The Long Reach of Education: Health, Wealth, and DI Participation

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June 2015
Revised December 2016

ABSTRACT

Education is strongly related to participation in the Social Security Disability Insurance (DI) program. To explore this relationship, we investigate both direct and indirect linkages between education and DI participation. Education is correlated with health, wealth, occupation, and employment, all of which are in turn correlated with DI participation. We call these indirect linkages "pathways." We estimate an empirical model using Health and Retirement Study data for the 1992-2012 period to determine how education is related to DI participation through each of these pathways. We then use the results to estimate how education-related changes in these pathways, for example the change over time in the difference in health status between those with high and low educational attainment, have affected DI participation. The results suggest that the largest effect of education on DI participation comes through the health pathway. For men more than one-third, and for women over two-thirds, of the correlation between education and DI receipt can be "explained" by the correlation of education with health, and health with DI receipt.

Acknowledgements: This research was supported by the U.S. Social Security Administration through grant DRC12000002-03 to the National Bureau of Economic Research as part of the SSA Disability Research Consortium. Funding was also provided through grant number P01 AG005842 from the National Institute on Aging. Poterba is a trustee of the College Retirement Equity Fund (CREF), a provider of retirement income services. The findings and conclusions expressed are solely those of the authors and do not represent the views of SSA, any agency of the Federal Government, TIAA, or the NBER.

Understanding the relationship between education and Social Security Disability Insurance (DI) participation is critical to projecting future trends in DI participation. The educational attainment of cohorts approaching the traditional retirement age has changed significantly in recent decades. In 1972, the percentages of men approaching retirement age (50 to 62) with less than a high school degree, a high school degree, some college, and more than a college degree were 48, 30, 11, and 12 respectively. In 2012, the percentages in these education groups were 10, 31, 28, and 31 respectively. If there is a relationship between educational attainment and DI receipt, then these changes in the educational composition of the population need to be considered in projecting future DI utilization rates and program outlays.

Several recent papers, including Autor, Katz and Kearney (2006), Goldin and Katz (2008), and Acemoglu and Autor (2012), have emphasized the relationship between the changing educational composition of the population and the dramatic restructuring of the U.S. labor market in recent decades. There is growing concern that the growth in the education of the workforce has failed to keep pace with the growth of high-skill jobs. One widely studied consequence of restructuring has been growing earnings inequality or "job polarization." The restructuring of the economy has likely also influenced retirement and disability decisions.

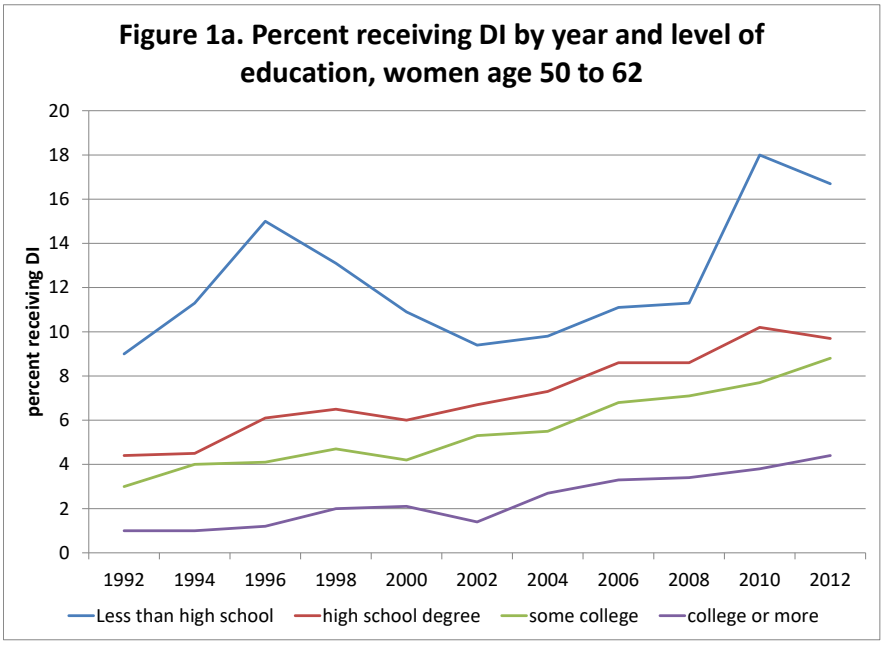
This paper considers how the evolving educational composition of the workforce may have affected rates of DI participation. The focus is on the take-up of disability benefits by persons who are over the age of 50 but have not yet reached the Social Security early retirement age of 62. This age restriction is motivated by the concern that DI is used by many as a route to early retirement. A related study by Cutler and Lleras-Muney (2010) considers the strong relationship between education and rates of disability in old age, defined as functional disability of persons over the age of 65. They find that those who have spent much of their career in a blue-collar job, those who smoke, and those who are obese, are much more likely to report late-life disabilities. Each of these factors, in turn, is closely correlated with education.

