant closings or firm shutdowns) on students' post-secondary education choices. The effects are negative, particularly among middle-class students who are not poor enough to receive full need-based aid but not wealthy enough to pay for their education out of pocket; however, the estimated effects are fairly small, regardless of the outcome of interest; students whose fathers are laid off are 0.43 percentage points less likely to attend college, and attend colleges whose alumni earn $84 less per year. Coelli (2011) uses Canadian data to match children to their families' main income earners and looks at the effects of those earners' job loss (either through mass layoff, firm shutdown, or plant closing) on the child's post-secondary choices. There are significant negative effects on college attendance, as a main income earner's job loss is associated with a 10-percentage point decrease in the probability of attending a postsecondary institution; there is no change in the probability of attending a community college, while almost all of the effect is on the probability of attending a university. However, there are no controls for students' academic ability, so any counterfactual predictions are based solely on demographics such as race, parents' education, and family income. Oreopoulos, Page, and Stevens (2008) match fathers to sons, looking at the effects of a father's job loss (due to plant closing or firm shutdown) while his son is in adolescence on the son's long-run outcomes. Sons do indeed lose about 9% of long-run income when their fathers lose their jobs at this stage, and this effect is even stronger among children in the least-wealthy families. Kalil and Wightman (2011) look in the Panel Study of Income Dynamics at the relationship between parental job losses and postsecondary enrollment, finding that Black students are three times as vulnerable to being induced to skip college than their white counterparts, even among middle-class students.

Lovenheim and Reynolds (2013) look at positive income shocks instead, focusing on house price appreciation. They use data from the 1997 National Longitudinal Survey of Youth (NLSY97), allowing them to capture the rapid increase in home prices that occurred in the late 1990s and early 2000s. Their key finding is that a $10,000 increase in home prices in the four years prior to high school graduation is associated with a 0.2% increase in a student's likelihood of attending his or her state flagship public university (such as the University of Michigan, University of Virginia, or University of Florida) as opposed to a non-flagship public university (such as Eastern Michigan University, Virginia Commonwealth University, or University of Central Florida) and a 0.6% decrease in the likelihood of attending a community college. There is no effect on the probability of attending a private university. Most of the variation is driven by students in the lowest income categories. Charles, Hurst, and Notowidigdo (working), however, find opposite results. An increase in housing demand in a metropolitan area, instrumented by a structural break in housing prices between 2000 and 2006, is associated with a decrease in college attendance in that metropolitan area as measured both by Census data and by the Integrated Postsecondary Education Data System (IPEDS).

The second focuses on the effect of changes in local labor market opportunities on educational investments and other related outcomes. Ananat et al. (2009) use county-level data on job losses in North Carolina between 1997 and 2007, focusing on the impact of job losses on 8th graders' test scores. Their identification strategy includes a weighted index of local job losses (again, measured through plant closings and mass layoffs) from the past several quarters, using an exponential decay function to determine the weights. After regressing 8th grade exam scores on this weighted index of job losses, student demographics, time trends, and county fixed effects, Ananat et al. find a small and insignificant negative effect of job losses for the full student population, but the effect grows to a statistically significant drop of 2.4 percentage points per percentage point of job loss when the sample is limited to students from low socioeconomic status families. The authors conclude that despite the county-wide measure of job losses, the effects do indeed result from family income shocks, rather than declines in school funding (which is largely determined by the state and responds more slowly); even though parents' job losses are not identified directly, they explain most of the phenomena.

Studies such as Black, McKinnish, and Sanders (2005) and Cascio and Narayan (2015) examine the effects of changes in employment in extractive industries on educational outcomes; the former paper focuses on the coal boom and bust, while the latter focuses on hydraulic fracturing for natural gas. Both find that as employment in extractive industries increases, male students are less likely to go to college, while female students' college decisions do not change; the opportunity cost of college increases as more high-paying jobs are available for low-skilled men in the coal mines and fracking rigs. Ost, Pan, and Webber (working) look at how mass layoffs affect working college students' time allocation and educational persistence; they find that few effects on enrollment but an increase in credits attempted due to a decline in the opportunity cost of coursework. Ge (2015) finds spillovers from mass layoffs associated with the reform of Chinese state-owned enterprises near the turn of the 21st century, as students in cities where more people lost their jobs in these events are even less likely to continue their education than those whose fathers worked in businesses with smaller layoffs.

What I aim to do in this study is to adapt the local-shock framework used by Ananat et al. (2009) to study similar outcomes to those examined by Hilger (2016). The results from Ananat et al. provide reassurance that there are legitimate effects of plant closings and mass layoffs on educational outcomes, and that the mechanism of these effects is through family income shocks rather than through schools' resources. Foote, Grosz, and Stevens (2015) support the use of WARN data as a proxy for unemployment data, for reasons that include the endogeneity of local unemployment with respect to labor supply and migration, the discrete nature of the shocks in a mass layoff, and the possible measurement error in unemployment rates collected for small geographic areas. With these results in mind, I can confidently use job losses within a commuting radius to proxy and/or instrument for directly-measured job losses, and take advantage of some of the benefits of Michigan's student administrative data to more completely capture students' postsecondary choice sets, with and without large local job losses. Most notably, other papers that look at the effect of local job losses on college attendance, such as Foote et al. (2015), do not have students' test scores or other measures of academic achievement. Thanks to the administrative education data, I am able to estimate outcomes separately for students who are very likely to attend college, very unlikely to attend college, or on the margin; it would make sense for these students to respond differently to changes in family resources and opportunity costs, as labor market prospects and access to need-based and merit-based aid may vary across the spectrum of academic achievement. The individual-level education data allow me to estimate the responses to job loss events *contingent* on the choice set that a student would have faced otherwise, proxied by the student's standardized test scores, demographics, and home town. I describe these data more completely in Section 4.

3 Theoretical Foundations

When students graduate from high school, they choose between attending a two-year college, attending a four-year college, and entering the labor market immediately. For exposition, I assume that students attend college for the allotted time, receive the appropriate degree, and enter the labor market when they graduate without working for pay during school. All students graduate from high school at age 18 and retire at age 65. I discuss the implications of relaxing these assumptions at the end of this section.

Each student i has a different expected lifetime earnings Y with a high-school diploma, an associate's degree, and a bachelor's degree, as well as their respective prices of earning those degrees. The price of a high-school diploma is normalized to zero. In other words, students choose the maximum of the following three options:

$$(1) \qquad \left\{ E\Big[\sum_{t=18}^{65} \frac{Y_{i,t-18,12}}{(1+\beta)^{t-18}}\Big], E\Big[\sum_{t=20}^{65} \frac{Y_{i,t-20,14}}{(1+\beta)^{t-18}}\Big] - c_{i,A}, E\Big[\sum_{t=22}^{65} \frac{Y_{i,t-22,16}}{(1+\beta)^{t-18}}\Big] - c_{i,B} \right\}$$

These options correspond to a high-school diploma, an associate's degree, and a bachelor's degree, respectively. Note that all choices are discounted from age 18, when the selection of which level of education is made.

Each student is endowed with disposable wealth Ω_i; if $\Omega_i < c_{i,A}$, then student i must borrow to earn an associate's degree or a bachelor's degree, while if $c_{i,A} \leq \Omega_i < c_{i,B}$, then student i may earn an associate's degree without borrowing, but must borrow to earn a bachelor's degree. Student i may borrow at interest rate $r_i > \beta$ up to a credit constraint $\bar{\Omega}_i$. If $\bar{\Omega}_i < c_{i,B}$, then student i cannot afford a bachelor's degree even with borrowing, while if $\bar{\Omega}_i < c_{i,A}$, then student i cannot afford an associate's degree even with borrowing.

Earnings are assumed to increase with education; they also increase (in expectation) with the strength of the local labor market (both overall and in a particular education category) and the student's ability. If many workers with a bachelor's degree lose their jobs, then the expected value of $Y_{i,t-22,16}$ will decline more dramatically than its counterparts, which will see modest spillover effects. Therefore, as jobs in a particular education category are lost, then students will seek other levels of education. Earnings at the highest levels of education are assumed to always be the highest, and the least susceptible to fluctuations in response to job-market conditions.

If there is a decline in available family resources Ω_i, student i may be forced to borrow, and this increases the price of education because $r_i > \beta$ for all i. Therefore, the effect of local labor-market shocks on students' educational attainment depends on how much the shock affects family resources (which could foreclose some college opportunities) versus how much it affects expected future earnings (which could make higher levels of education more attractive, particularly if the job losses are concentrated among workers with lower levels of education). Additionally, families with higher Ω_i may also face lower interest rates r_i because they have more collateral or higher credit scores. Even if students are not credit constrained, if they must borrow at a high interest rate to pay for college, they must either expect a very high return or have a very high discount rate. Overall, when family resources are high, students are freest to react to local job losses by acquiring more education.

Student ability is not modeled explicitly here, but it is likely to factor into the decision in at least two ways. One is abstract and policy-dependent: as long as some colleges offer merit-based financial aid, higher-ability students will face a lower price of college. These students may be less affected by changes in the returns to college, because they are already likely to go when it is free or inexpensive. The other does not depend on policy but does depend on the relationship between ability and education: if there is a positive ability bias (that is, the returns to education are highest for higher-ability students), then $E[Y_{i,\tau,16}] \gg E[Y_{i,\tau,12}]$ for all time periods τ, and it would require very large changes in prices or family resources to dissuade a high-ability student from choosing to attend college.

Other policy considerations may also affect students' choices under this framework. State funding for education is often procyclical; when economic conditions are weak and budgets are tight, higher education is among the first expenditures cut (Barr & Turner 2003). If colleges make up for the funding shortfalls by increasing tuition, then a shock to local labor markets would raise c_i through this pathway as well, decreasing the probability that a student attends college. However, when colleges and the federal governmnent offer need-based financial aid, then there is a positive relationship between c_i and Ω_i; students with the means to do so pay higher prices, while poor students receive large scholarships. Therefore, for students who suffer a shock to family resources, the probability of attending college may go up if the scholarships available are generous enough.

Changes to some of the assumptions inherent in the model are largely outside the scope of the paper but do not alter the implications significantly. If students can work while they attend college, an additional $E\left[\sum_{t=18}^{20} \frac{Y_{i,t-18,12}}{(1+\beta)^{t-18}}\right]$ would be added to the community college equation and $E\left[\sum_{t=18}^{22} \frac{Y_{i,t-18,12}}{(1+\beta)^{t-18}}\right]$ would be added to the four-year college equation; this would overall make students more likely to choose college (assuming it does not affect their studies or their time to graduate) but its interaction with local labor markets depends on how responsive student jobs are to broader labor market conditions. A work-study position in a laboratory is fairly insulated from the local economy; a waitstaff position at a local restaurant is not.

The probabilities of graduating and of lasting two, four, five, etc. years in college can be factored into the expectation terms, both in terms of earnings and in terms of costs. Retirement ages may also differ by level of education; workers with high-school educations may require more years of earnings to be able to retire, but they also are more likely to work manual jobs that would require earlier retirement. This model imposes no costs upon working and therefore levels of education that require more years of work are seen as more appealing, which may overestimate the appeal of entering the job market immediately after high school.

