The health effects of leaving school in a bad economy

Job Market Paper

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Abstract

This study investigates the effect of leaving school in a bad economy, defined as a state unemployment rate of 9% or higher, on men's health at age 40. Three empirical patterns motivate this research: workers who leave school in a bad economy persistently earn lower wages and work in less prestigious careers, individuals' career outcomes are associated with health outcomes, and the macroeconomy affects health. I use macroeconomic fluctuations between 1976 and 1992, and variation across states, as a quasi-experiment to identify the persistent health effects. Three health outcomes are examined: physical functioning, mental functioning, and depressive symptoms. I draw data from the recently available National Longitudinal Survey of Youth 1979 Cohort Age 40 Health supplement. I find that men who leave school in a bad economy have worse health at age 40 than men who leave school in a stronger economy. The results are robust to various econometric specifications, including the use of instrumental variables to correct for the potential endogeneity of the timing and location of leaving school. Supplementary analysis sheds light on potential mechanisms. Factor analysis indicates that effects are concentrated in mental health domains. This study provides the first published evidence on the persistent health effects of leaving school in a bad economy. The findings suggest that men who left school during the 2007-09 recession may experience persistently poor careers and health.

Keywords: health; school-leaving; macroeconomic fluctuations.

JEL classification: I1; I12; J2

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1. Introduction

This study investigates the persistent health effects of leaving school in a bad economy, defined as a state unemployment rate of 9% or higher. I compare the age 40 health of men who left school in a bad economy with the age 40 health of men who did not. Three empirical patterns motivate this study: leaving school in a bad economy has persistent and negative career effects; individual's career and health outcomes are correlated; and macroeconomic fluctuations affect health. My findings are timely as the U.S. is recovering from the 2007-09 recession. Figure 1 plots the national unemployment rate between 1950 and 2010. The high and persistent unemployment rates of the 2007-09 recession are apparent. The national unemployment rate was 8.5% in December 2011 and the rate was higher, 14.4%, among those aged 20-24 (Bureau of Labor Statistics [BLS], 2012). Rates of underemployment[1] are estimated to be as high as 15.2% (BLS, 2011). Research shows that new labor market entrants have suffered disproportionately in terms of employment outcomes in the 2007-09 recession (Bell & Blanchflower, 2009). Research implies the 2007-09 recession led to stress, food insecurity, morbidity, sedentary lifestyles, lower use of medical services, and loss of health insurance (Lusardi et al, 2010; Nord et al, 2009; Cawley et al, 2011; Colman & Dave, 2011; Currie & Telkin, 2011; Deaton, 2011; Holahan, 2011). These statistics imply that the current cohort of school-leavers may experience persistent, negative career and health effects as a result of entering a fragile labor market.

Previous literature suggests that the link between leaving school in a bad economy and age 40 health may operate, at least partially, through career, marriage, and education outcomes. Leaving school in a bad economy leads to a higher probability of unemployment and a low-quality job (e.g., lower wage, less satisfying, less likely to offer health-related benefits, more harmful work environment) in the short run as there are few open jobs from which to choose. Labor studies show that labor market frictions limit the ability of workers to shift into better jobs as the economy rebounds,

[1] Underemployment measures include the unemployed, discouraged workers, workers in part time jobs for economic reasons, and persons marginally attached to the labor market.

leaving workers persistently stuck in low-wage and low-quality jobs (e.g., Oreopolous et al, 2006; Oyer 2006; 2008; Mansour, 2009; Genda et al, 2010; Kahn, 2010).[2] The career effects are economically meaningful. Kahn (2010), using the same data set that I analyze in this study, finds that among white male college graduates a 1 percentage point increase in the state unemployment rate at school-leaving is associated with an annual wage loss of 2.5-9% and a less prestigious career 15 years later. A robust health economics literature shows that income is positively associated with health; job attributes (health benefits, satisfaction, hours worked, working conditions) affect health after conditioning on income; and job loss/unemployment negatively affects health beyond what is predicted by standard income effects. Additionally, leaving school in a bad economy may affect marriage and education by altering marriage market opportunities or the opportunity cost of attaining additional education.

I draw data from the recently available, geocoded National Longitudinal Survey of Youth 1979 Cohort (NLSY79) Age 40 Health supplement. The supplement is well-suited to my research objectives: it contains rich information on age 40 health, detailed educational and labor market histories, and comprehensive background information. I model age 40 health outcomes as a function of leaving school in a bad economy and use macroeconomic fluctuations between 1976 and 1992 as a quasi-experiment to identify health effects. The early 1980s recession lies in the middle of this period (July 1982-November 1983). My findings are may be informative to current policy makers because the early 1980s is arguably the most similar economic event in recent history to the 2007-09 recession.

My results suggest that men who leave school in a bad economy have worse health, particularly mental health, at age 40 than men who do not. The magnitude of the estimated effects is similar in absolute value to having a mother with a high school diploma relative to a mother who dropped out of high school. The results are robust to various econometric specifications, including the use of

[2]I employ a broad definition of labor market frictions: any deviation from perfect worker mobility between jobs. In a spot market only contemporary shocks affect employment outcomes while frictions (imperfect information, signaling, implicit contracts, internal labor markets, human capital accumulation) suggest that leaving school in a bad economy may persistently affect outcomes. See Baker et al (1994), Oyer (2006; 2008), or Kahn (2010) for relevant theories.

instrumental variables to correct for the potential endogeneity of the timing and location of leaving school. Health effects vary by race/ethnicity, family background, occupation, and skill. I identify career, marriage, fertility, education, and self-esteem outcomes as potential mechanisms.

This study contributes to several economic literatures. First, it adds to the labor literature on the effects of leaving school in a bad economy (e.g., Oyer, 2006; Kahn, 2010), as it identifies a previously unrecognized consequence: health. Second, it relates to the robust economics literature that documents the health effects of career outcomes (Duleep, 1986; Fletcher et al, 2010). Third, this study extends the active, although mixed, line of research that examines the health effects of macroeconomic fluctuations (Ruhm, 2000; Miller et al, 2009; Huff Stevens et al, 2011; Davalos et al, forthcoming). Fourth, this paper contributes to the growing interest in sensitive developmental periods (Heckman, 2007; Almond & Currie, 2011): neuroscience research documents that school-leaving age is an important period for emotional development (Dahl, 2004). While the literature has largely ignored the potential health effects of leaving school in a bad economy, it does suggest that a relationship may exist.

This paper is structured as follows. Section 2 reviews channels from leaving school in a bad economy to later health. Data and measures are described in Section 3; Section 4 reports the empirical model and results. Robustness checks are reported in Section 5 and Section 6 concludes.

2. Channels from leaving school in a bad economy to later health

Leaving school in a bad economy may have a persistent negative effect on health through several channels. Workers who leave school in a bad economy earn less than workers who do not. Empirical health studies document a positive association between income and health (Duleep, 1986; Deaton & Paxson, 1998; Deaton, 2002; Gardner & Oswald, 2007; Currie, 2009). Job displacement is associated with income loses, morbidity, unhealthy behaviors, suicide, and mortality (Jacobson et al, 1993; Eliason & Storrie, 2009; Kuhn et al, 2009; Strully, 2009; Sullivan & von Wachter, 2009; Classen & Dunn, 2011; Davis & von Wachter, 2011; Deb et al, 2011). Job churning is correlated with poor

health (Strully, 2009), workers with past unemployment spells have worse mental health than continuously employed workers (Knabe & Ratzel, 2009), and the unemployed have particularly poor health (Dooley et al, 1996). If mental health declines in bad economies (Ruhm, 2000), workers may be less productive and receive a low wage regardless of the number of jobs available (Ettner et al, 1997).

Low-quality jobs may lack benefits and provide unhealthy working conditions because working conditions are correlated within jobs (Kenkel & Supina, 1992). Workers who leave school in a bad economy work in less prestigious careers and are less likely to be promoted (Oyer, 2006; 2008; Kwon & Meyersson Milgrom, 2007; Kahn, 2010). In the U.S. health insurance is highly tied to employment: 61% of Americans under 65 receive health insurance through an employer-sponsored plan (AHRQ, 2010). If men who leave school in a bad economy systematically lack access to health insurance, they may experience health losses (Franks et al, 1993; Currie & Gruber, 1996). Unsafe and unpredictable work is linked with worse health, and cumulative exposure may be particularly harmful (Fletcher et al, 2007; Fletcher & Yamaguchi, 2010). Long work hours are associated with obesity (Courtemanche, 2009), repetitive tasks and work overload are correlated with sleep problems (Knudsen et al, 2007), and job satisfaction is associated with reporting good health (Fischer & Sousa-Poza, 2009).