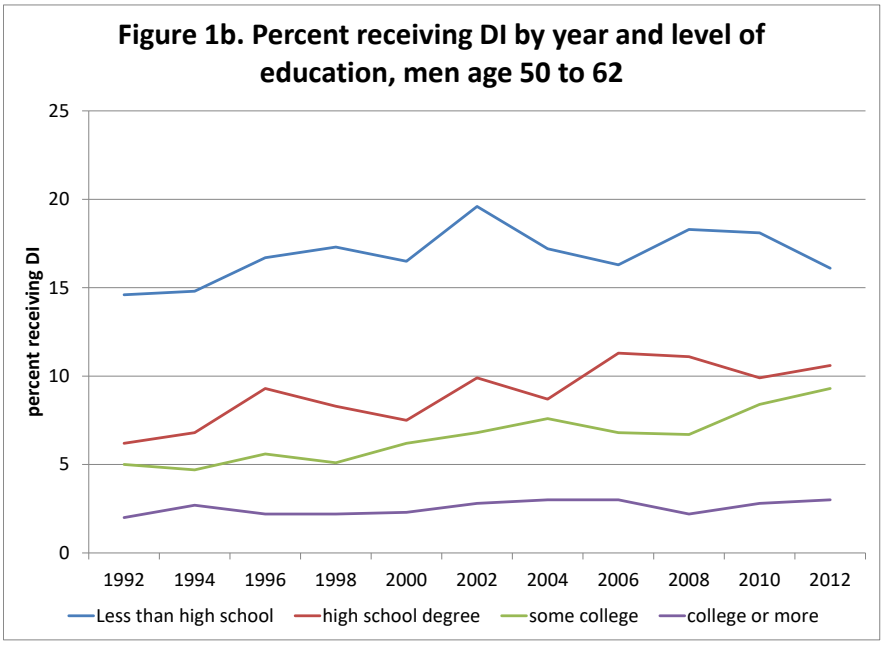
This paper is divided into four sections. In the first, we use descriptive data to highlight the strong relationship between education and DI participation. In section two, we focus on the role of four "pathways," health, employment history, occupation, and wealth, through which education can affect the decision to apply for DI benefits. We develop and estimate an empirical model to trace the effect of education through the various pathways, and we also consider education's direct effect. In section three, we use our estimates to assess how changes in education may have affected the probability of receiving DI benefits at each level of education over the 1992-2012 period spanned by the HRS data, as well as over a longer post-1972 period. For the longer period, we use data from the NHIS, SCF and CPS. There is a brief conclusion.

1. The Relationship between Education and DI: Summary Evidence

Figures 1a and 1b show the percentage of women and men receiving DI benefits who were between age 50 and age 62 in alternate years from 1992 to 2012. These

figures use data from the Health and Retirement Study (HRS), which surveyed persons every two years between these dates. Both figures show the well-known upward trend in DI participation in the recent past, evident here for all levels of education. The upward trend is more pronounced for women than for men and is generally thought to be the consequence of increasing labor force participation among women. The differences by level of education are striking. Averaged over all years, the DI participation rate for women with less than a high school degree is 12.3 percent and the rate for women with a college degree or more is 2.4 percent. For men the comparable rates are 16.9 percent and 2.6 percent.