4 Data

4.1 Student Data

The state of Michigan collects detailed information on all its public school students, from elementary school through high school as well as any postsecondary school that they may attend. Each observation used in this analysis is a record from the Michigan Student Data System (MSDS), which observes students in Michigan public elementary and secondary schools three times per year from the 2002-03 academic year onward, collecting information ranging from attendance to race to disciplinary incidents. I obtain the latitude and longitude associated with each student's home ZIP code in the student's last year in the data. If the student's home ZIP code is unavailable, I use the ZIP code of the student's high school. The other variables that I gain from the MSDS are demographics such as race, gender, special education, and limited English proficiency.

For students who attend college, I use a common unique identifier to merge in variables from the National Student Clearinghouse (NSC), a nationwide database of attendance at colleges of all sorts, including community colleges, private colleges, for-profit institutions, and public universities. The vast majority of these institutions[3] nationwide report to the NSC, and the state of Michigan collects data from the NSC on all college students who ever attended public school in Michigan. The variables of interest from the NSC database are the college that a student attends and the year that he or she begins to attend. 76% of MSDS observations at this point merge into the NSC data; the remaining students do not attend any college during the sample period or attend a college that does not report to NSC. College attendance outcomes are measured as of three years after expected graduation, thus making the last year of the high school sample 2011-12.

The last state data set that I use is a database of students' scores on 8^{th} and 11^{th}-grade state standardized exams. Michigan's high school standardized testing regime changed significantly during the sample period, as the state replaced the high school MEAP (Michigan Educational Assessment Program) with a new assessment, known as the Michigan Merit Exam (MME), that incorporates the ACT college entrance exam. To make results easier to interpret, I normalize the scores within each grade, subject, and year such that they have a mean of zero and a standard deviation of 1. Thus, it is straightforward to compare students who scored the same number of standard deviations above or below the mean against each other, regardless of subject area, year, or test type.

I match the state data with a database of ACT scores and self-reported high-school grade-point averages provided by ACT, Inc. Even before the MME came into effect, making the ACT mandatory, it was the most popular college entrance exam in Michigan. This data set contains observations for all students who took the test in Michigan between 2003 and 2011. It contains the same unique identifier variable as the state data; students in the state data who do not merge into this data set are assumed not to have taken the ACT.

[3] Michigan's NSC records account for colleges attended by over 90% of college students; most of the colleges still missing are small, for-profit, less-than-two-year institutions.

4.2 Unemployment and Plant Closings

The simplest measure of a local labor market shock is the unemployment rate. I use county-level unemployment rates from the Bureau of Labor Statistics, averaging them out over a school year, and matching the average to a student's home county and year of expected graduation. For instance, if a high school student in Grand Traverse County takes the 11$^{\text{th}}$-grade standardized test in 2006-07, that student is expected to graduate in the spring of 2008, and is assigned the average of all monthly unemployment rates in Grand Traverse County between September 2007 and August 2008, the period that would most likely be that student's senior year and the period in which the student would most likely decide whether and where to attend college. For middle-school students, I use the average of the 12 months before the 8$^{\text{th}}$-grade exam; if a middle school student in Kent County takes the 8$^{\text{th}}$-grade standardized test on February 11$^{\text{th}}$, 2007, that student is assigned the average of all monthly unemployment rates in Kent County between February 2006 and January 2007. However, there are well-documented concerns about measurement error and endogeneity in county unemployment rates (see Foote et al. 2015), and many workers in Michigan commute across county lines. To address some of these concerns, I instrument and proxy for county unemployment rates with data on plant closings and mass layoffs from the WARN Act.

The federal Worker Adjustment and Retraining Notification Act ("WARN Act") of 1988 requires all employers with 100 or more employees to provide 60 days' advance notice before laying off at least 50 workers at once or closing a facility (such as a store, a factory, or an office) with at least 50 employees. Companies must not only inform their employees of plant closings and mass layoffs, but they also must provide the same notice to the mayor of the city where the relevant facility is located and to the relevant state agency responsible for dislocated workers. In Michigan, these notices are reported to the Michigan Workforce Development Agency (WDA); the web sites of the WDA and of Michigan Labor Market Information (MILMI), a state repository of economic statistics, provide data from the notices to the public in an electronic format. All notices dating back to 2000 are available through these channels, with identifying information including the company name, the type of action (mass layoff or facility closing), the number of workers displaced, the date of the action, and the city in which the affected facility is located. Additional searching allowed me to find the addresses associated with a large majority of the sites where a layoff or closing took place, usually by locating a scanned version of the paper notice[4]. Using Google Maps' geocoding API through the `geocode3` package for Stata, I obtained precise coordinates associated with these addresses, which I use to determine the distance from each layoff site to each high school. 92% of WARN Act events between 2002 and 2011 were geocoded successfully.

Figure 1 graphs the distribution of jobs lost per event. The left-most bar represents the number of plant closings or mass layoffs in which the total number of jobs lost was between 50 and 99; each additional bar has a similar interval of 50. Most of the events displace fewer than 200 workers, but some of them displace over 1,000 workers. Five of the ten largest

[4]The largest single event in the WARN Act data is the closing of the Farmer Jack supermarket chain in 2007, which is coded as a "statewide" event rather than as a series of local store closings. I use the paper notice to obtain the addresses of all the Farmer Jack locations in the state, remove any that were immediately sold to other supermarket chains such as Kroger, and assign equal fractions of the total statewide job losses to each of the remaining store locations. Results are robust to removing the Farmer Jack observations.

plant closings in Michigan during the sample period involved the decommissioning of General Motors factories; the discontinuation of the Oldsmobile brand resulted in three factories in Lansing (Michigan's capital and Oldsmobile's longtime home) being closed down and laying off more than 900 workers each, while plant closings in Pontiac (an industrial suburb north of Detroit) and Grand Rapids (a mid-sized city on the west side of the state) displaced 1,230 and 1,500 workers, respectively.

Figure 2 collapses the job losses listed in Figure 1 to the year level. Not surprisingly, the level of job losses was high throughout the 2000s as auto manufacturers and suppliers condensed operations and moved production overseas, and it hit its peak in 2007-2009, as General Motors and Chrysler declared bankruptcy and Ford teetered on the edge. Soon thereafter, the frenzy of plant closures calmed, and fewer than 5,000 workers per year were laid off as a result of WARN Act eligible plant closings and mass layoffs in Michigan in 2010-2013.

Figure 3 overlays job loss events on a map of the Lower Peninsula of Michigan[5], with each dot representing a plant closing or mass layoff; darker markers correspond to more jobs lost. To a large extent, Figure 3 mirrors the overall population distribution of the state. Much of the job loss activity is in southeast Michigan in the Detroit metropolitan area, but considering that over four million of the state's nearly 10 million residents live in the Detroit Metropolitan Statistical Area (MSA), this is hardly disproportionate. Large plant closings and mass layoffs certainly occurred in the state's secondary population centers; cities such as Lansing, Grand Rapids, Flint, Battle Creek, and Kalamazoo all saw major WARN events during the sample period. A few coastal communities along Lake Michigan and in the tourist-friendly northern region of the state saw some job losses as well; fewer jobs were lost in these regions, but these areas are populated quite sparsely. Overall, none of the evidence in Figure 3 indicates that job losses are concentrated geographically in a fashion that is not proportional to population density.

4.3 College Analysis Sample

For the college analysis, I keep all students who take the 11$^{\text{th}}$-grade Michigan standardized test between 2001-02 and 2010-11, regardless of whether they graduate. I drop any students who are missing common demographic information (race, gender, subsidized lunch eligibility, limited English proficiency, or special education enrollment). This leaves me with approximately 950,000 students.

I now have a detailed picture of the academic trajectory and personal characteristics of each of the approximately 950,000 students in the data; what remains is to match them to the job losses in their surrounding neighborhoods. A student expected to graduate in the 2005-06 school year will be assigned the job losses from September 2005 through August 2006. I calculate the number of jobs lost within radii of 30 miles[6] of each ZIP code in each

[5]There were some job loss events in the Upper Peninsula, but this area is left off the map for space reasons. A map including the Upper Peninsula is available upon request. The Upper Peninsula contained approximately 3% of the population of Michigan as of the 2010 Census.

[6]According to the American Community Survey, the average commuting time in Michigan in 2009-2013 was 24 minutes. At a 70-mph highway speed (the speed limit on many freeways in Michigan), this corresponds to a 28-mile commute. For robustness, I also use radii of 10 and 50 miles; results, available upon request, are

academic year, then divide it by the number of people living in tracts within that radius according to the 2000 Census.[7] Figure 4 shows the plant closings that occurred in September 2005 through August 2006 within a 30-mile radius of an address in southern Oakland County.

When I use WARN as the independent variable of interest in an OLS regression, I standardize these per capita measures at the student level, so that the average student has a value of 0 and a value of 1 represents one standard deviation above the student-level average. This allows the empirical estimates to be interpreted as the effects of a 1-standard deviation increase in per capita job losses. A kernel density plot of the distribution of this variable is shown in Figure 5. When WARN is used to instrument for a measure of unemployment, I leave it in per capita terms.

4.4 The Big Picture

Table 1 presents a summary of high school student characteristics separated by their postsecondary education choices.[8] Most of the results are not surprising. Students who ever attend four-year colleges have higher scores on state standardized tests, higher ACT scores, and higher grade-point averages. These students are also less likely to be Black or Hispanic, less likely to be eligible for subsidized lunch, and less likely to be enrolled in special education. Two-year attendees and students who do not go to college are similar on some measures, but two-year attendees perform somewhat better on the state exam (if not on the ACT) and are less likely to be in special education or eligible for subsidized lunch.

Table 2 divides high school students into quartiles by the per capita job losses in their surrounding areas in their expected graduation year. One might expect that areas where very few job losses occur have substantially different populations from areas that are harder-hit. The actual pattern is not as clear. Most notably, the average state standardized test scores in the hardest-hit and least hard-hit areas are separated by about 0.13 standard deviations. Students are somewhat different across quartiles in terms of characteristics such as race and subsidized lunch eligibility, but not in consistent monotonic patterns; furthermore, some regions of the state suffered more job losses in particular years. For instance, more than 4,000 jobs were lost due to plant closings and mass layoffs in Lansing in 2005, while fewer than 200 were lost in Lansing in 2008; meanwhile, more than 2,000 jobs were lost in similar events in Grand Rapids in 2008, while about 1,000 were lost in Grand Rapids in 2005. The least hard-hit quartile does look somewhat different from the rest of the state in several ways: it is much more concentrated in rural areas and small towns, which explains the disparities in race and income between this quartile and the other three quartiles, as Michigan's rural population tends to be whiter and poorer than the state as a whole. These areas were economically hard-hit, but since they have fewer businesses employing enough people to be required to file WARN Act notices, the job losses in these areas are less likely to enter into the data here. [9]

largely similar.

[7] Later population sizes would presumably be affected by changes in the labor market, so I use a population size that predates the sample period to avoid endogeneity.

[8] All summary tables are calculated for the high school graduating class of 2006, for whom the ACT was not yet mandatory. Patterns of results, except for ACT results, are broadly similar for other cohorts.

[9] Because of this, I estimate my empirical models both including and excluding the least population-dense areas of the state; results are very similar.