Leaving school in a bad economy may affect health through marriage, fertility, and education. These outcomes are associated with good health (Grossman, 1972; Gardner & Oswald, 2004; Fuchs, 2004; Cutler & Lleras-Muney, 2008). Marriage and fertility decisions may be postponed or a worker may choose not to enter into these family arrangements. For example, a man who leaves school in a bad economy and obtains a low paying job may have poor marriage market opportunities. He may decide to delay or forego marriage and/or fertility. Similarly, workers who leave school in a bad economy may seek out education as lower wages reduce opportunity costs or alternatively they may be unable to finance education with lower earnings. Additionally, psychological research associates unmet expectations with poor health (Aron & Aron, 1987). If men who leave school in a bad economy are

unable to achieve expectations they may experience poor health.

Health shocks received during the school-leaving period may have persistent effects absent labor market frictions. Economists are increasingly interested in sensitive periods of development: some skills or traits are most easily acquired at specific stages (Heckman, 2007). Although much of this line of research has focused on early childhood (Almond & Currie, 2011), neuroscience research shows that typical school-leaving age (late-teens to mid-20s) is an important period for prefrontal cortex development. This region of the brain governs emotion and self-regulation (Dahl, 2004).[3]

Several surprising studies call to question whether leaving school in a bad economy will hurt health. Work by Ruhm (1995; 2000; 2003; 2005) and others (e.g., Dehejia & Lleras-Muney, 2004; Dave & Rashad-Kelly, 2010) shows that physical health and health behaviors improve while mortality declines as the unemployment rate rises. Several studies that use the Social Security Notch, Earned Income Tax Credit, or inheritances as exogenous sources of variation in income show no, or a negative, relationship between income and health (Snyder & Evans, 2006; Schmeiser, 2009; Cawley et al, 2010; Kim & Ruhm, 2012). The RAND health insurance experiment, a large-scale experiment than randomized levels of health insurance across individuals, finds that large differences in co-payments lead to small differences in health outcomes (Newhouse, 1993). Recent quasi-experimental studies challenge the causal role of education in health production that is predicted by the Grossman model (Grossman, 1972; Albouy & Lequien, 2009; Clark & Royer, 2010; McCary & Royer, 2011). Taken together, these unexpected findings imply that leaving school in a bad economy may have no effect, or a positive effect, on later health. Thus, whether, or by how much, leaving school in a bad economy hurts health is an empirical question.

3. Data

I draw data from the recently available, geocoded National Longitudinal Survey of Youth 1979

[3] The prefrontal cortex region of the brain has been implicated in planning complex cognitive behaviors, personality expression, decision making, and moderating social behavior. The primary activity of the prefrontal cortex region is development of thoughts and actions that meet internal objectives.

Cohort Age 40 Health supplement. Respondents were administered the supplement once between 1998 and 2006 at or about age 40. The original sample consisted of 12,686 youth 14 to 22 in 1979. Excluding subsamples dropped by the NLSY79 for financial reasons (military sample in 1984 and low income white sample in 1991) leaves 9,964 eligible respondents. 8,465 respondents (85% of the eligible sample) completed the supplement, including 4,169 men. 4,161 men have valid school-leaving information. 14 men with missing instrumental variable information (described later) are excluded. I focus on the persistent effects of leaving school in a bad economy and retain men who left school 15 years or more prior to the supplement (n=4,047). I exclude men who left school before 1976 (n=273) as state-level unemployment rates from the BLS are available beginning in this year. The analysis sample includes 3,774 men (Table 1) who left school between 1976 and 1992. Results are robust to alternative sample exclusion rules.

The supplement is well suited to my research objectives. The timing and content permit investigation of persistent effects on multiple health outcomes. The education history and geocodes allow me to locate the exact state, month, and year of school-leaving and take advantage of monthly variation in economic conditions. The NLSY79 is a longitudinal survey and offers a substantial advantage over cross-sectional surveys: cross-sectional data typically do not include school-leaving time or location. Researchers must impute this information, introducing measurement error (Genda et al, 2010). The detailed labor market and demographic histories allow me to analyze potential mechanisms. The rich personal information allows me to control for a comprehensive set of covariates. The NLSY79 has several notable limitations: a small sample size, respondents complete the supplement only once, age 40 may be too young to observe health effects, and health outcomes are self-reports rather than objective measurements.

Figure 2 presents the quasi-experiment: the seasonally adjusted national unemployment rate is plotted between 1976 and 1992 (the years in which my sample left school). This period covers more

than a full business cycle and provides substantial variation in economic conditions to identify the health effects of leaving school in a bad economy. The U.S. experienced high inflation (late 1970s); three recessions (a mild recession in 1980, a severe recession between July 1982 and November 1983, and a moderate recession between July 1990 and March 1991); and a period of economic growth (late-1980s). States were differentially impacted by these events: bars indicate the yearly minimum and maximum state unemployment rates. Because the early 1980s recession lies in the middle of the quasi-experiment, my findings are potentially useful for current policy makers. Although the U.S. has undergone substantial economic and demographic changes in the last 30 years, the early 1980s recession is arguably the most informative economic event for anticipating the persistent impact of the 2007-09 recession. Both recessions were long contractions (16 and 18 months, the average recession between 1945 and 2000 lasted 11 months [NBER, 2011]) and generated high, sustained unemployment. There are differences between these two contractions. For example, the early 1980s recession was concentrated in the manufacturing sector while the 2007-09 recession was more broadly experienced.

The dependent variables in this study are three health outcomes.[4] The Short Form 12 physical score ("physical functioning") ranges from 0 to 100 and is calibrated such that 50 is the average score (Quality Metric, 2011). The score is calculated from 12 questions on physical functioning from the individual's perspective (see Appendix Table 1 for questions). The Center for Epidemiologic Studies Depression score ("depressive symptoms") measures depressive symptoms experienced in the past week (Radloff, 1977). Scores are based on 7 items and range from 0 to 24; higher scores indicate worse health (see Appendix Table 2 for questions). Weighted summary statistics are reported in Table 2. Sample means for physical functioning, mental functioning, and depressive symptoms are 53.1, 54.0, and 2.63. These statistics suggest that the sample is in good health, not surprising as respondents are approximately 40 years old at the time of the supplement.

[4] In unreported analyses I have analyzed self-reported health and chronic conditions. Results are robust and available upon request.

The key covariate is an indicator for leaving school with a state unemployment rate of 9% or higher ("bad economy"). I focus on the first period of school-leaving, this occurs only once for each respondent. I include both graduates and drop outs in the school-leaving definition. I first use responses to survey items asked between 1979 and 1998 on education history to identify the first time the respondent left school (i.e., exact month and year): respondents are allowed to return to school and remain in the sample.[5] Next, I use the geocodes to determine the state of school-leaving.[6] Respondents who left school between 1976 and 1978 are assigned the 1979 interview state. This imputation assumes that individuals do not move across state lines between school-leaving and 1979 and arguably does not introduce substantial measurement error: only 5.9% of school-leaving age men (13 to 28 years) report a between state move in the past year. The interview state is assigned to respondents who left school in 1979 and thereafter. The sample average school-leaving state unemployment rate is 7.48, and 19.7% of my sample left school in a bad economy.

Although no there is no single measure of economic activity, the unemployment rate provides a reasonable proxy. It is one of the variables used by the NBER Business Cycle Dating Committee (2010).[7] The unemployment rate is easily understood, as the rate increases fewer people are employed, and is commonly used to measure economic activity in empirical research (Beaudry & DiNardo, 1991; Ruhm, 2000; Kahn, 2010). Monthly state unemployment data are available from the BLS. The bad economy indicator parallels the current economic climate: the national unemployment rate was 8.5% in December 2011; thus findings are relevant for current school-leavers.

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[5] Non-enrolled respondents were asked "When were you last enrolled in regular school? What was the month and year?" I require that respondents remain out of school for at least two years. I locate the period of school-leaving using current enrollment items for respondents who do not provide school-leaving month and year (n=235). I define the period of school-leaving for these respondents as the first period they report enrollment in $t-1$, non-enrollment in t, and non-enrollment in $t+1$. I exclude respondents who report never being enrolled in school.

[6] In a robustness check I replace the state of residence with the college state for college attenders. Results are consistent.

[7] The NBER Business Cycle Dating Committee considers GDP, GDI, manufacturing and trade sales, industrial production, income, hours worked, and employment (NBER, 2010). Many of these measures are not available by state. Measuring school-leaving economic conditions with per capita income, male unemployment rate, employment growth rates, and employment-to-population rates produced consistent results. In a sensitivity check I replace the interview state with the college state, when different, for college attenders. Results are consistent.

The regression models include school-leaving state and year fixed effects; time since school-leaving; demographics (race/ethnicity, foreign birth, school-leaving age and education); age 14 characteristics (parental education; access to newspapers, magazines, or a library card; living with biological parents; number of siblings; rural residence; residence in the South); a proxy for health endowment (mother or father experiencing a major health problem by the Age 40 Health supplement); a proxy for baseline health (height in inches[8]); and a proxy for ability (age-standardized 1980 Armed Forces Qualification Test (AFQT) score[9]). I include indicators for missing covariates and assign missing observations the sample mean (continuous) or mode (binary).