5 Empirical Specifications and Results

5.1 Specifications

In order to gain a fuller understanding of the effects of local labor market shocks on student outcomes without worrying about issues related to costs, I begin by examining the impact of these shocks on 8$^{\text{th}}$ graders' standardized test scores. These students are affected by reduced family resources and increased uncertainty at home as well as possible reductions in school resources, just like high school students, but there is no direct monetary cost to earning a higher exam score, and the opportunity cost of studying does not generally change because the minimum age for almost all employment in Michigan is 14.[10] The general equation that I use is as follows:

$$TestScore_{8ijsct} = \psi + \delta J_{ct} + \chi \mathbf{X_i} + \kappa_{ct} + \mu_s + \tau_t + \nu_{ict} \tag{2}$$

The 8$^{\text{th}}$-grade standardized test score (rescaled to have mean zero and standard deviation 1) of student i in subject j, who attends school s and lives in location c in year t, depends on some measure of local job losses J_{ct} and a set of student characteristics $\boldsymbol{X_i}$, which includes indicators for whether the student is female, Black, Latino, Asian-American, eligible for subsidized school lunch, in a program for students with limited English proficiency, and in special education. κ_{ct} is a county-level linear time trend, μ_s is a school fixed effect, and τ_t is a graduation year fixed effect. The coefficient of interest here is δ, the estimated effect of an increase in job losses on the student's standardized test score.

The focus of this paper is college attendance, though, and the richness of the Michigan student data allows for a number of potential specifications that can shed light on the relationship between local job losses and students' college decisions. Perhaps the most drastic reaction to local economic shocks involves credit-constrained students choosing to forgo attending college entirely and enter the labor force; other students might avoid the poor labor market and attend college instead of seeking work immediately. I model this as follows:

$$AnyColl_{isct} = \alpha + \beta J_{ct} + \gamma TestScore_{11i} + \theta \mathbf{X_i} + \eta_{ct} + \omega_s + \phi_t + \epsilon_{ict} \tag{3}$$

The probability of student i, who attends school s and lives in location c, attending any college after graduating in year t depends on some measure of local job losses J_{ct}, the student's score on the state high school standardized test, and student characteristics $\boldsymbol{X_i}$. η_{ct} is a county-level linear time trend, ω_s is a school fixed effect, and ϕ_t is a graduation year fixed effect. The coefficient of interest in these specifications is β, the estimated effect of an increase in job losses on the probability of attending any college in the NSC data.

This framework can also be used to estimate effects more narrowly on attendance at four-year colleges or two-year colleges, by changing the outcome variable to take the value 1 if a student attends a four-year college and 0 otherwise (or a similar setup substituting two-year college attendance for four-year college attendance). In an unconstrained world,

[10] The minimum age to work as a youth sports referee or golf caddy is 11; the minimum age to participate in some farming occupations or set traps for some shooting events is 13 (Youth Employment Standards Act).

we would expect to see students responding to labor market shocks by demanding more education, resulting in higher attendance at four-year colleges; the effects on two-year college attendance would be ambiguous and depend on additional factors. The opposite would be true in a world where credit constraints are important; students would be pushed out of four-year college attendance by labor market shocks, and some of them may choose to attend community colleges, while some students who might have attended community college could choose not to pursue any postsecondary education at all. Examining attendance at two-year and four-year colleges separately is a useful way to pit the competing theories against each other and see which is more accurately reflected in the data.

Additionally, the effects of local unemployment on college attendance may vary across different groups of students. Poor students may be particularly vulnerable to unemployment shocks because their families have little to no money saved, even as they may also have the most to gain from a college education. Similarly, there are massive wealth gaps between the average white household and the average Black household, which could result in different responses from Black students and white students; in 2009, the average white household had a net worth of $113,149, while the average Black household had a net worth of $5,677 (Kochhar, Fry, and Taylor 2011). On the other hand, female students and male students may also react differently to changes in the local job market, as many of the most common jobs in Michigan that do not require a college education are dominated by male workers (such as work in automotive factories), and those jobs are also the most likely to be displaced during the state's economic struggles. As such, I include results estimated separately by race, gender, and subsidized lunch eligibility.

5.2 Comparing Measures

There are multiple ways to measure the strength of a student's local labor market. The most straightforward measure is probably the county unemployment rate, and I begin by presenting results from OLS linear probability regressions[11] of college outcomes on county unemployment rates (along with other observables). However, as outlined by Foote et al. (2015) and discussed in previous sections, there are reasons to be cautious about using unemployment rates as the sole measure of labor market strength, and the WARN Act data can help to alleviate some of these concerns. Worker separations may be endogenous; workers who become unemployed for reasons other than plant closings and mass layoffs may have been fired for poor performance, or they may have quit their jobs and found no employers willing to hire them. Either of these reasons may be correlated with their children's success at navigating the college application and financial aid system. Additionally, unemployment rates at the county level are measured with error, as they frequently extrapolate from surveys with small sample sizes, while WARN reporting is required by law and thus the WARN data should capture the full population of major job loss events.

Depending on one's preferred interpretation, the WARN variable can be used either as a proxy or an instrument for the local unemployment rate. I report results both with the OLS framework (using WARN job losses as a proxy for unemployment) and the instrumental

[11] Preliminary results using probits instead of linear probability models had vastly similar results to the OLS models. As a result, OLS results are reported throughout the paper due to computing limitations stemming from the size of the data set and the number of fixed effects.

variables framework (using WARN job losses to instrument for unemployment). In cases where the WARN variable is used as a proxy, I put it into standard deviation terms for ease of interpretation; most WARN shocks involve less than 1% of the local population losing a job in a given year, so leaving it in percentage terms would be illustrating the impact of an event that is so large as to be exceedingly rare. In cases where the WARN variable is used as an instrument, I leave it in per capita terms, because unemployment rates are conventionally listed in percentages.

Still, it is worth checking to see that these capture the same thing. A first-stage regression of the average county unemployment rate on the per capita WARN Act job loss measure, along with a set of year and county fixed effects, produces a positive and highly statistically significant relationship, with a coefficient of 0.513 and an F-statistic of 25.77. The coefficient means that 1.95% of the local population must lose their jobs in a given year in WARN-eligible events to induce a 1-percentage point increase in the unemployment rate. The median student is exposed to about 0.1% of the local population losing jobs in a year (with a standard deviation of 0.13%), so reporting these results involves reporting the impact of an event that is extraordinarily large. Put differently, the median ZIP code in the data has 470,793 people living within 30 miles of it; 9,180 of these people must lose their jobs in mass layoffs and plant closings to trigger a 1-point increase in the unemployment rate. This is, again, an extremely rare event, and the IV results should be interpreted with this in mind.

Another concern with the instrumental variables framework is that the plant closing job losses may violate the exclusion restriction. Children's lives and schooling decisions are affected by mass layoffs and plant closings in ways that go beyond the unemployment rate. Even if laid-off workers find new jobs in short order, those jobs are often lower-paying, and the uncertainty associated with searching for a job or knowing that your job is in danger can lead to increased household stress. I look to capture these phenomena and incorporate them in how local economic shocks affect students' college choices; I therefore prefer the OLS proxy specification because it reflects the local conditions most fully and accurately, even if any causal interpretations must be made with more caution.

5.3 Results

Methodologically, the most similar paper to this one may be Ananat et al. (2009), which studies the effect of plant closings and mass layoffs on 8^{th} grade exam scores. They find a small negative effect on exam scores in the full sample, which becomes larger when limited to a sample of students of low socio-economic status. As shown in Table 3 and Table 4, local job losses are associated with some test score decreases in the Michigan context as well. A 1-standard deviation increase in per capita job losses in the preceding 12 months is associated with a statistically significant 0.005-standard deviation decrease in 8^{th} grade reading scores; effects on math scores are minimal. When the sample is limited to students eligible for free or reduced-price lunch, the effect on reading scores remains constant. Seeing that the results of a similar specification are in line with a well-known previous study leads to a more confident interpretation of the headline results in this addition to the literature.

In the college attendance results, I present each outcome in a separate table, with results using the county unemployment rate, the standardized WARN variable, and an instrumental variables framework with the latter instrumenting for the former, in separate columns from left to right. Standard errors are clustered by ZIP code throughout the empirical results. Table 5 presents results for whether a student attends college at all. The variables driving overall college attendance most are the ones that one would expect; students with high standardized test scores are much more likely to go to college than their peers, while students in special education and students eligible for subsidized school lunch are less likely to attend college. The phenomenon of Black students attending college more than their white peers (conditional on observable characteristics) while Hispanic students attend less than their white peers is fascinating, but a proper investigation and explanation of it is outside the scope of this paper[12]. The unemployment rate seems to have no significant impact on the probability of a student attending college, but in both OLS and instrumental variables frameworks, WARN Act job losses do have a positive association with college attendance. In the OLS WARN Act results, a 1-standard deviation increase in per capita job losses is associated with a 0.2-percentage point (0.3%) increase in the probability of attending college, which is significant at the 5% level. This translates to approximately 6.51 jobs lost per student induced to enroll in college[13]. The IV results are similar in sign and significance but have a larger magnitude; a 1-percentage point increase in the county unemployment rate is associated with a statistically significant 3.2-percentage point (4.5%) increase in the probability of attending college. This result by itself supports the Becker/Rosen opportunity cost story. High school graduates exposed to more severe labor market shocks are more likely to attend college than those exposed to smaller shocks or no shocks at all. Both effects might be at play, but with this indicator variable for any college attendance as the outcome, the reduced opportunity cost outweighs credit constraints in the aggregate.

However, not all colleges are the same, and there may be significant substitutions within the set of colleges that would support Lochner and Monge-Naranjo's credit constraint hypothesis. Credit-constrained students may move from pricier schools to cheaper colleges, perhaps including community colleges, while students focused on the opportunity cost of college may choose to continue their education beyond a two-year degree. In order to understand which of these explanations might characterize the results here, it is necessary to look at additional outcomes. Table 6 presents similarly-organized results for four-year colleges. The effects are never statistically significant in any specification, even in the IV framework that otherwise produces large coefficients. Table 7 finishes the exercise with two-year colleges, which appear to drive the results seen in Table 5. The local unemployment rate remains statistically insignificant, but in the OLS WARN framework, a 1-standard deviation increase in per capita job losses is associated with a statistically significant 0.3-percentage point (1.2%) increase in the probability of attending a two-year college. A back-of-the-envelope calculation similar to the one above suggests that 5.44 jobs are lost per student induced to attend community college, according to this result. The instrumental variables result is large enough to stretch credibility: a 1-percentage point increase in the county unemployment rate is associated with a 3.8-percentage point (15.3%) increase in the probability of attending community college. These results imply that most of the new students who enter two-year colleges in

[12]For a more careful study of this phenomenon, see Black, Cortes, and Lincove (2015).

[13]There were 9,938,444 people living in Michigan as of the 2000 Census. One standard deviation of job losses is 0.127% of the population, or 12,661 people. Collegegoing increased by 0.2 percentage points in a sample of 944,748, or 1,946 new college students. $12,661 \div 1,946 = 6.51$. Of course, this abstracts from the involvement of population density and which students are exposed to which job losses.

the aftermath of a local unemployment shock are students who otherwise would not have attended college at all; there is little to no movement out of four-year schools into two-year schools. Due to the difficulty of interpreting the IV effect sizes, I will focus on the OLS proxy specification in future sections, and I will discuss potential biases in Section 6.2.

5.4 Heterogeneity

Table 8 presents the OLS results for various subgroups. Students who are eligible for subsidized lunch would be the least likely to be able to pay the sticker price for college on their own, due to their parents' low incomes; if charged the full price, they would need to borrow, and these students are also the most likely to be credit-constrained. However, these students are also frequently eligible for need-based grants and scholarships that could reduce their costs significantly; additionally, if credit constraints are already binding for these students, they are less susceptible to further damage from a local economic shock. The results are broadly similar to those in the full sample. A 1-standard deviation increase in per capita job losses is associated with a 0.2-percentage point (0.3%) increase in the probability that a subsidized lunch eligible student attends college; this is the same magnitude as in the overall sample, although it is not statistically significant in the subsample due to the smaller sample size. Unlike in the full sample, this is largely driven by four-year attendance; a 1-standard deviation increase in per capita job losses is associated with a 0.2-percentage point (0.6%) increase in the probability of attending a four-year college, but a 0.02-percentage point (0.1%) increase in the probability of attending a two-year college. (Neither is statistically different from zero.) On the other hand, students who are not eligible for subsidized lunch have slightly different responses to local unemployment shocks. There is still a small (0.2 percentage points, or 0.3%, significant at the 10% level) increase in overall college attendance and a somewhat larger (0.5 percentage points, or 2.1%, significant at the 1% level) increase in community college attendance in response to a 1-standard deviation increase in per capita job losses, but there is a 0.3-percentage point (0.6%) decrease in the probability of attending a four-year college. Perhaps students eligible for subsidized lunch have a dimmer view of their labor market prospects without a college education, thus making their perceived opportunity cost of attending a four-year college lower.

The set of jobs commonly filled by young women with a high school diploma is somewhat different from the set of jobs commonly held by their male counterparts, and this may result in different reactions to labor market shocks by men and women. The overall effect on college attendance among women is positive but not statistically significant; the effect on attendance at four-year colleges is essentially zero. There is a 0.2-percentage point (0.8%) increase in the probability that a female graduate attends a two-year college associated with a 1-standard deviation increase in per capita job losses, which is slightly smaller than the effect in the full population, although it is significant at the 10% level. In contrast, all results are stronger for male graduates, including a 0.3-percentage point (0.4%) increase in the probability of attending any college and a 0.5-percentage point (2%) increase in the probability of attending community college. Given that many of the jobs that disappeared in these plant closings and mass layoffs were held by men with high school diplomas, it is not surprising that male students may be more sensitive to events in this particular sector of the labor market. The stronger negative coefficient in the specification examining four-year college attendance is more surprising, but the effect is still not significant at any conventional statistical level, so it is probably worth less concern. In other results (not shown, available by request), I find that none of the coefficients are significant for Black students while the results for white students mimic those of the overall sample, but this may be due more to differences in sample size than any differences between students or between their labor markets.

One may also expect that students are affected differently depending on their academic qualifications and other variables that may determine how likely they would be to attend college absent any economic shocks. Students with exceptional standardized test scores would likely be offered scholarships if their families could not pay the bill, and they may be highly motivated students who do not need the additional external incentive that comes from a shock to the opportunity cost of college. Meanwhile, students who struggled with their coursework and standardized tests may be less internally motivated and have areas of career interest that do not involve college education, and a shock to the opportunity cost of college may not be enough to induce them to attend. Academic preparation, of course, is not the only predictor of college attendance; students from wealthier families, for instance, are more likely to attend college and also are more likely to be able to weather a shock to family resources. Any effects are likely to be concentrated among students at the margin between attendance and non-attendance.

To measure this, I run a preliminary OLS regression of four-year college attendance on all the right-side variables except for job losses. From this, I obtain each student's predicted probability of attending a four-year college, which I split into quartiles. I then run Equation 3 and its equivalents for two-year and four-year attendance separately for each quartile of predicted probability of attendance, using the standardized WARN variable as the measure of job losses. Table 9 contains the results. As expected, the effects of job losses are concentrated among students in the middle of the distribution, who are closest to the margin of college attendance. In the middle two quartiles, a 1-standard deviation increase in per capita WARN Act job losses is associated with a 0.4-percentage point increase in the probability of college attendance, stemming from a 0.4 to 0.5-percentage point increase in the probability of attending a two-year college. Effects are close to zero and not statistically significant in the highest and lowest quartiles.

These results combine to show us who the marginal students who are induced into changing their college choices are, and these students are often the same ones whose labor-market opportunities changed most drastically as a result of job losses in their communities. A large percentage of the jobs lost in Michigan during this sample period, particularly in WARN Act eligible events, were manufacturing jobs at automotive companies or their suppliers. These jobs were often held by men without college degrees. The logical alternative to these blue-collar, male-dominated jobs may be a trade such as heating and cooling repair, welding, or construction management, which may require study at a community college. Accordingly, there are sizable increases in community-college attendance among boys exposed to more job losses. These students are rationally readjusting their human capital development in response to changes in their labor-market options.

5.5 Potential Mechanisms and Other Outcomes

Earlier sections of this paper address the most direct ways that local job losses might influence students' postsecondary education choices: shocks to family income and shocks to the individual-specific return to education. Measuring these requires well more information than we actually have about individual students; we can make inferences about which effect dominates but cannot isolate each effect. However, there are intermediate outcomes that could be affected by the plant closings, and these outcomes could also serve as mechanisms for the effect of job losses on college choice. Students cannot go on to higher education without finishing high school; they cannot go to four-year colleges without taking a college placement exam, which is usually the ACT in Michigan. Students' takeup of these intermediate steps could determine whether and how they advance to higher education. Additionally, students could be affected by changes in school funding; if they struggle during their senior year because of overfilled and underequipped classrooms or if their guidance counselors are forced to take on additional duties, then this may make the college application process even more daunting.

Table 10 presents the results. A 1-standard deviation increase in per capita job losses is associated with a 0.3-percentage point increase in the probability that a student graduates, conditional on observables. If the local job market is deteriorating, this makes jobs especially few and far between for high school dropouts as more-credentialed candidates take the jobs that they once held. This gives students an incentive to finish high school, and this effect is indeed visible. Also, a 1-standard deviation increase in per capita job losses in 11^{th} grade is associated with a 0.5-percentage point decrease in the probability that a student takes the ACT. This is almost certainly an underestimate of the true effect, considering that the ACT was mandatory for much of the later part of the sample period. Before the move to the mandatory ACT, taking one of the college placement exams was costly in terms of both money and time, and so if a student felt fairly sure that he or she would not be applying to four-year colleges, he or she would be more likely to skip the ACT. The move toward two-year attendance (and, in some subsamples, away from four-year attendance) is consistent with the decline in ACT taking, although we cannot observe whether the students knew ahead of time that they would not apply to four-year colleges and thus rationally chose not to take the ACT or whether they were unable to apply to four-year colleges, even if they wanted to, because they lacked an ACT score. However, the specifications focus on job losses in 12^{th} grade, which generally occur after the student has taken the ACT (or when it is too late for him/her to take it), and there is no relationship between 12^{th} grade job losses and ACT-taking when conditioning for observables. Similarly, there is a significant decline in per-pupil expenditure after a major job loss shock during the previous school year, but there is no simultaneous relationship.

Other results (available upon request) indicate that there does not seem to be anything happening differentially by tuition prices at local community colleges. Marginal students may be more able to opt into going to college when it is less expensive, and students who otherwise might have gone to four-year institutions can save more money by attending a community college instead if tuition at the community college is lower; both of these phenomena imply a stronger relationship between local job losses and college (particularly community college) attendance in areas where community college is cheaper. In reality, I find no evidence of such behavior. Splitting the data set by quartile of local community college tuition and estimating the equations shown in Tables 5-7 produces no patterns of differential responses by tuition price. Perhaps marginal students view community college as inexpensive enough that they are not especially price-sensitive.

6 Discussion and Conclusion

6.1 Context

It is worth examining the findings of the collegegoing specifications in the context of the 8$^{\text{th}}$-grade test score results. Students exposed to more job losses in high school are more likely to attend college (particularly at a community college), while those exposed to more job losses in middle school perform slightly worse on standardized tests; put differently, job losses are associated with an increase in attainment despite a decrease in achievement. Most of the job losses in the collegegoing specifications occur after students would have submitted their applications to four-year colleges, but any possible decline in student performance associated with the job losses cannot affect students' admission to an open-access community college. Students may lose motivation if their achievement in school declines, which would give them a negative signal that would discourage them from continuing their education, but this effect appears to be dominated by the decrease in opportunity cost.

Of course, this also assumes that students would react the same way at age 17 as at age 13. It is also possible that adolescents are navigating enough turbulence already and are poorly equipped to weather a decline in family resources, whereas older teenagers are more fully mature and can withstand adversity better. High-school seniors may also respond to shocks to family resources by entering the labor market themselves, or increasing their hours worked; this would allow families with older children to smooth their consumption more effectively than families with middle-school students may.

6.2 Validity and Robustness

There are certainly some pieces of unobserved information that would provide additional clarity if I were able to incorporate them into the analysis. For instance, the National Student Clearinghouse data do not contain information on the financial aid that a student receives. While information about financial aid is certainly not always transmitted effectively to college applicants (see, for instance, Dynarski and Scott-Clayton 2007), it is not a stretch to say that some students will at least consider it as they make their college decisions. Generous need-based aid may explain why there is no decrease in four-year attendance among students eligible for subsidized lunch; even though these students may be the most credit constrained, they may be eligible for enough financial aid that tuition at four-year colleges is not much more expensive than tuition at two-year colleges.

There is also an unobserved heterogeneity among the students who are affected by local plant closings. Some of them have parents with stable incomes that are undisrupted by local economic fluctuations; these students see the closed factories out their car windows as they drive by, but there are no immediate effects on them or their families. For these students, the only result of the local economic shock is a change in their expected earnings if they enter the labor market. Their resources on hand to pay for college do not change. These students would react very differently from students whose families lost income, up to and including lost jobs, due to the local shock. The latter group of students now has fewer resources on hand to pay for college, and we expect credit constraints to be more likely to bind for them. I cannot distinguish between these types of students, and so any effects that I estimate are averaging across two very different groups. Perhaps the best available measure of a shock to a student's family income is whether he or she is newly eligible for free or reduced-price lunch; Table 8 shows that these students are particularly likely to be induced into college attendance; a 1-standard deviation increase in per capita job losses is associated with a 0.9-percentage point (1.5%) increase in the probability of attending college, and a 0.8-percentage point (3%) increase in the probability of attending a two-year college. Credit constraints appear to bind surprisingly little for this population.

Another threat to validity is the nature of the WARN data. Firms that do not employ at least 100 workers are not required to file WARN notices; layoffs or closings that result in fewer than 50 job losses are also not required to be reported. Obviously, densely-populated areas will have higher concentrations of large firms, while more rural areas will have more workers working in firms that are too small to be eligible. To provisionally test the degree to which this matters, I use the Longitudinal Employer-Household Dynamics database to find the percentage of workers working in firms with fewer than 50 employees in each county, then run the main specifications again after removing counties with fewer than 30% of private-sector workers working in firms of sufficient size. This ends up removing five counties, whose observations make up about 0.5% of the data; coefficients on the job loss variable increase in size by about 3% after performing this sample restriction. The inclusion of these small counties biases the full-sample results toward zero.