4. Results

This study takes a standard health production function as a starting point (Rosenzweig & Schultz, 1983). Health is produced using market (e.g., medical care) and non-market (e.g., exercise) inputs. Consumers are endowed with a health stock and value health and other goods. They make consumption decisions to maximize utility given preferences, prices, the budget set, and the health production function. I choose covariates to proxy for these factors. Recently, economists have extended the Rosenzweig & Schultz (1983) framework by building in sensitive developmental periods: health shocks received during such periods persistently affect health (Heckman, 2007; Almond & Currie, 2011). These extensions capture the developmental importance of school-leaving age (Dahl, 2004). Features of these models provide my conceptual framework and guide my empirical analysis.

I take a reduced form approach rather than estimate a full structural model that specifies all causal pathways from leaving school in a bad economy to health at age 40. I exploit a quasi-experiment, macroeconomic fluctuations between 1976 and 1992 and variation across states, to

[8] I use height from the 1981 round, the first year height information is collected. If height is missing in 1981, I assign the 1982 value. Height in the NLSY79 is self-reported. I calculate predicted height based on race, ethnicity, and age following equations developed by Cawley & Burkhauser (2006). Results are robust if I use self-reported height.

[9] The AFQT is a multiple-choice test that measures arithmetic reasoning, mathematics knowledge, paragraph comprehension, and word knowledge used to determine eligibility for enlistment in the U.S. Armed Forces. 94% of the sample completed the AFQT in 1980. Missing AFQT scores were imputed using race/ethnicity, and birth year and month fixed effects. The AFQT is age-standardized as respondents completed the test at different ages (15 to 23). Age-standardized AFQT=(AFQT-[mean AFQT for age])/(AFQT SD for age). Results are unchanged if the raw score is used.

credibly identify net health effects. My primary objective is to estimate the total effect of leaving school in a bad economy on health, not the partial effect after conditioning on career outcomes, marital status, and other endogenous health determinants. In the core models, I control only for exogenous and predetermined variables. One interpretation of the parameter estimates is the health effect after men make endogenous decisions about employment, marriage, and other health determinants. In a later section I investigate potential mechanisms to shed light on how the net relationship may operate.

I estimate the following health production to model age 40 health as a function of leaving school in a bad economy:

$$H\_40_{is} = \alpha_0 + \alpha_1 U_{is} + X_{is}\alpha_2 + S_i\alpha_3 + D_i\alpha_4 + \varepsilon_{is} \qquad (1)$$

H_40_{is} is an age 40 health outcome for individual i in school-leaving state s. The key explanatory is U_{is}, an indicator for leaving school in a bad economy. I compare the age 40 health of men who left school in a bad economy with the age 40 health of men who did not. X_{is} is a vector of personal characteristics for individual i in school-leaving state s. S_i and D_i are school-leaving state and year fixed effects. ε_{is} is the error term. Inclusion of school-leaving state fixed effects implies that within school-leaving state variation in unemployment rates is used to identify health effects while school-leaving year fixed effects capture national trends in the macroeconomy. The key identifying assumption is presented in Equation (2):

$$Cov(U_{is},\varepsilon_{is}|X_{is},S_i,D_i)=0 \qquad (2)$$

In words, the bad economy indicator is uncorrelated with the error term after conditioning on personal characteristics and various fixed effects. Equations are estimated with least squares.[10] For interpretation I take log transformations of the functioning scales, parameter estimates have the interpretation of demi-elasticities. Results are robust if I use the raw scales. I use sample weights that account for survey design and attrition, and I cluster standard errors by the school-leaving state.

[10] Results are consistent, and more precisely estimated, if a count data model (e.g., Poisson, negative binomial) is used to estimate the depressive symptom equation.

Table 3A reports regression results. Leaving school in a bad economy is associated with 1.8% lower physical functioning, 1.2% lower mental functioning, and 0.333 more depressive symptoms at age 40. These parameter estimates imply 1.2% to 12.6% reductions in health and are similar in absolute value as having a mother with a high school diploma relative to a mother with less than high school. I report results from a short specification (covariates include school-leaving state and year fixed effects). Results generated in the short specification are nearly identical to the core results. This finding is consistent with the assumption that men who leave school in a bad economy are not systematically different from men who leave school in stronger economies.

Appendix Table 3 reports results for women. The parameter estimates suggest that women are largely unaffected by leaving school in a bad economy, at least as measured by the health outcomes I investigate. Leaving school in a bad economy is hypothesized to operate partially through career and marriage outcomes. Historically, women are less likely to participate in the labor market than men. Appendix Figure 1 plots labor force participation rates by sex between 1976 and 2010. In all years women have a lower probability of participating in the labor market than men: in 1976 48% of women participated in the labor market while 78% of men participated. Leaving school in a bad economy may not have a substantial effect on women's careers as women have less to lose than men. Economic theories of marriage predict that career outcomes are stronger marriage determinants for men than women (Becker, 1981). Labor market participation patterns and economic theory are consistent with studies that document no robust associations between economic conditions at school-leaving and employment or marriage among women (Kondo, 2008; Hershbien, 2010). I focus on men in the remainder of this study, although examining the relationship between leaving school in a bad economy and women's health is an interesting direction for future research.

In Table 3B I report results using indicators for school-leaving state unemployment rates of 5 to < 6%; 6 to < 7%; 7 to <8%; 8 to <9%; 9 to <10%; 10 to <11%; and 11% + with <5% as the omitted

category to motivate the bad economy indicator. Negative health effects generally do not emerge at lower levels of unemployment (less than 8%) but become evident at higher levels (8-9% +). Results are robust if the linear state unemployment rate is used, but effects are muted. Defining a bad economy as a school-leaving state unemployment rate of 10% or higher generally implies larger effects than those estimated in the core model. For parsimony, I report results using the 9% bad economy indicator.

Tables 4A-4D report health effects by race/ethnicity (non-white vs. white), family background (proxied by father's education: less than high school vs. high school or more), expected occupation (blue collar vs. white collar[11]), and skill at school-leaving (no college degree vs. college graduate). Labor studies document that career effects are largest among white and high skill workers. First, I stratify the sample by race/ethnicity. Interesting heterogeneity emerges. Non-white men who leave school in a bad economy may experience better physical functioning than non-white men who leave school in a stronger economy. However, they have lower mental functioning and more depressive symptoms by age 40. White men who leave school in a bad economy have worse health across all domains than white men who do not. These results imply that physical health effects are concentrated among white men while mental health effects are experienced by all men, but the effect may be largest among non-whites. Stratifying the sample by family background, occupation, or skill suggests that negative health effects are generally concentrated among men with more high skill fathers, men who expect a white collar job, and men with a college degree. My findings are broadly consistent with labor studies that identify the largest career effects among high skill men, although the mental health results by race/ethnicity are somewhat different (e.g., Oyer, 2006; Kahn, 2010).

The second objective of this study is to shed light on potential mechanisms for the net relationship between leaving school in a bad economy and health at age 40. The net relationship is hypothesized to operate, at least partially, through career outcomes, marriage, fertility, education, and

[11] In 1979 respondents were asked what they expected to be doing at age 35. One response was "working." Those who reported working were asked their expected occupation. I code managerial, professional, or technical sales as white collar.

unmet expectations. I investigate potential mechanisms in this section. Potential mechanisms (measured at the supplement) including labor supply (full time employment, weeks worked per year, hours worked per week), income (hourly wage, poverty), job attributes (white collar job, satisfaction, health insurance, visiting a doctor in the past year, shift work), job churning (number of jobs across the career, tenure), marital status (married, divorced, never married), fertility (any children), education obtained after school-leaving, and self-esteem are constructed.[12] Mechanisms are 1) regressed on the bad economy indicator in separate regressions and 2) are entered into the health production function as additional regressors. If these outcomes are mechanisms they should be predicted by the bad economy indicator and health effects should decline after their inclusion in the health production function.

Tables 5 and 6 report results from the first exercise. Men who leave school in a bad economy are less likely to work full time, work fewer hours per week, are more likely to live in poverty, are more likely to work an irregular shift, exhibit evidence of higher job churning (lower tenure at the current job, more jobs across the career), and are less likely to be married (this effect operates through foregone marriage). Such men may work fewer weeks per year, earn lower wages, be less likely to work in a white collar job, work in less satisfying jobs, have less access to employ-sponsored health insurance, use fewer medical services, be less likely to have children, be less likely to attain additional schooling, and have lower self-esteem; but these relationships are imprecisely estimated.

Results from the second exercise are reported in Table 7: mechanisms are entered into the core model as additional regressors. Parameter estimates generated in these models may not have a causal interpretation: the mechanisms are determined by the bad economy indicator ("bad controls"); inclusion of bad controls in a regression model can lead to biased estimates (Angrist & Pischke, 2009).

[12] Full time employment is defined as working 35+ hours per week. Annual weeks worked, weekly hours, and total number of jobs across the career relate to all jobs. Wage, occupation (professional, managerial, or technical sales), job satisfaction, health insurance, shift work, and tenure pertain to the primary job. The CPI is used to convert hourly wages into 2008 dollars. Wages less (more) than $1 ($1000) are excluded. Additional schooling is the difference between years of school-leaving at the supplement and school-leaving. Self-esteem is measured using the Rosenberg (1965) scale. The scale is based on 10 items and higher scores indicate higher levels of self-esteem (see Appendix Table 4 for the list of items).

These mechanisms explain some, but not all, of the association between leaving school in a bad economy and health at age 40: estimates decline by 44% to 67%. These findings suggest that the net relationship operates at least partially through career, marriage, fertility, education, and self-esteem.

5. Robustness checks

This section reports results from a series of robustness checks that test how well the core findings hold up to various econometric specifications. An obvious concern is that the time or location of school-leaving is endongeous to the contemporaneous unemployment rate. School-leavers may engage in endogenous timing (enrolling in additional schooling, dropping out, forced out for financial reasons) or migration (moving to a stronger labor market). The intuition for the sign of the potential bias is as follows. School-leavers who avoid bad economies have characteristics (ability, financial resources, forethought) that permit avoidance behavior. These characteristics are arguably positively correlated with age 40 health. The rich background information contained in the NLSY79 allows me to control, at least partially, for these characteristics. To the extent that characteristics remain unobservable, failure to account for them is expected to bias least squares estimates away from zero.[13] Classical measurement error in the school-leaving variables, a familiar feature of survey data, will attenuate least squares estimates towards zero. It is not clear *a priori* which effect will dominate.

Table 8 reports a basic test for endogenous timing and migration. The sample is split between men who left school in a bad economy and men who did not. If school-leavers are avoiding bad economies, differences in observable characteristics should exist between men who leave school in a bad economy and men who do not. However, these groups of men are broadly similar in terms of their observable characteristics and there are few statistically significant differences. Differences may be an artifact of the early 1980s recession: this recession was concentrated in northern states with relatively

[13] Assume the true model takes the following form: $H\_40_{is}=\alpha_0 + \alpha_1 U_{is} + \alpha_2 C_{is}$; $\alpha_1<0$; $\alpha_2>0$. C_{is} is scalar that captures characteristics that allow avoidance behavior and are positively associated with age 40 health. The estimated model can be written as $H\_40_{is}=\beta_0 + \beta_1 U_{is}$; $\beta_1<0$. The association between omitted and included regressor takes the form $C_{is}=\gamma_0 + \gamma_1 U_{is}$; $\gamma_1<0$. The omitted variable formula implies $\beta_1 = \alpha_1 + \gamma_1 * \alpha_2$; $\gamma_1 * \alpha_2 <0$: least squares estimates are biased away from zero.

high prevalence of whites and relatively low prevalence of Hispanics (e.g., Michigan). Appendix A reports an exploratory analysis into endogenous timing and migration using proxies for these behaviors contained in the NLSY79. The results suggest that endogenous behavior is not driving the findings.

I use two-stage least squares to address remaining endogeneity concerns and measurement error in the school-leaving variables.[14] Two variables are used to instrument for leaving school in a bad economy: 1) on-time state unemployment rates and 2) respondent-expected state unemployment rates. I create on-time state unemployment rates using birth date, state of residence at age 14, and education at school-leaving.[15] Respondents are assigned the state unemployment rate they would face if they left school on time. For example, I assign a college graduate the June (modal school-leaving month in my sample) unemployment rate in the year he turned 22 (modal school-leaving age for college graduates in my sample) in the state of residence at age 14. State of residence at age 14 is used as it is arguably exogenous to the school-leaver while the school-leaving state is suspect. I make similar assignments for all educational levels. I construct respondent-expected[16] state unemployment rates using birth date, reported educational expectations in 1979, and state of residence at age 14. In 1979 respondents were asked "What level of education do you expect to attain?" The respondent-expected state unemployment rate is the unemployment rate the respondent would have faced had he left school at his expected time. For example, I assign a respondent who reported that he expected to complete high school the June unemployment rate in the year he turns 18 in state of residence at age 14. I make similar assignments for all levels of expected education. The compliers are men who form an educational plan and do not deviate in response to contemporaneous macroeconomic fluctuations. The time since school-leaving is also potentially endogenous. I instrument time since school-leaving with

[14] Results are consistent if a two-step residual inclusion (2RSI) estimator is employed. Terza et al (2008) argue that the 2SRI estimator is more appropriate if the potentially endogenous variable is binary as in my model. Angrist (2001) contends that two stage least squares can generate consistent estimates of causal effects in the presence of a binary endogenous variable.
[15] I use 1965 compulsory schooling laws to calculate school start dates (see Appendix Table 1 in Cascio & Lewis, 2006).
[16] I would like to thank David Card for suggesting this instrumental variable.

the on-time and respondent-expected time since school-leaving variables.[17] The school-leaving state and year fixed effects are replaced with age 14 state fixed effects and on-time and respondent-expected year fixed effects. Standard errors are clustered by the age 14 state of residence.

The key identifying assumption in this model is, after conditioning on personal characteristics and various fixed effects, the IVs are correctly excludable from the health production function. The IVs must predict the endogenous regressor to consistently estimate a local average treatment effect for the compliers. Table 9 presents results from first-stage regressions: in separate equations I regress the bad economy indicator on the IV and covariates using a linear probability model. The IVs are strong, with *F*-statistics well above 10 (Stock et al, 2002): 99.83 and 82.23. A 1 percentage point increase in the on-time and respondent-expected state unemployment rate is associated with a 10.5 and 8.4 percentage point increase in the probability of leaving school in a bad economy. By construction there is less variation in the instrumented probability of leaving school in a bad economy than in the bad economy indicator: on-time and respondent-expected school-leaving occurs in June, while monthly variation is used to construct the bad economy indicator. Thus, the IV parameters may be less precisely estimated than the core model parameters.[18]

The IV results are consistent with the core results (Table 10A). IV estimates imply that leaving school in a bad economy leads to 3.3% lower physical functioning and 0.429 more depressive symptoms. Surprisingly, leaving school in a bad economy leads to a 0.5% increase in mental functioning; although the wide confidence interval contains zero and cannot rule out a negative effect consistent with the core results. Results are robust if I estimate just-identified models. Table 10B reports results from an intent-to-treat model. Parameter estimates represent an averaged effect between compliers who are fully affected by leaving school in a bad economy and non-compliers who are

[17] I define the on-time since school-leaving as the supplement year minus the on-time school-leaving year; I define respondent-expected time since school-leaving analogously.
[18] Instrumental variable estimators typically use less variation than used by the least squares estimator to estimate effects. The former set of estimators relies on variation in the potentially endogenous regressor induced by the instrumental variable. Alternatively, the least squares estimator uses all variation in the potentially endogenous variable.

unaffected. Results are consistent with the core models: by age 40 men who left school in a bad economy have worse physical functioning, mental functioning, and depressive symptomatology.

Next, I use a family fixed effect estimator to assess persistent health effects of leaving school in a bad economy. This estimator controls for all family-invariant characteristics that are correlated with leaving school in a bad economy and age 40 health; thus the family fixed estimator may better control for individual heterogeneity than the core model. Variation is generated by siblings who face different economic conditions at school-leaving: I compare the age 40 health of siblings who left school in a bad economy with the age 40 health of siblings who did not. The sibling sample includes 1,137 male, biological siblings from 526 families with 2 to 5 male children identified in the 1979 roster. Results (Table 11) are consistent with the core findings. I present results generated in the sibling sample with and without the family fixed effect, results are broadly consistent across the specifications although estimated effects are larger after including the family fixed effect. In the preferred specifications that include a family fixed effect, men who leave school in a bad economy have 4.1% lower physical functioning, 6.8% lower mental functioning, and 0.942 more depressive symptoms than siblings who leave school in a stronger economy. These results are consistent with the core findings.

Table 12 reports results from models that use the school-leaving region unemployment rate to define a bad economy at school-leaving. These models permit endogenous migration within the region. School-leaving region fixed effects replace state fixed effects and robust standard errors are reported; covariates are unchanged. Results are broadly consistent with the core results: men who leave school in a bad economy have 1.0% lower physical functioning, 0.6% lower mental functioning, and 0.215 more depressive symptoms at age 40 than men who left school in a stronger economy. The estimates are imprecise, not surprising as I rely on within region variation to identify health effects.