Furthermore, there are a number of other elements of the college decision process that I do not observe in the data. If I observe a student from a hard-hit community who has extraordinarily high test scores and attends a community college, I implicitly assume that the student is attending community college instead of a four-year school as a response to the job losses. However, the mechanism through which this takes place is not always clear. The student could have been accepted at, say, Michigan State and chosen not to attend; she could have chosen not to even apply to Michigan State for fear that it was too expensive; she may have even been rejected from Michigan State despite her strong credentials. I do not observe the set of colleges to which a student is accepted; I have some information on the set of schools to which the student sends ACT scores, which can serve as a proxy for the set of schools to which the student applies, but the process in which the student sits down with her family at the dinner table and decides which schools she should apply to and which are out of reach is unobservable to researchers.

Additionally, not every student who starts his or her postsecondary career at a community college intends to enter the labor market with an associate's degree. Some community college students intend to transfer to four-year schools and earn a bachelor's degree; others do not intend to graduate at all, but only seek to take a few classes to build their human capital and train themselves for jobs in a particular field or industry. Spending the first two years at a less-expensive community college before earning a degree from a four-year school is a rational response to credit constraints that still enables students to get four years of higher education; if a student gets an associate's degree within two years and transfers to a four-year college immediately afterward, we treat that student as a four-year college student and not as a two-year college student. However, community college students' intentions are unobserved in this data set. Therefore, it is most straightforward to treat community college students as pursuing an associate's degree unless they are seen transferring, even though the reality is significantly more complex.[14]

While Michigan's economic experience in the 21st century has been more challenging than most other states', providing more variation in the data for the purposes of this study, there is little that is unique to Michigan that would make this study not replicable in other locations in the United States. The WARN Act requires all states to report large unemployment shocks due to plant closings or mass layoffs, so the job loss data should be available throughout the country. The state's student data system is generally quite good, complete with a unique ID that allows linking of records across state databases, but other states are catching up and placing more emphasis on tracking student data.

6.3 Future Research

While this paper as it currently exists may make a valuable contribution to the literature on the determinants of college attainment and college choice, there is certainly room for expansion upon its findings. For instance, since the data on job losses are calculated at the local level, I am careful to phrase the impact of these plant closings as stemming from local economic shocks, rather than from a direct unemployment shock to the student's family. Again, this is still valuable; students' responses to local economic shocks are worth observing. However, it cannot accurately estimate the effects of plant closings on their most immediate victims: the households that had a family member become unemployed. If a data source allows for the merging of unemployment insurance filings onto student records (using address and perhaps last name as match variables), this would enable a much more precise estimation of the impact of family members' job losses on college outcomes, similar to what Coelli (2011) and Oreopoulos et al. (2008) accomplish with Canadian data or the work by Hilger (2015) using U.S. tax data. There would be flaws in this type of study as well, of course; not everyone who loses a job files for unemployment benefits, and it is certainly possible that there are systematic differences between filers and non-filers that could result in a biased estimate of the effects of unemployment. However, even considering these biases, a match using unemployment benefits data would allow a more definitive estimate of how students' college decisions respond to job losses in their own families.

6.4 Conclusion

As Michigan's automotive industry accelerated its decline in the 2000s, a number of factories throughout the state shut their doors for good, putting thousands of workers out of their jobs. The contagion from the industry's downturn spread through the state's economy, shuttering grocery stores, hospitals, shopping malls, and small businesses. In a perfect and

[14] Additional results, available by request, show that there is no effect of local job losses on community college students' transferring to four-year colleges in the full sample. There is a positive and significant effect when the sample is limited to students eligible for free or reduced-price lunch.

frictionless world, high school graduates would likely respond to this by demanding more education; the opportunity cost of a year in college is low when one's job prospects are poor, and education will help a student get a better job if the job market remains in a downturn after he or she graduates. In reality, things may be more complex; if families are credit-constrained, they may be unable to help pay for their children's education after an income loss. This is particularly pronounced among households headed by high school graduates, underrepresented minorities, and lower-income families; their children may benefit greatly from higher education, but they are significantly credit constrained and have less experience navigating the financial aid system.

In my study of Michigan students' educational response to local mass unemployment events, I find evidence that credit constraints matter for the overall population. Students exposed to economic shocks are more likely to attend two-year colleges and less likely to attend four-year colleges. If credit constraints did not bind, there would be movement *toward* attending four-year colleges in response to local economic shocks; this may or may not come at the expense of two-year colleges. Interestingly, the result largely goes away when the population of study is a less-privileged subgroup of Michigan high school graduates; effects are less significant for Black students or for students eligible for subsidized school lunch. These students may be eligible for more types of financial aid, whereas the "next-poorest" students may come from families making too much money to receive much grant aid (or subsidized lunch) but not enough to pay for college without borrowing, particularly in the event of an economic shock. These students are the ones hurt most by credit constraints, as they are prevented from achieving the optimal level of education in the face of a downturn in the local labor market.[15]

If this trend persists, Michigan may see widening income inequality in years to come, as less-wealthy students are priced out of accessing the education that could help them improve their situation, despite having the academic credentials required for admission. Meanwhile, seats at the best universities will remain largely reserved for students from more-privileged backgrounds who can afford the tuition and who are not credit constrained. These temporary unemployment shocks may end up having damaging consequences for poorer students' careers and for the quality of Michigan's labor force in the years to come.

[15] From a glance at some of the more detailed paper WARN notices, the majority of jobs lost in WARN Act-eligible events in the sample period were in occupations that did not require a four-year degree. Students are not re-calculating their unconstrained optimum and, in response to local labor market contractions, choosing less education as their optimal decision.