An important source of bias is between school-leaving state differences in difficult to observe characteristics that are correlated with leaving school in a bad economy and age 40 health. The core

model includes school-leaving state fixed effects and controls for time invariant differences. My sample left school between 1976 and 1992, and state characteristics may have changed over this period. In this section I first estimate the core model without school-leaving state fixed effects and second augment the core model with school-leaving state-specific linear time trends. The former specification uses variation between school-leaving states and variation within school-leaving state over time to identify health effects. The latter specification uses variation off a school-leaving state linear time trend and controls for time-varying between school-leaving state differences; this specification is more demanding on the data than the core model. Results, reported in Table 13, are consistent with the core results regardless of how I model between state differences.[19] One interpretation of these results is that the core findings are not driven by difficult-to-observe between state differences.

I next perform a series of falsification tests. I select two outcomes that should not be predicted by leaving school in a bad economy: natural blond hair and blue eyes (coded one for blond hair or blue eyes; zero otherwise). 13% of the sample has blond hair and 29% have blue eyes. Results (Table 14) suggest no relationship between leaving school in a bad economy and these outcomes: parameter estimates are small and indistinguishable from zero.

This section tests whether bias from non-random attrition is driving the findings. The NLSY79 has remarkably high retention rates (77% in 2006, the last year the supplement was fielded) and 85% of eligible respondents completed the supplement. I use sample weights, which correct for attrition, in all analyses. To test whether attrition remains a concern, I compare demographics of completers and attritors; regress the probability of attriting on the bad economy indicator; and re-estimate the core model assigning attritors 1) a healthy outcome and 2) an unhealthy outcome (bounding exercise). Healthy outcomes are physical and mental functioning scores at the 90th percentile, and depressive symptoms set to zero. I define unhealthy outcomes symmetrically: physical and mental functioning

[19] School-leaving state-specific time trends soak up much of the variation in school-leaving economic conditions. Variance inflation factors, a common metric for testing collinearity, are often above 10. This is a sign of problematic collinearity and ill-conditioning (Anderson & Wells, 2007). These data limitations can lead to inflated standard errors.

(depressive symptoms) at the 10^{th} (90^{th}) percentile. Table 15 reports the comparison of observable characteristics by attrition status. I do not include respondents dropped by the NLSY79 for financial reasons or respondents I exclude from the sample due to missing variables, time since school-leaving, or school-leaving year. These groups are broadly similar in terms of observable characteristics. Results reported in Tables 16 and 17 imply that leaving school in a bad economy does not strongly predict attrition and results are robust to the bounding exercise. One reason for a non-interview is mortality. Interestingly, men who leave school in a bad economy may be a higher risk of all-cause mortality than men who leave school in a stronger economy. The parameter estimate is imprecise, but I can rule out a zero effect. This relationship may explain the modest association between leaving school in a bad economy and the probability of attrition.

In this section I report results from a factor analysis. Variation in my three selected health outcomes may be driven by a smaller set of latent variables. Factor analysis models these latent variables as a linear combination of my three observed health outcomes. I use the principal components method to analyze the correlation matrix between my three health outcomes. I retain two factors. Factor loadings, which report correlations between the factors and health outcomes, are reported in Table 18A. Factor 1 loads most heavily on mental functioning and depressive symptoms. Factor 2 loads most heavily on physical functioning. Results (Table 18B) indicate that men who leave school in a bad economy have lower measures of latent health, particularly as measured by Factor 1 which captures dimensions of mental health, by age 40 than men who do not.

6. Discussion

This study provides the first published evidence on the persistent health effects of leaving school in a bad economy. Findings contribute to the labor literature examining career effects of leaving school in a bad economy; literatures on the health effects of employment and the macroeconomy; and the growing health literature that investigates important development periods. My results suggest that

by age 40 men who left school in a bad economy have worse health, particularly mental health, than men who did not. The effect sizes are similar in absolute value as having a mother with a high school diploma relative to a mother who dropped out of high school. Health effects vary by race/ethnicity, family background, occupation, and skill. Supplementary analyses suggest career, marriage, fertility, education, and self-esteem outcomes as mechanisms. Results are robust to various econometric specifications, including the use of instrumental variables to correct for the potential endogeneity of the school-leaving variables. Factor analysis suggests that effects may be concentrated among mental health domains. The current findings imply that labor studies underestimate the full cost of leaving school in a bad economy: consequences extend beyond the career and into the health domain.

Recent work on avoidance behavior suggests that individuals respond to health shocks in ways that minimize health damage (Niedell, 2009; Moretti & Niedell, 2011). Failure to account for such avoidance behavior can lead to underestimates of the true effect of a health shock. For example, men who are initially placed in an unhealthy job because they left school in a bad economy may undertake actions (diet, exercise, stress management) to offset health effects. The avoidance literature implies that the parameter estimates have the interpretation of lower bounds and the true health effects of leaving school in a bad economy are larger than those estimated in this study.[20]

Policy makers may find my results useful. There is general concern for the economic well-being of the current cohort of school-leavers (e.g., von Wachter, 2010). My findings suggest that the full effects of leaving school extend beyond career outcomes. Government policies should take into account the magnitude and persistence of health effects associated with leaving school in a bad economy: effects potentially represent substantial health losses (the core estimates imply a 1.2% to

[20] Following Moretti and Niedell (2011) a standard health production function can be augmented to allow avoidance behavior: $H=H(S*A,X)$ where H is health, S is a health shock, A is avoidance behavior, and X is all other health determinants. To observe the impact of avoidance behavior, one can take the derivative with respect to the shock: $\partial H/\partial S = \partial H/\partial S + \partial H/\partial A * \partial A/\partial S$. The first term is the biological effect and the second term is the avoidance term. If $\partial H/\partial S>0$, then $\partial H/\partial A * \partial A/\partial S$ is likely > 0 (individuals undertake action to minimize damage imposed by a health shock). Failing to account for the second term will lead to an underestimate of the health effect.

12.6% reduction in health outcomes relative to sample means, and the avoidance literature suggests that these underestimate the true health effects) that are evident more than 20 years after school-leaving. Health policy can be packaged with career re-orientation policies (von Wachter, 2010). For example, general information on how long a recovery period may last, health effects of a low-quality job, steps individuals can take to offset negative effects, and access to health programs (e.g. stress management) can be provided to labor market entrants. Locating health information at unemployment centers my increase awareness.

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Table 1. NLSY79 analysis sample

Sample	Observations
Original NLSY79 sample	12686
Original sample remaining after NLSY dropped samples [1]	9964
Completed Age 40 Health supplement	8465
Men who completed Age 40 Health supplement	4169
Men with valid school-leaving information	4161
Men with valid instrumental variable information	4147
Men out of school 15+ years at supplement	4047
Men who left school 1976 and onwards	3774

[1]1079 members of the military (*n*=1208) and white low income (*n*=1643) subsamples were not followed after 1984 and 1991 respectively.

Table 2. Weighted health outcomes, full sample

	N	Mean	SD	Min	Max
Physical functioning	3742	53.1	6.78	11.6	68.4
Mental functioning	3742	54.0	7.34	10.1	72.0
Depressive symptoms	3717	2.63	3.61	0	21

Table 3A. Effect of leaving school in a bad economy on health at age 40: core regression results

	Log(physical functioning)	Log(mental functioning)	Depressive symptoms
Mean	53.1	54.0	2.63
Full specification	-0.018*	-0.012*	0.333*
	(0.010)	(0.007)	(0.186)
Short specification	-0.018*	-0.016**	0.333*
	(0.010)	(0.007)	(0.175)
N	3742	3742	3717

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 3B. Effect of leaving school in a bad economy on health at age 40: various measures of a bad economy

	Log(physical functioning)	Log(mental functioning)	Depressive symptoms
Mean	53.1	54.0	2.63
Indicators			
5 - <6%	-0.007	-0.013	0.094
	(0.011)	(0.018)	(0.347)
6 - <7%	-0.006	-0.009	0.171
	(0.012)	(0.015)	(0.305)
7 - <8%	-0.012	-0.001	-0.289
	(0.014)	(0.015)	(0.305)
8 - <9%	-0.003	-0.025	0.050
	(0.016)	(0.017)	(0.316)
9 - <10%	-0.022	-0.016	-0.099
	(0.017)	(0.016)	(0.356)
10 - <11%	-0.017	-0.029	0.320
	(0.021)	(0.024)	(0.502)
11% +	-0.028	-0.031	0.389
	(0.021)	(0.018)	(0.368)
Unemployment rate	-0.004**	-0.003*	0.019
	(0.002)	(0.002)	(0.043)
Unemployment rate >10%	-0.013	-0.020	0.544***
	(0.011)	(0.011)	(0.192)
N	3742	3742	3717

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. Omitted category in indicator school-leaving unemployment rate regression is a school-leaving state unemployment rate less than 5%. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 4A. Effect of leaving school on health at age 40, by race/ethnicity

	Non-white			*White*		
	N	Mean	Estimate	N	Mean	Estimate
Log(physical functioning)	1859	52.21	0.022	1883	53.32	-0.026**
			(0.017)			(0.012)
Log(mental functioning)	1859	54.22	-0.023	1883	53.96	-0.009
			(0.015)			(0.010)
Depressive symptoms	1842	3.10	0.806*	1875	2.51	0.213
			(0.413)			(0.187)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 4B. Effect of leaving school on health at age 40 by family background

	Father less than high school			*Father high school or higher*		
	N	Mean	Estimate	N	Mean	Estimate
Log(physical functioning)	2932	52.69	-0.014	810	54.03	-0.025
			(0.016)			(0.019)
Log(mental functioning)	2932	54.00	-0.010	810	54.05	-0.024
			(0.009)			(0.015)
Depressive symptoms	2910	2.83	0.224	807	2.16	0.775**
			(0.265)			(0.333)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 4C. Effect of leaving school on health at age 40 by expected occupation

	Do not expect white collar			*Expect white collar*		
	N	Mean	Estimate	N	Mean	Estimate
Log(physical functioning)	1406	52.36	0.008	1802	53.68	-0.021
			(0.013)			(0.014)
Log(mental functioning)	1406	53.74	0.027**	1802	54.11	-0.026*
			(0.013)			(0.015)
Depressive symptoms	1393	3.05	0.091	1789	2.35	0.518*
			(0.430)			(0.298)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 4D. Effect of leaving school on health at age 40 by skill level at school-leaving

	Less than college			*College graduate*		
	N	Mean	Estimate	N	Mean	Estimate
Log(physical functioning)	3187	52.63	-0.018	555	54.97	-0.009
			(0.012)			(0.015)
Log(mental functioning)	3187	53.92	-0.008	555	54.37	-0.025
			(0.007)			(0.017)
Depressive symptoms	3164	2.86	0.281	553	1.70	0.530
			(0.211)			(0.469)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 5. Effect of leaving school on labor market outcomes at age 40

	N	Mean/proportion	Estimate
Full time employment	3768	0.80	-0.042**
			(0.017)
Annual weeks worked	3433	49.31	-0.119
			(0.296)
Weekly hours	3768	41.28	-2.144*
			(1.129)
Log(hourly wage)	3467	22.77	-0.015
			(0.041)
Poverty	3475	0.09	0.044***
			(0.014)
White collar job	3370	0.50	-0.008
			(0.026)
Satisfied with job	3534	0.49	-0.003
			(0.034)
Health insurance	3165	0.84	-0.015
			(0.023)
Visit doctor in the past year	3475	0.58	-0.020
			(0.039)
Irregular shift	3354	0.21	0.042**
			(0.020)
Number of jobs	3774	11.33	1.078**
			(0.423)
Tenure (weeks)	3500.	383.16	-39.730*
			(20.315)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 6. Effect of leaving school on marriage, fertility, education, and self-esteem outcomes at age 40

	N	Mean/proportion	Estimate
Married	3774	0.64	-0.062**
			(0.029)
Never married	3774	0.17	0.043*
			(0.022)
Divorced	3774	0.19	0.020
			(0.023)
Children	3774	0.75	-0.029
			(0.023)
Additional education	3774	0.34	-0.015
			(0.026)
Self-esteem scale	3280	23.84	-0.505
			(0.311)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 7. Effect of leaving school on health at age 40, augmented health production function

	N	Mean	Core	+Mechanisms	$\%\Delta\beta$
Log(physical functioning)	3742	53.0	-0.018*	-0.010	-44.44
			(0.010)	(0.011)	
Log(mental functioning)	3742	54.0	-0.012*	-0.004	-66.67
			(0.007)	(0.009)	
Depressive symptoms	3717	2.65	0.333*	0.114	-65.77
			(0.186)	(0.197)	

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. $\%\Delta\beta = (\beta_M - \beta_C)/(\beta_C) * 100$. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 8. Test of covariate balance

	School-leaving UE<9%	School-leaving UE>=9%	Difference
Unemployment rate at school-leaving	6.56	11.2	-4.64*
Time since school-leaving	22.4	22.1	0.3
School-leaving year	1980.2	1981.4	-1.2
Age at school-leaving	19.0	19.2	-0.2
White	0.78	0.83	-0.05*
Black	0.14	0.13	0.01
Hispanic	0.070	0.041	0.029*
Foreign born	0.042	0.037	0.005
Less than high school at school-leaving	0.19	0.13	0.06*
High school at school-leaving	0.47	0.47	0
Some college at school-leaving	0.15	0.17	-0.02
College graduate at school-leaving	0.19	0.22	-0.03
Father's years of schooling	12.0	11.9	0.1
Father's years of schooling missing	0.100	0.085	0.015
Mother's years of schooling	11.7	11.8	-0.1
Mother's years of schooling missing	0.048	0.060	-0.012
Magazines age 14	0.67	0.71	-0.04
Magazines age 14 missing	0.0079	0.0045	0.0034
Newspaper age 14	0.84	0.87	-0.03
Newspaper age 14 missing	0.0012	0.0045	-0.0033
Library card age 14	0.75	0.71	0.04
Library card age 14 missing	0.0021	0.0051	-0.003
Live with biological parents age 14	0.76	0.76	0
Live with biological parents age 14 missing	0.0026	0.00040	0.0022
Number of siblings	3.28	3.18	0.1
Number of siblings missing	0.00038	0	0.00038
Rural residence at age 14	0.22	0.24	-0.02
Rural residence at age 14 missing	0.0026	0.0029	-0.0003
Reside in South at age 14	0.31	0.25	0.06*
Reside in South at age 14 missing	0.028	0.018	0.01
Father major health problem	0.39	0.36	0.03
Father major health problem missing	0.028	0.034	-0.006
Mother major health problem	0.41	0.40	0.01
Mother major health problem missing	0.071	0.071	0
Height in 1981	69.8	69.6	0.2
Height in 1981 missing	0.0090	0.0081	0.0009
AFQT score standardized	0.28	0.36	-0.08
Observations	3083	691	

Notes: *Statistically different from zero at 1% confidence interval.

Table 9. First stage regression results

	On-time	Respondent-expected
Proportion	0.197	0.197
IV	0.105***	0.084***
	(0.011)	(0.009)
F-statistic	99.83	82.23
Observations	3774	3774

Notes: Standard errors are clustered by age 14 state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 10A. Effect of leaving school on health at age 40: IV model

	N	Mean	Core model	IV model
Log(physical functioning)	3742	53.0	-0.018*	-0.033
			(0.010)	(0.024)
Log(mental functioning)	3742	54.0	-0.012*	0.005
			(0.007)	(0.015)
Depressive symptoms	3717	2.65	0.333*	0.429
			(0.186)	(0.428)

Notes: Standard errors are clustered by age 14 state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 10B. Effect of leaving school on health at age 40: Intent-to-treat model

	N	Mean	Core model	On time	Respondent expected
Log(physical functioning)	3742	53.0	-0.018*	-0.013	-0.008
			(0.010)	(0.010)	(0.008)
Log(mental functioning)	3742	54.0	-0.012*	-0.0003	-0.002
			(0.007)	(0.010)	(0.009)
Depressive symptoms	3717	2.65	0.333*	0.051	0.099
			(0.186)	(0.210)	(0.246)

Notes: Standard errors are clustered by age 14 state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 11. Effect of leaving school on health at age 40: Family fixed effect model

	Core model			*Family fixed effect model*			
	N	Mean	Estimate	N	Mean	No FE	FE
Log(physical functioning)	3742	53.0	-0.018*	1128	53.35	-0.012	-0.041
			(0.010)			(0.022)	(0.042)
Log(mental functioning)	3742	54.0	-0.012*	1128	54.19	-0.051***	-0.068*
			(0.007)			(0.019)	(0.034)
Depressive symptoms	3717	2.65	0.333*	1124	2.60	0.609	0.942
			(0.186)			(0.374)	(0.812)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 12. Effect of leaving school on health at age 40: Regional unemployment rates

	N	Mean	Core model	Region UE rate
Log(physical functioning)	3742	53.0	-0.018*	-0.010
			(0.010)	(0.011)
Log(mental functioning)	3742	54.0	-0.012*	-0.006
			(0.007)	(0.012)
Depressive symptoms	3717	2.65	0.333*	0.215
			(0.186)	(0.270)

Notes: Robust standard errors reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 13. Effect of leaving school on health at age 40: School-leaving state unobservable characteristics

	N	Mean	Core model	No state fixed effect	State-specific time trend
Log(physical functioning)	3742	53.0	-0.018*	-0.014*	-0.011
			(0.010)	(0.007)	(0.011)
Log(mental functioning)	3742	54.0	-0.012*	-0.006	-0.009
			(0.007)	(0.007)	(0.008)
Depressive symptoms	3717	2.65	0.333*	0.177	0.306
			(0.186)	(0.159)	(0.195)