7 Supplemental Figures

Figure 1: Distribution of Plant Closing and Mass Layoff Sizes

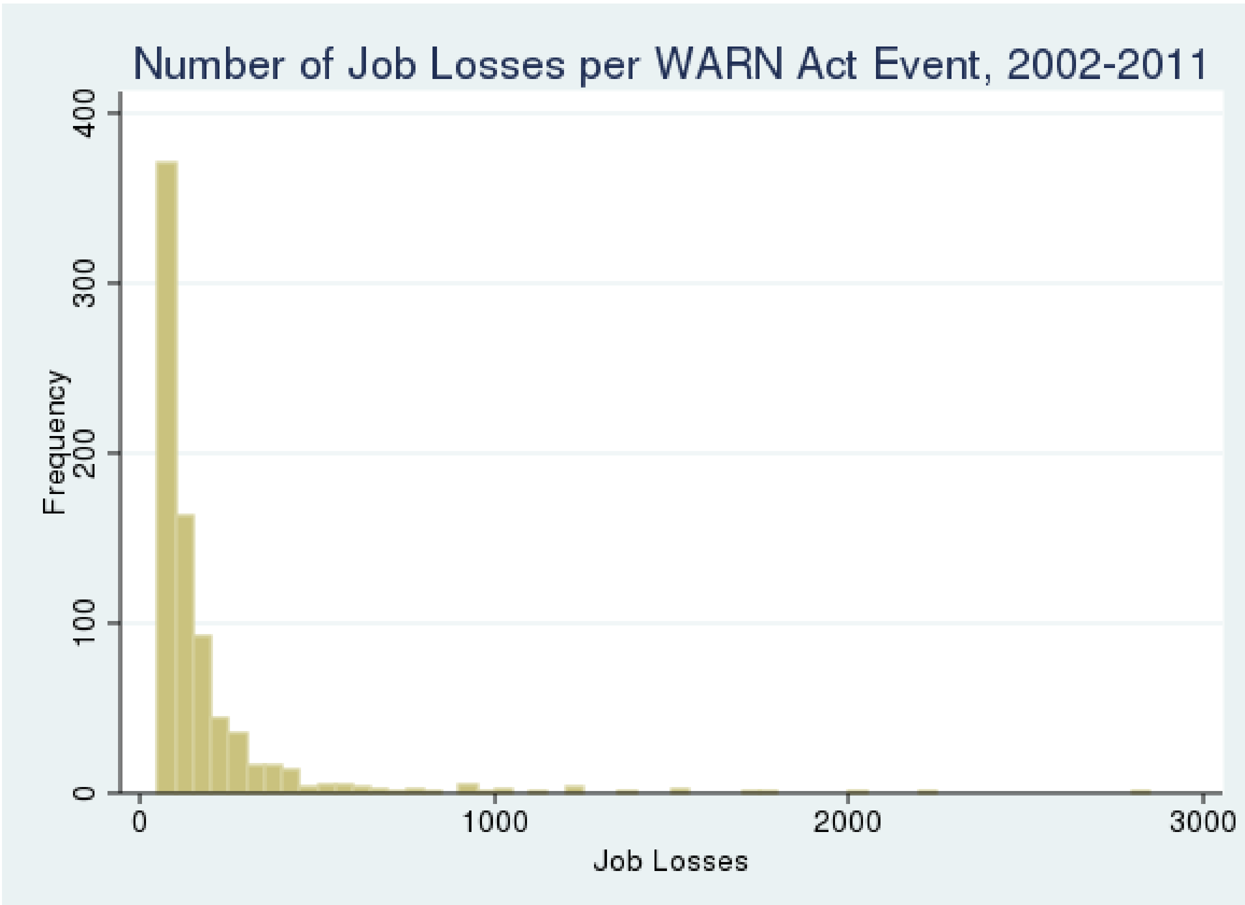


Figure 2: Annual Total Job Losses Due to Plant Closings and Mass Layoffs

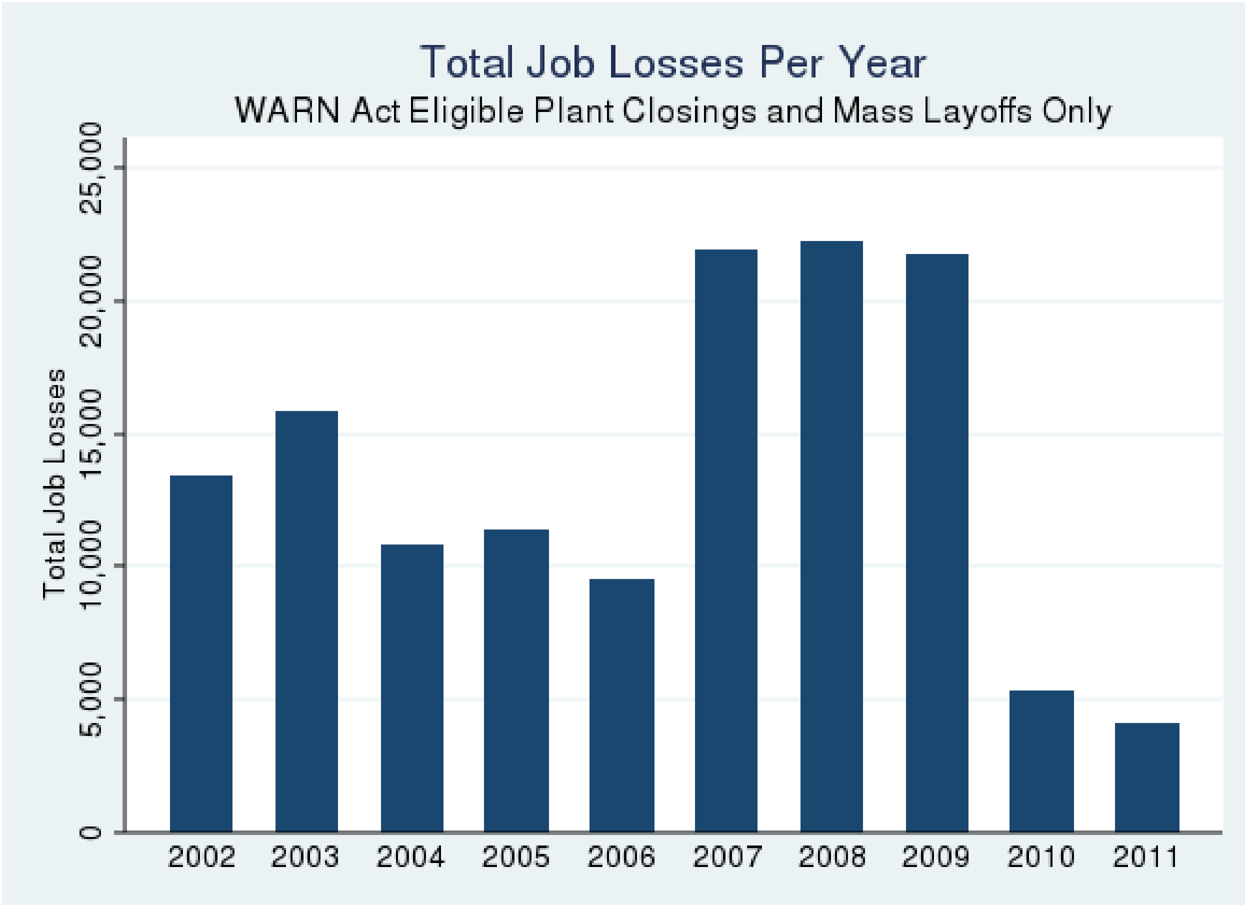
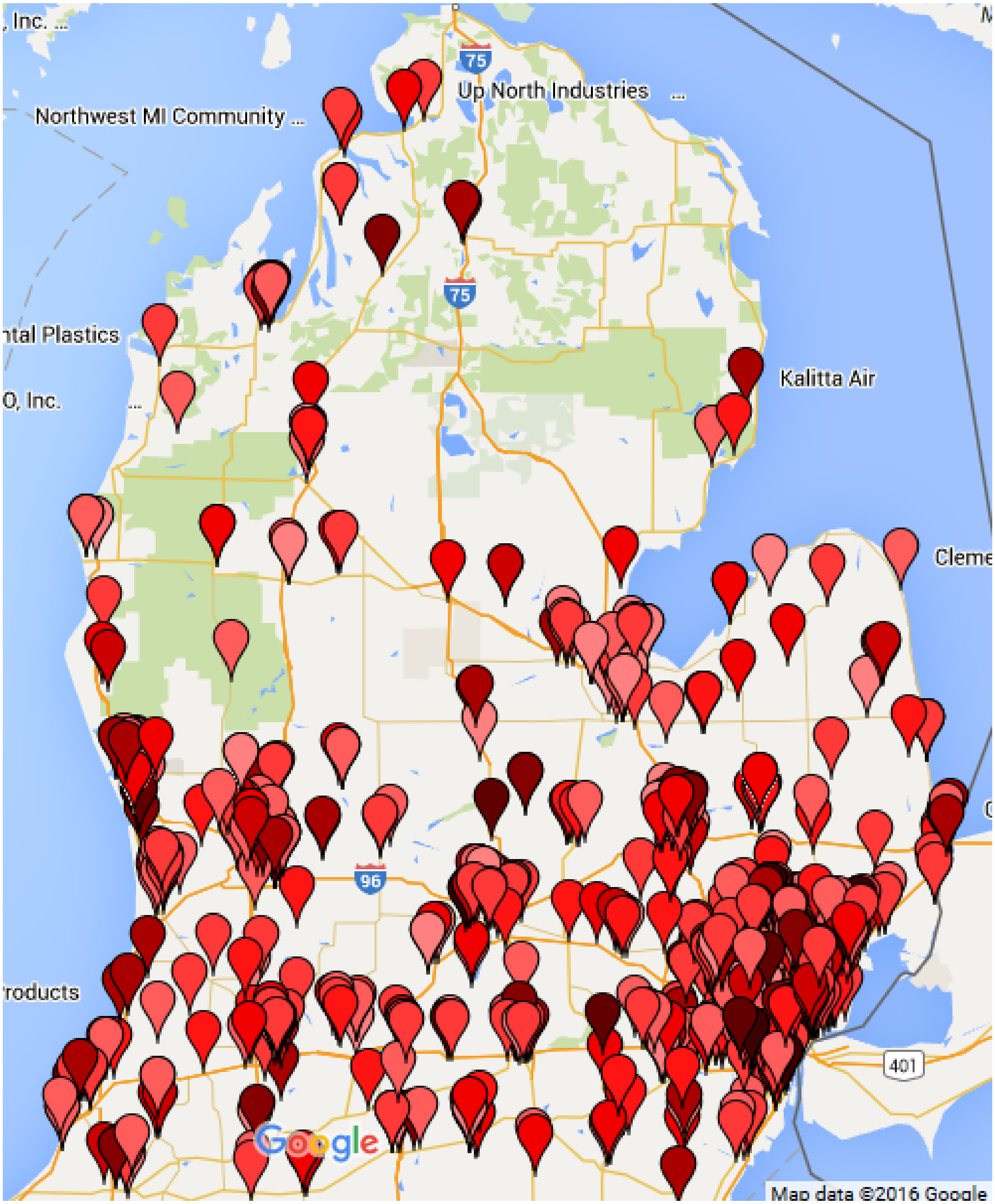
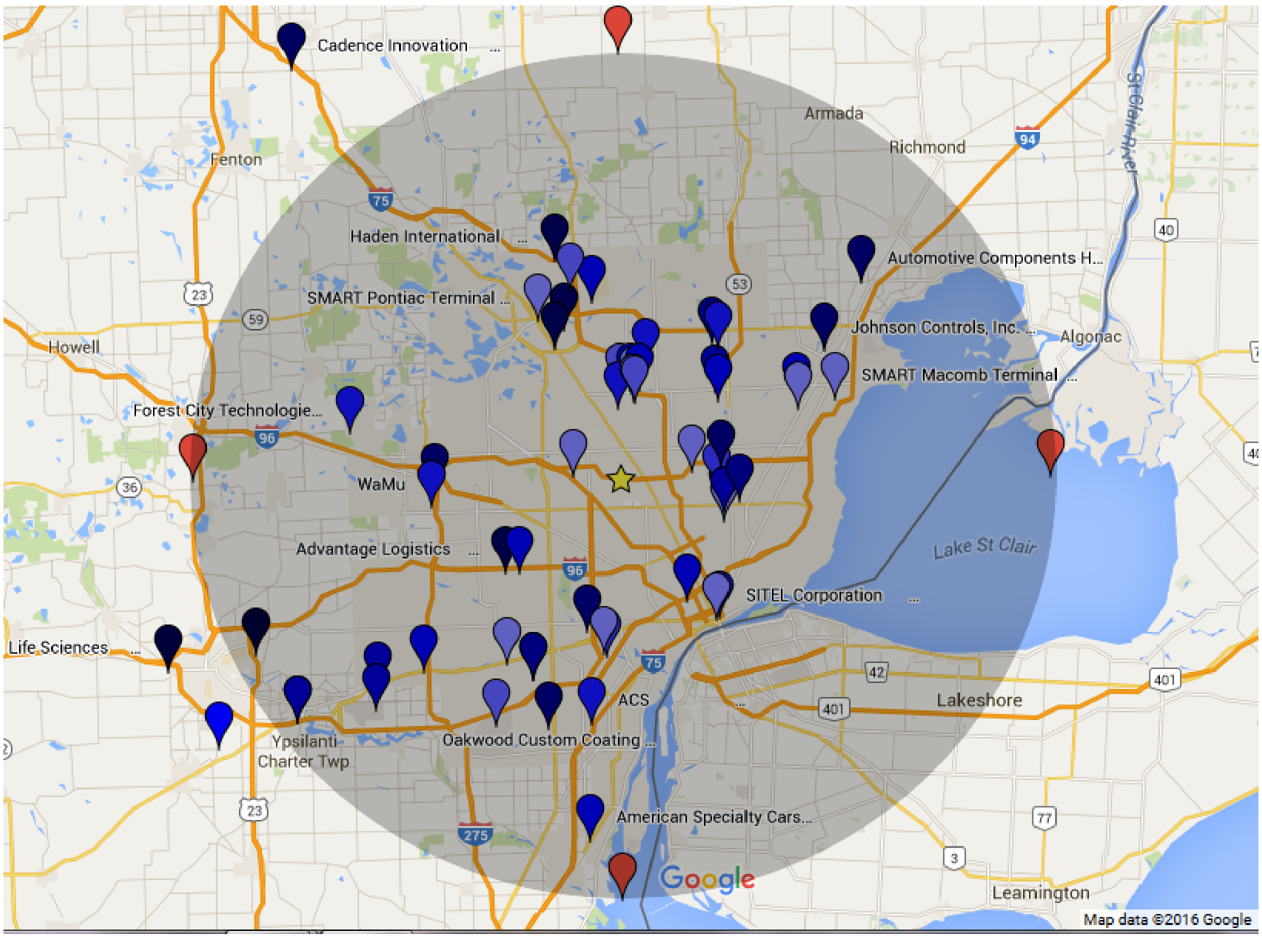


Figure 3: Geographic Distribution of Plant Closings and Mass Layoffs



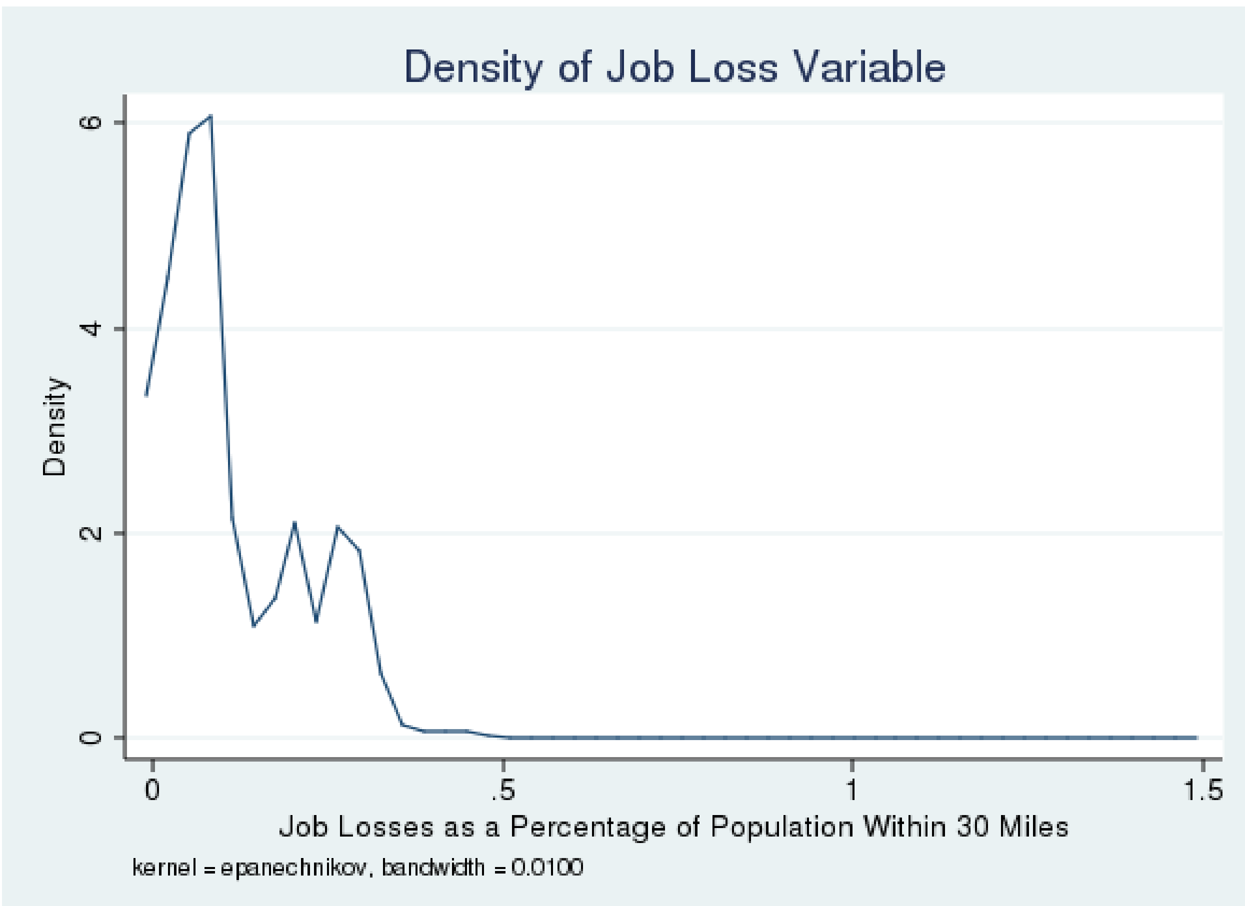
Each red marker is a plant closing or mass layoff. Darker red markers are associated with more jobs lost.

Figure 4: An Empirical Example: Plant Closings in Metropolitan Detroit in 2005-2006



Each blue marker is a plant closing or mass layoff that occurred between September 1, 2005, and August 31, 2006. Darker blue markers are associated with more jobs lost. Blue markers inside the circle are counted toward the "per capita job losses" measure of a student who lives at the star and graduates in spring of 2006. Red markers mark the edges of the circle; they do not correspond to plant closings or mass layoffs.

Figure 5: Distribution of Job Loss Variable



8 Supplemental Tables

Table 1: Summary Statistics by Postsecondary Choice

	No College	2-Year Only	Ever In 4-Year
Standardized State Test Score	-0.585	-0.25	0.461
	(1.02)	(0.877)	(0.804)
Percentage Taking ACT	26.4	47.5	87.2
ACT Composite Score	18.6	18.5	22.2
	(4.87)	(3.9)	(4.51)
High-School GPA	2.89	2.9	3.39
	(0.74)	(0.616)	(0.53)
Percentage Female	43.6	48.5	54.6
Percentage Black	17.9	18.2	13.9
Percentage Hispanic	5.15	3.22	1.9
Percentage Asian	1.66	1.35	2.83
Percentage Subsidized Lunch Eligible	37.5	27.7	16.7
Percentage Special Education	19.1	11.9	3.86
Percentage Limited English Proficiency	3.15	2.08	1.13
Percentage in Urban Schools	18.3	18.5	15.4
Percentage in Town/Rural Schools	40.4	35	32.9
Number of Students	30,215	25,543	52,009

Standard deviations in parentheses. Summary tables use only 2006 graduates.

Table 2: Summary Statistics by Population-Adjusted Job Loss Quartile

	Lowest	Second	Third	Highest
Standardized State Test Score	0.018	0.08	0.014	-0.114
	(0.955)	(0.998)	(1.01)	(1.03)
Percentage Taking ACT	57.7	61.3	65	58.7
ACT Composite Score	21	21.5	21.3	20.5
	(4.47)	(4.55)	(4.95)	(4.99)
High-School GPA	3.25	3.27	3.26	3.2
	(0.614)	(0.629)	(0.597)	(0.623)
Percentage Female	49.3	49.5	50.4	51.1
Percentage Black	8.11	8.23	22	26.1
Percentage Hispanic	2.82	4.5	2.36	2.85
Percentage Asian	1.11	1.83	2.84	2.83
Percentage Subsidized Lunch Eligible	27.5	21.9	20.2	31.1
Percentage Special Education	11	10.4	8.73	10.1
Percentage Limited English Proficiency	0.704	1.7	2.16	3.16
Percentage in Urban Schools	12.7	13.5	15.7	26.2
Percentage in Town/Rural Schools	66.2	49.5	12.7	13.3
Percentage Attending Any College	70	70.3	75.6	71.9
Percentage Attending 4-Year College	45.3	47.2	53.3	47.1
Number of Students	26,999	26,911	27,340	26,405

Standard deviations in parentheses. Job losses are taken within a 30-mile radius of the student's high school, divided by the population living in census tracts within that radius. Summary statistics use only 2006 graduates.

Table 3: 8^{th} Grade Exam Scores, Full Sample

	Math	Reading
Standardized WARN, Last 12 Mos.	0.001	-0.005***
	(0.003)	(0.002)
7^{th} Grade State Exam Score	0.628***	0.614***
	(0.006)	(0.002)
Female	-0.088***	0.1***
	(0.002)	(0.002)
Black	-0.267***	-0.114***
	(0.008)	(0.005)
Hispanic	-0.107***	-0.03***
	(0.009)	(0.007)
Asian	0.309***	0.124***
	(0.023)	(0.009)
Subsidized Lunch Eligible	-0.173***	-0.107***
	(0.004)	(0.003)
Limited English Proficiency	-0.234***	-0.249***
	(0.019)	(0.014)
Special Education	-0.486***	-0.354***
	(0.007)	(0.004)
Year Dummies?	Yes	Yes
School FE & County Trends?	Yes	Yes
Student Demographics?	Yes	Yes
R^2	0.483	0.546
Number of Observations	1,022,588	695,039

Standard errors in parentheses, clustered by school. Exam year dummies and school-specific time trends included. “Standardized WARN” variable is the per-capita number of jobs lost in the preceding year within a 30-mile radius of the student’s home ZIP code in 8^{th} grade, adjusted so that the mean is zero and the standard deviation is one. The reading exam was not offered in all years of the sample. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 4: 8^{th} Grade Exam Scores, Students Eligible for Subsidized Lunch

	Math	Reading
Standardized WARN, Last 12 Mos.	0.002	-0.005**
	(0.003)	(0.002)
7^{th} Grade State Exam Score	0.585***	0.599***
	(0.006)	(0.003)
Female	-0.071***	0.098***
	(0.002)	(0.002)
Black	-0.205***	-0.102***
	(0.006)	(0.006)
Hispanic	-0.063***	-0.012
	(0.009)	(0.008)
Asian	0.218***	0.129***
	(0.016)	(0.014)
Limited English Proficiency	-0.186***	-0.233***
	(0.02)	(0.018)
Special Education	-0.383***	-0.344***
	(0.006)	(0.005)
Year Dummies?	Yes	Yes
School FE & County Trends?	Yes	Yes
Student Demographics?	Yes	Yes
R^2	0.418	0.504
Number of Observations	386,093	284,695

Standard errors in parentheses, clustered by school. Exam year dummies and school-specific time trends included. "Standardized WARN" variable is the per-capita number of jobs lost in the preceding year within a 30-mile radius of the student's home ZIP code in 8^{th} grade, adjusted so that the mean is zero and the standard deviation is one. The reading exam was not offered in all years of the sample. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 5: Effects of Labor Market Shocks on Any College Attendance: Full Sample

	Unemployment Rate	Standardized WARN	IV - WARN for Unemployment
Labor Market Shock, Grade 12	0.003	0.002**	0.032**
	(0.002)	(0.001)	(0.014)
High School State Exam Score	0.138***	0.14***	0.137***
	(0.002)	(0.002)	(0.001)
Female	0.054***	0.054***	0.053***
	(0.002)	(0.002)	(0.001)
Black	0.104***	0.101***	0.103***
	(0.005)	(0.005)	(0.003)
Hispanic	-0.045***	-0.049***	-0.045***
	(0.005)	(0.005)	(0.003)
Asian	0.007	0.008	0.007*
	(0.008)	(0.008)	(0.004)
Subsidized Lunch Eligible	-0.074***	-0.076***	-0.074***
	(0.003)	(0.003)	(0.001)
Limited English Proficiency	0.014	0.009	0.013***
	(0.009)	(0.009)	(0.005)
Special Education	-0.084***	-0.083***	-0.085***
	(0.002)	(0.002)	(0.002)
First Stage			0.513***
			(10.1)
First-Stage F Statistic			25.77
R^2	0.189	0.191	0.188
Number of Observations	945,759	944,748	944,748
Outcome Mean	0.713	0.713	0.713

"Labor market shock" corresponds to the variable at the top of each respective column. Year dummies, school fixed effects, and county time trends included. Unemployment rates are measured at the county level. "Standardized WARN" variable is the per-capita number of jobs lost within a 30-mile radius of the school that the student attends in 11th grade, adjusted so that the mean is zero and the standard deviation is one. Per capita WARN job losses used as an instrument for the county unemployment rate during the 12-month period starting in September of the year after a student starts 11th grade for the first time. Standard errors in parentheses, clustered by ZIP code. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 6: Effects of Labor Market Shocks on Four-Year College Attendance: Full Sample

	Unemployment Rate	Standardized WARN	IV - WARN for Unemployment
Labor Market Shock, Grade 12	0.001	-0.001	-0.006
	(0.002)	(0.001)	(0.015)
High School State Exam Score	0.202***	0.203***	0.202***
	(0.002)	(0.002)	(0.001)
Female	0.057***	0.053***	0.057***
	(0.001)	(0.001)	(0.001)
Black	0.098***	0.095***	0.098***
	(0.005)	(0.005)	(0.003)
Hispanic	-0.037***	-0.035***	-0.038***
	(0.004)	(0.004)	(0.003)
Asian	0.047***	0.051***	0.047***
	(0.007)	(0.007)	(0.004)
Subsidized Lunch Eligible	-0.076***	-0.074***	-0.076***
	(0.002)	(0.002)	(0.001)
Limited English Proficiency	0.016**	0.013**	0.016***
	(0.007)	(0.007)	(0.004)
Special Education	-0.044***	-0.037***	-0.044***
	(0.003)	(0.003)	(0.002)
First Stage			0.513***
			(10.1)
First-Stage F Statistic			25.77
R^2	0.249	0.25	0.249
Number of Observations	945,759	944,748	944,748
Outcome Mean	0.464	0.464	0.464