Notes: Estimate is parameter estimate on bad economy indicator. Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 14. Falsification test: Effect of leaving school in a bad economy on hair and eye color

	Blond hair	Blue eyes
Proportion	0.13	0.28
Bad economy	-0.019	0.006
	(0.020)	(0.024)
Observations	3643	3645

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 15. Observable characteristics by attrition status

	Complete (n=3774)	Attrite (n=761)	Difference
White	0.79	0.81	-0.02
Black	0.15	0.13	0.02
Hispanic	0.064	0.060	0.004
Foreign born	0.041	0.054	-0.013
Father's education	12.1	12.1	0
Father's education missing	0.094	0.11	-0.016
Mother's education	11.8	11.8	0
Mother's education missing	0.050	0.053	-0.003
Magazines age 14	0.68	0.67	0.01
Magazines age 14 missing	0.0070	0.0061	0.0009
Newspaper age 14	0.85	0.86	-0.01
Newspaper age 14 missing	0.0020	0.0034	-0.0014
Library card age 14	0.74	0.77	-0.03
Library card age 14 missing	0.0029	0.0028	0.0001
Live with biological parents age 14	0.76	0.76	0
Live with biological parents age 14 missing	0.0023	0.0030	-0.0007
Siblings age 14	3.22	3.15	0.07
Siblings age 14 missing	0.00033	0.00056	-0.00023
Rural residence at age 14	0.22	0.20	0.02
Rural residence at age 14 missing	0.0028	0.0020	0.0008
Reside in South at age 14	0.30	0.25	0.05*
Reside in South at age 14 missing	0.024	0.026	-0.002
Height in 1981	69.8	69.5	0.3
Height in 1981 missing	0.0084	0.060	-0.0516*
Age-standardized AFQT score	0.31	0.31	0

Notes:*=statistically different from zero at the 1% level.

Table 16. Effect of leaving school in a bad economy on attrition and all-cause mortality

	Attrite	Mortality
Proportion	0.18	0.04
Bad economy	0.023	0.019
	(0.019)	(0.013)
Observations	4535	4535

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 17. Effect of leaving school on health at age 40: Bounding exercise

	N	Mean	Core	N	Healthy outcome	Unhealthy outcome
Log(physical functioning)	3742	53.0	-0.018*	4535	-0.010	-0.023**
			(0.010)		(0.011)	(0.010)
Log(mental functioning)	3742	54.0	-0.012*	4535	-0.006	-0.017*
			(0.007)		(0.012)	(0.009)
Depressive symptoms	3717	2.65	0.333*	4535	0.215	0.450**
			(0.186)		(0.270)	(0.217)

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 18A. Factor loadings

Health outcome	Factor 1	Factor 2
Physical functioning	0.079	0.219
Mental functioning	0.388	-0.105
Depressive symptoms	-0.473	-0.154

Table 18B. Effect of leaving school on health at age 40: Factor analysis

	Factor 1	Factor 2
Mean	0.026	0.023
Estimate	-0.077**	-0.023
	(0.034)	(0.015)
Observations	3696	3696

Notes: Estimate is parameter estimate on bad economy indicator. Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table 1. SF12 survey questions

Number	Question wording
1	In general, would you say your health is ....
	The following items are activities you might do during a typical day. Does your health limit you in these activities?
2	.....Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf?
3	.....Climbing several flights of stairs?
	During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?
4	..... Accomplished less than you would like?
5	.... Were limited in the kind of work or other activities?
	During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? (Please answer YES or NO for each question.)
6	.... Accomplished less than you would like?
7	.... Didn't do work or other activities as carefully as usual?
8	During the past 4 weeks, how much did pain interfere with your normal work (including both work outside of the home and housework)?
	The next questions are about how you feel and how things have been with you during the past 4 weeks. for each question, please give the one answer that comes closest to the way you have been feeling. How often during the past 4 weeks....
9	.... Have you felt calm and peaceful?
10	.... Did you have a lot of energy?
11	.... Have you felt down-hearted and blue?
12	During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

Appendix Table 2. Center for Epidemiologic Depression Studies questions

Number	Wording
	Now I am going to read a list of the ways that you might have felt or behaved recently. After each statement, please tell me how often you felt this way during the past week.
1	I did not feel like eating; my appetite was poor.
1A	I felt that I could not shake off the blues, even with help from my family or friends.
2	I had trouble keeping my mind on what I was doing.
3	I felt depressed.
4	I felt that everything I did was an effort.
5	My sleep was restless.
5A	I felt lonely.
6	I felt sad.
7	I could not get "going".

Appendix Table 3. Effect of leaving school on health at age 40: Women

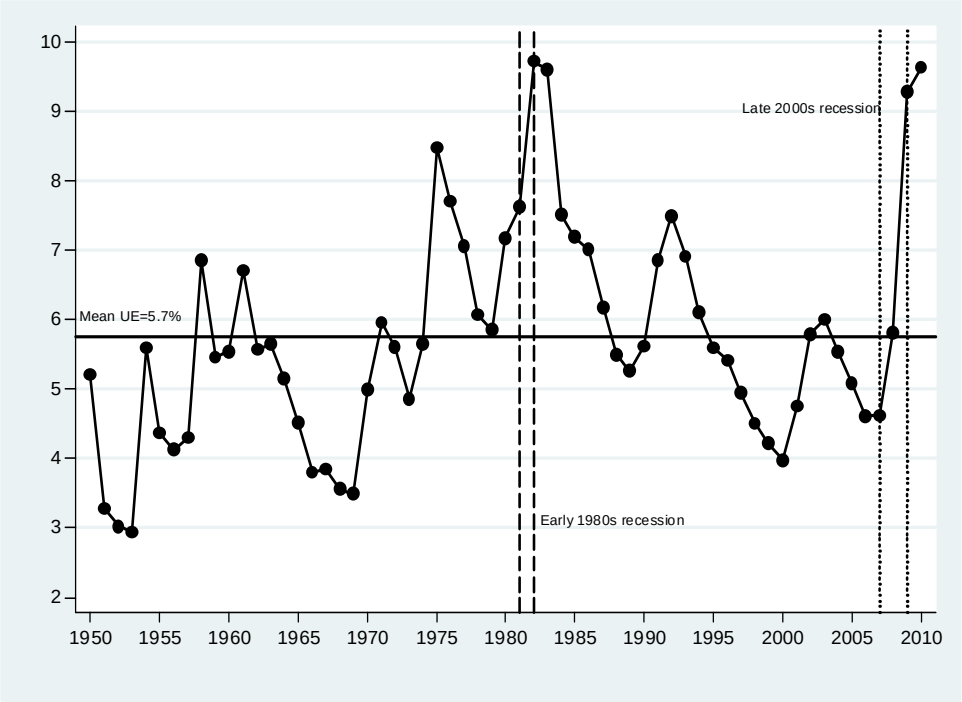
	Log(physical functioning)	Log(mental functioning)	Depressive symptoms
Mean/proportion	53.1	54.0	2.63
Estimate	-0.007	-0.013	-0.094
	(0.015)	(0.018)	(0.349)
N	3844	3844	3827

Notes: Estimate is parameter estimate on bad economy indicator. Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table 4. Rosenberg self-esteem scale questions

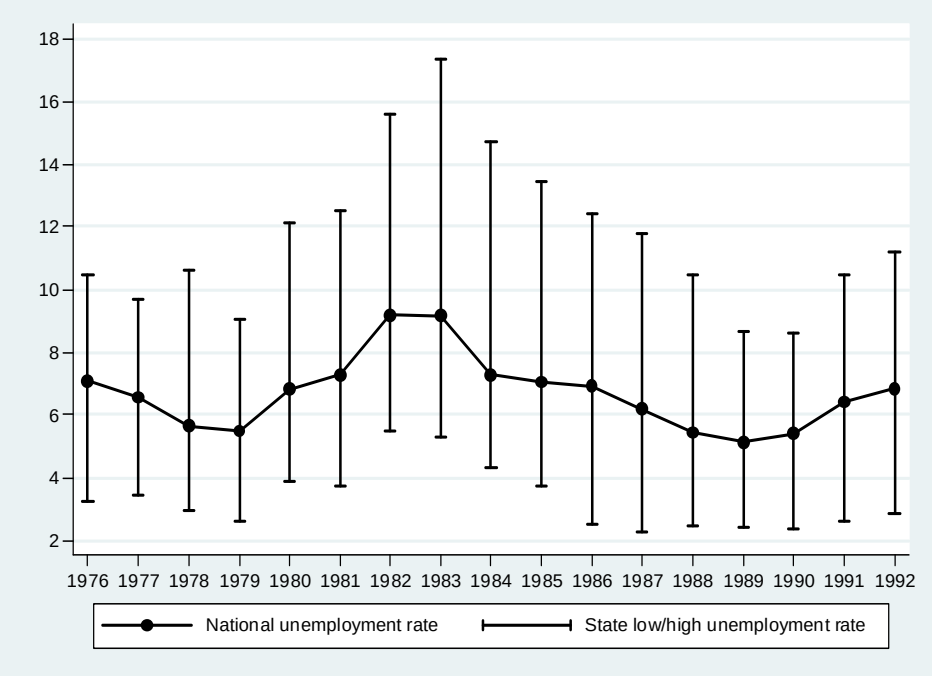
Number	Wording
	Now I'm going to read a list of opinions people have about themselves. After I read each statement, please tell me how much you strongly agree, agree, disagree or strongly disagree with these opinions.
1	I feel that I'm a person of worth, at least on equal basis with others.
2	I feel that I have a number of good qualities.
3	All in all, I am inclined to feel that I am a failure.
4	I am able to do things as well as most other people.
5	I feel I do not have much to be proud of.
6	I take a positive attitude toward myself.
7	On the whole, I am satisfied with myself.
8	I wish I could have more respect for myself.
9	I certainly feel useless at times
10	At times I think I am no good at all