"Labor market shock" corresponds to the variable at the top of each respective column. Year dummies, school fixed effects, and county time trends included. Unemployment rates are measured at the county level. "Standardized WARN" variable is the per-capita number of jobs lost within a 30-mile radius of the school that the student attends in 11th grade, adjusted so that the mean is zero and the standard deviation is one. Per capita WARN job losses used as an instrument for the county unemployment rate during the 12-month period starting in September of the year after a student starts 11th grade for the first time. Standard errors in parentheses, clustered by ZIP code. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 7: Effects of Labor Market Shocks on Two-Year College Attendance: Full Sample

	Unemployment Rate	Standardized WARN	IV - WARN for Unemployment
Labor Market Shock, Grade 12	0.001	0.003***	0.038***
	(0.001)	(0.001)	(0.014)
High School State Exam Score	-0.064***	-0.063***	-0.064***
	(0.002)	(0.002)	(0.001)
Female	-0.003**	0.001	-0.003***
	(0.002)	(0.002)	(0.001)
Black	0.006*	0.007*	0.005**
	(0.003)	(0.004)	(0.002)
Hispanic	-0.008**	-0.014***	-0.007**
	(0.004)	(0.004)	(0.003)
Asian	-0.04***	-0.042***	-0.04***
	(0.004)	(0.004)	(0.003)
Subsidized Lunch Eligible	0.002	-0.002	0.002*
	(0.002)	(0.002)	(0.001)
Limited English Proficiency	-0.002	-0.004	-0.002
	(0.009)	(0.009)	(0.005)
Special Education	-0.04***	-0.046***	-0.041***
	(0.003)	(0.003)	(0.002)
First Stage			0.513***
			(10.1)
First-Stage F Statistic			25.77
R^2	0.053	0.051	0.051
Number of Observations	945,759	944,748	944,748
Outcome Mean	0.249	0.249	0.249

"Labor market shock" corresponds to the variable at the top of each respective column. Year dummies, school fixed effects, and county time trends included. Unemployment rates are measured at the county level. "Standardized WARN" variable is the per-capita number of jobs lost within a 30-mile radius of the school that the student attends in 11th grade, adjusted so that the mean is zero and the standard deviation is one. Per capita WARN job losses used as an instrument for the county unemployment rate during the 12-month period starting in September of the year after a student starts 11th grade for the first time. Standard errors in parentheses, clustered by ZIP code. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 8: OLS Linear Probability Model Results, WARN: Subgroups

	Any College Attendance	4-Year Attendance	2-Year Attendance
Students Eligible for Subsidized Lunch	0.002	0.002	0.0002
	(0.002)	(0.002)	(0.002)
	[0.596]	[0.319]	[0.276]
Students Not Eligible	0.002*	-0.003**	0.005***
	(0.001)	(0.001)	(0.001)
	[0.764]	[0.526]	[0.238]
Students Newly Eligible	0.009**	0.001	0.008**
	(0.003)	(0.004)	(0.003)
	[0.616]	[0.347]	[0.269]
Female Students	0.002	-0.001	0.002*
	(0.001)	(0.002)	(0.001)
	[0.753]	[0.506]	[0.247]
Male Students	0.003**	-0.002	0.005***
	(0.001)	(0.001)	(0.001)
	[0.673]	[0.422]	[0.252]
Year Dummies?	Yes	Yes	Yes
School FE & County Trends?	Yes	Yes	Yes
Student Demographics?	Yes	Yes	Yes

Coefficients on "Standardized WARN" variable shown. "Standardized WARN" variable is the per-capita number of jobs lost within a 30-mile radius of the school that the student attends in 11th grade, adjusted so that the mean is zero and the standard deviation is one. Standard errors in parentheses, clustered by ZIP code; subgroup means in brackets. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

Table 9: Effects by Predicted Probability of Four-Year Attendance

	Any College Attendance	4-Year Attendance	2-Year Attendance
Lowest Quartile	0.003	0.001	0.003
	(0.002)	(0.002)	(0.002)
	[0.467]	[0.166]	[0.301]
Second Quartile	0.004*	-0.0005	0.004**
	(0.002)	(0.002)	(0.002)
	[0.696]	[0.372]	[0.324]
Third Quartile	0.004***	-0.001	0.005***
	(0.001)	(0.002)	(0.002)
	[0.83]	[0.593]	[0.237]
Highest Quartile	-0.001	-0.001	0.001
	(0.001)	(0.001)	(0.001)
	[0.909]	[0.805]	[0.104]
Year Dummies?	Yes	Yes	Yes
School FE & County Trends?	Yes	Yes	Yes
Student Demographics?	Yes	Yes	Yes

Coefficients on “Standardized WARN” variable shown. “Standardized WARN” variable is the per-capita number of jobs lost within a 30-mile radius of the school that the student attends in 11th grade, adjusted so that the mean is zero and the standard deviation is one. Standard errors in parentheses, clustered by ZIP code; subgroup means in brackets. * = significant at 0.10 level, ** = 0.05, *** = 0.01. Students are assigned to a ”predicted” group based a regression of an indicator for attending a 4-year college on all covariates except for job losses; I take predicted values from this and break them into quartiles.

Table 10: Possible Mechanisms for College Effects

	Graduation	ACT Taking	Gr. 12 Per Pupil Expenditure
Prior-Year Standardized WARN	0.003*	-0.005**	-0.005***
	(0.002)	(0.002)	(0.002)
High School State Exam Score	0.057***	0.103***	-0.004***
	(0.001)	(0.001)	(0.001)
Female	0.025***	0.027***	0
	(0.001)	(0.001)	(0.001)
Black	0.005*	0.05***	0.021***
	(0.002)	(0.003)	(0.004)
Hispanic	-0.021***	-0.007**	0.007***
	(0.003)	(0.003)	(0.002)
Asian	-0.02***	0.014***	0.006**
	(0.003)	(0.005)	(0.003)
Subsidized Lunch Eligible	-0.039***	-0.032***	0.003**
	(0.002)	(0.001)	(0.001)
Limited English Proficiency	0.005	-0.019***	0.004
	(0.004)	(0.005)	(0.003)
Special Education	0.004	-0.054***	0
	(0.003)	(0.003)	(0.004)
Year Dummies?	Yes	Yes	Yes
School FE & County Trends?	Yes	Yes	Yes
R^2	0.139	0.512	0.913
Number of Observations	944,748	944,748	942,788

Standard errors in parentheses, clustered by ZIP code. School and graduation year fixed effects and county-specific time trends included. "Standardized WARN" variable is the per-capita number of jobs lost in the preceding year within a 30-mile radius of the student's home ZIP code, adjusted so that the mean is zero and the standard deviation is one; for ACT taking and per-pupil expenditure, this is measured in 11^{th} grade. * = significant at 0.10 level, ** = 0.05, *** = 0.01.

References

[1] Ananat, E., Gassman-Pines, A., & Gibson-Davis, C. (2009). *The Effect of Plant Closings on Children's Educational Achievement.* Brookings Institute.

[2] Barr, A., & Turner, S. (2013). Expanding Enrollments and Contracting State Budgets: The Effect of the Great Recession on Higher Education. *The Annals of the American Academy of Political and Social Science*, 168-193.

[3] Becker, G. (1975). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, 2nd ed. University of Chicago Press, Chicago.

[4] Berhard, S. (2013). *GEOCODE3: Stata Module to Retrieve Coordinates or Addresses from Google Geocoding API, Version 3.* Statistical Software Components S457650, Boston College Department of Economics. https://ideas.repec.org/c/boc/bocode/s457650.html. Revised July 25, 2013.

[5] Black, D., McKinnish, T., & Sanders, S. (2005). Tight Labor Markets and the Demand for Education: Evidence from the Coal Boom and Bust. *Industrial and Labor Relations Review*, 3-16.

[6] Black, S., Cortes, K., & Lincove, J. (2015). *Apply Yourself: Racial and Ethnic Differences in College Application*. Working paper.

[7] Cascio, E., & Narayan, A. (2015). *Who Needs a Fracking Education? The Educational Response to Low-Skill Biased Technological Change.* Working paper.

[8] Charles, K., Hurst, E., & Notowidgdo, M. (2015). *Housing Booms and Busts, Labor Market Opportunities, and College Attendance.* Working paper.

[9] Coelli, M. (2011). Parental Job Loss and the Education Enrollment of Youth. *Labour Economics*, 25-35.

[10] Dynarski, S., & Scott-Clayton, J. (2007). *College Grants on a Postcard: A Proposal for Simple and Predictable Federal Student Aid.* The Hamilton Project.

[11] Foote, A., Grosz, M., & Stevens, A.H. (2015). *Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response.* Working paper.

[12] Ge, R. (2015) *Economic Restructuring and Children's Educational Attainment: Lessons from China's State-owned Enterprises Reform in the Mid-1990s.* Working paper.

[13] Hilger, N. (2016). Parental Credit Constraints and College Attendance: Evidence from Timing of Fathers' Layoffs. *American Economic Journal: Applied*, 247-283.

[14] Hirsch, B.T., & Macpherson, D.A. (2002). *Union Membership, Coverage, Density and Employment by State, 2000.* Retrieved June 11, 2014, from Georgia State University Union Stats: http://unionstats.gsu.edu/State%20U_2000.htm.

[15] Hyman, J. *ACT For All: The Effect of Mandatory College Entrance Exams on Postsecondary Attainment and Choice*. Working paper.

[16] Kalil, A. & Wightman, P. Parental Job Loss and Children's Educational Attainment in Black and White Middle-Class Families. *Social Science Quarterly*, 57-78.

[17] Kochhar, R., Fry, R., & Taylor, P. (2011). *Wealth Gaps Rise to Record Highs Between Whites, Blacks, and Hispanics*. Pew Research Center Social & Demographic Trends.

[18] Lochner, L., & Monge-Naranjo, A. (2011). The Nature of Credit Constraints and Human Capital. *American Economic Review*, 2487-2529.

[19] Lovenheim, M., & Reynolds, C. (2013). The Effect of Housing Wealth on College Choice: Evidence from the Housing Boom. *Journal of Human Resources*, 1-35.

[20] Manoli, D., & Turner, N. (2014). *Cash-On-Hand and College Enrollment: Evidence from Population Tax Data and Policy Nonlinearities*. Working paper.

[21] Marcus, J. (2013, December 19). Canada Aims For US Student Growth. *Times Higher Education*.

[22] Oreopoulos, P., Page, M., & Stevens, A.H. (2008). The Intergenerational Effects of Worker Displacement. *Journal of Labor Economics*, 455-483.

[23] Oreopoulos, P., & Petronijevic, U. *Making College Worth It: A Review of Research on the Returns to Higher Education.* Working paper.

[24] Ost, B., Pan, W., & Webber, D. *The Impact of Mass Layoffs on the Educational Investments of Working College Students.* Working paper.

[25] Picard, R. (2010). *GEODIST: Stata Module to Compute Geodetic Distances*. Statistical Software Components S457147, Boston College Department of Economics. `https://ideas.repec.org/c/boc/bocode/s457147.html`. Revised Feb. 22, 2012.

[26] Rosen, S. (1977). Human Capital: A Survey of Empirical Research. *Research in Labor Economics* 1, 3-39.

[27] Stinebrickner, R., & Stinebrickner, T. (2003). Working During School and Academic Performance. *Journal of Labor Economics*, 473-491.

[28] Youth Employment Standards Act, Michigan Compiled Laws §§409-101-124 (1978).