Figure 1. National unemployment rate, 1950-2010



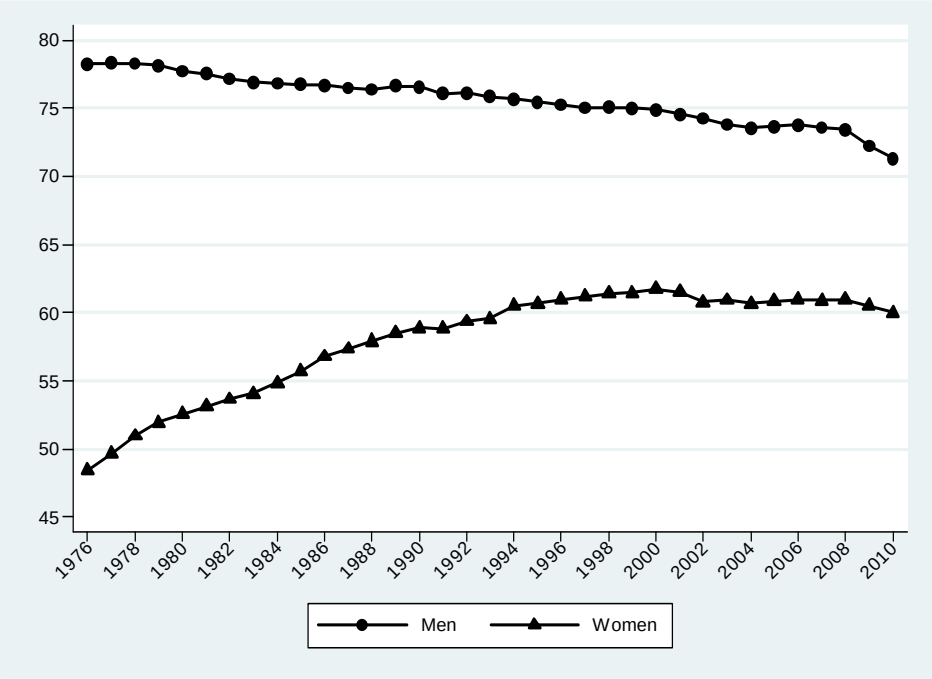
Notes: Data are drawn from the Bureau of Labor Statistics Historical Unemployment Rate data series (series number LNS14000000). The early 1980s recession (July 1981-November 1982) is indicated with dashed lines and the late 2000s recession (December 2007- June 2009) is indicated with dotted lines.

Figure 2. Nation and high/low state unemployment rates, 1976-1990



Notes: Data are drawn from the Bureau of Labor Statistics Historical Unemployment Rate data series (series number LNS14000000).

Appendix Figure 1. Labor force participation by sex, 1976-2010



Notes: Data are drawn from a special request by the author from the Bureau of Labor Statistics (Data on Employment Status by State and Demographic Group).

Appendix A. Exploratory analysis of school-leaving time and location

School-leavers may avoid leaving school in a bad economy through endogenous timing (enrollment, dropping out of school to take a job, leaving school for financial reasons) and migration (moving across state lines). In this section I first review the published U.S. literature on endogenous behavior. Second, I report an analysis of these behaviors using proxies contained in the NLSY79.

The empirical evidence in the U.S. suggests that delaying school-leaving through enrollment is not common. Corman (1983) shows that the state unemployment rate is not a strong correlate of college or vocational school attendance among men. Betts and McFarland (1995) find that a 1% increase in the state unemployment rate is associated with a 0.5% increase in full-time attendance at community colleges among recent high school graduates. Genda et al (2010) identify little correlation between the state unemployment rate and enrollment among men in the Current Population Survey. Card and Lemieux (2000) show that the state unemployment rate at age 18 is a modest predictor of high school completion, but not college outcomes, among young men. Kahn (2010) finds that the state unemployment rate at age 18 is a weak predictor of college completion in the NLSY79. Students may decide to drop out of school to take advantage of a strong economy or may be forced out of school during a bad economy if they cannot afford education costs. Published evidence suggests the former dominates: the probability of dropping out increases modestly as the unemployment rate declines (Rumberger, 1983; Rees & Mocan, 1997). School-leavers may move from a weak to a strong labor market at school-leaving. In 2000 42 million Americans moved. 11% reported moving because of a new job or to look for work, while 51.6% moved for housing-related reasons (U.S. Census, 2001). These statistics suggest that a minority of movers move for work-related reasons.

The NLSY79 contains proxies for endogenous timing and migration. Appendix Table A reports results from regressing an indicator for each behavior (enrollment, leaving school to take a job, leaving school for financial reasons, and moving across state lines) on an indicator for a current state unemployment rate of 9% or higher among school-leaving age men (13 to 28 years). Results are consistent if a lagged indicator for a bad economy is used. No statistically significant relationships emerge. An exception is moving: men are *less* likely to move across state lines when the unemployment rate is high (17% less likely relative to the sample mean). School-leaving cohort (men who left school in the same year) size is compared with the national unemployment rate. If school-leavers are avoiding bad economies through endogenous timing cohorts should be large in low unemployment years. Appendix Table B suggests this is not the case: two of the largest cohorts occurred in the highest unemployment rate years (1982, 1983). 36% of the sample left school in recessions of the early 1980s while 8.6% left in the low employment years of the late 1980s (1985-1989). Regressing school-leaving cohort size on the national unemployment rate reveals a positive relationship (beta=48.96, robust se=33.89): cohort size *increases* as the national unemployment rate rises. Economic conditions at age 14 are uncorrelated with education or age at school-leaving (see Appendix Table C), suggesting that economic conditions experience during youth are not strong predictors of age or educational attainment at school-leaving.

Taken together the published literature and analysis using the NLSY79 suggests that U.S. school-leaving men in the mid-1970s to late 1980s did not substantially alter school-leaving time or location through enrollment, dropping out, or moving. Nor were these men forced out of school in bad economies. Interestingly, these men were *less* likely to move and school-leaving cohort sizes were *larger* when the unemployment rate was high.

Appendix Table A. Effect of a bad economy on enrollment, dropping out, leaving school for financial reasons, and migration

	Currently Enrolled	Drop out	Financial difficulty	Move across state lines
Proportion	0.24	0.08	0.07	0.06
Bad economy	0.002	-0.003	0.014	-0.010**
	(0.007)	(0.013)	(0.016)	(0.004)
Sample	Full	Left school	Left school	Full
Observations	58193	5687	5687	60903

Notes: All models estimated with a linear probability model and control for personal characteristics and state and year fixed effects. Full sample includes all men of school-leaving age (13 to 28 years); left school sample includes men who left school since last interview. Standard errors clustered by state and reported in parentheses. ***;**;*= statistically significant at the 1%; 5%; 10% confidence level.

Appendix Table B. School-leaving cohort size and the national unemployment rate

Year	School-leaving cohort size	National unemployment rate
1976	258	7.09
1977	342	6.57
1978	459	5.64
1979	543	5.49
1980	452	6.81
1981	473	7.28
1982	426	9.18
1983	301	9.16
1984	182	7.27
1985	121	7.05
1986	89	6.92
1987	55	6.18
1988	32	5.44
1989	30	5.13
1990	9	5.41
1991	0	6.42
1992	2	6.84

Notes: A school-leaving cohort is a sample of men who left school in the same year.

Appendix Table C. Effect of a bad economy at age 14 on school-leaving age and years of education

	School-leaving age	School-leaving years of education
Mean	19.04	12.77
Bad economy	0.131	-0.025
	(0.138)	(0.103)
N	3774	3774

Notes: Standard errors are clustered by school-leaving state and reported in parentheses. ***; **; * = statistically significant at the 1%; 5%; 10% level.