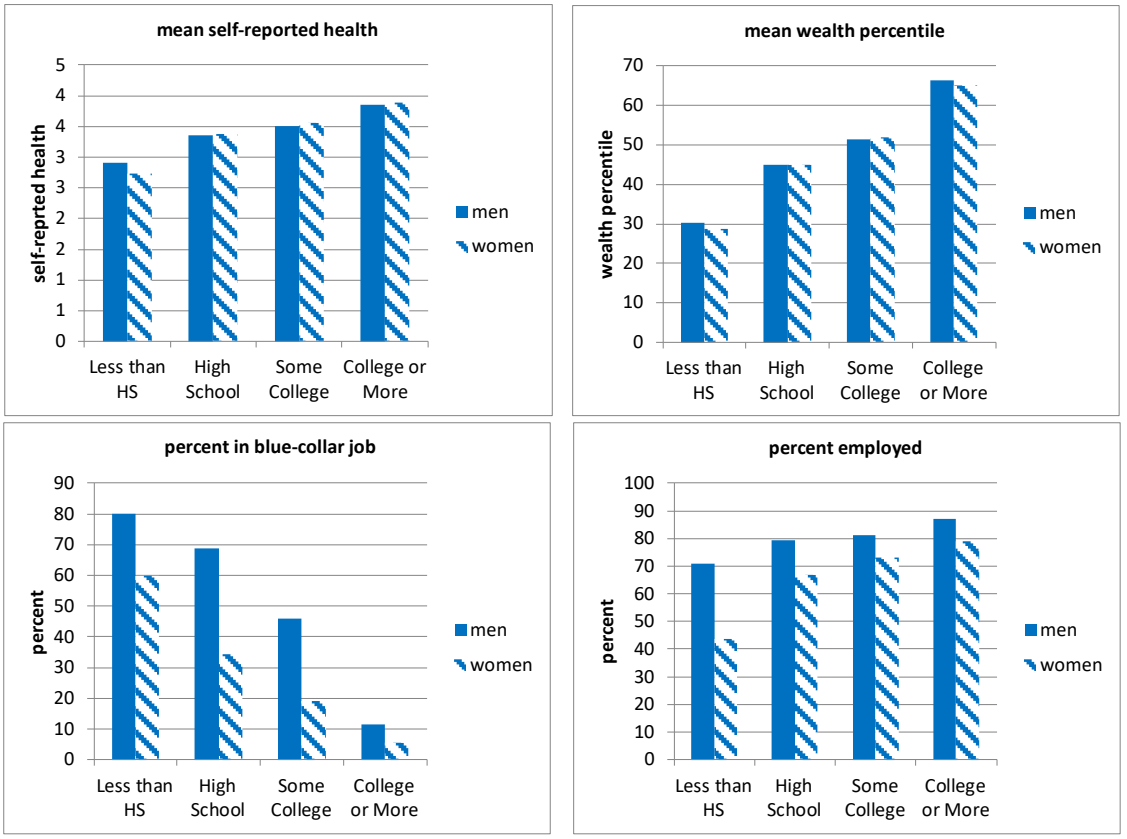


To describe how changing levels of education in the population have affected the proportion of persons on DI, we need to better understand how education may affect DI participation. We find it useful to distinguish *direct* and *indirect* effects. Direct effects could arise, for example, if additional education raises an individual's knowledge of the DI system, or their capacity to navigate the DI application process, and therefore affects the DI application and approval rate. Indirect effects could operate through individual attributes that are related to the decision to participate in DI, such as health, wealth, employment history, and occupation. We denote these indirect channels of influence as "pathways," and focus primarily on the effect of education on DI participation through them. Our list of pathways is not exhaustive, and as a practical matter, it will never be possible to empirically account for all of them. The direct effect we identify therefore also includes the indirect effects of pathways we have not included in our estimation.

We recognize that the pathway decomposition analysis that we present is only one of many possible ways of parsing the reduced form effect of education on DI participation rates, and that identifying causal pathways can be difficult, since educational attainment is likely to be correlated with unobserved individual attributes that may also affect the pathway variables. In spite of these challenges, we find the pathway estimates potentially useful for understanding how the effect of education on DI participation can change over time. We can, for example, obtain separate estimates of how education affects health and how health affects DI participation. By distinguishing two steps in this relationship, and attempting to estimate each of them, we can demonstrate that even if there is no change over time in the distribution of educational attainment in the population, there could be a change in the impact of education on DI claiming. This could occur if the effect of education on pathway variables, such as health, changed over time, for example if college graduates became healthier relative to those with less education.

We consider four pathways linking education to DI status: health, wealth, employment history, and employment status. There are large differences by level of education for each of these pathway variables. Figure 2 presents means of the four pathway variables by level of education. The four panels are based on data for persons age 50 to 62 from the HRS for the years 1992 through 2012. The HRS is a bi-annual survey, so some individuals appear in the sample more than once (at different ages). Persons who are currently receiving or have previously received DI benefits are excluded. Thus the sample is comprised of persons who could potentially – if they meet all program requirements - become DI recipients.

Figure 2. Means of pathway variables by level of education



Source: Respondents age 50 to 62 with no prior receipt of DI in the 1992 to 2012 waves of the HRS.

The upper-left panel in Figure 2 shows the relationship between self-reported health and the level of education. Each respondent was asked to report his or her health on a five point ordinal scale (1 = poor, 2 = fair, 3 = good, 4= very good, 5 = excellent). The panel reports the average of these responses. The differences by education level are striking. On average, men with at least a college degree report their health to be nearly a full category higher than men with less than a high school degree. The self-reported health gap between women with high and low levels of education is more than a full category.

The next panel shows how wealth differs by level of education. Because there is enormous variation in wealth, and substantial reporting error, we use the respondent's wealth percentile in each year rather than the level of wealth. Our definition of wealth includes home equity and the net value of other real estate, business assets, and financial assets. IRA, 401(k) and Keogh balances are included in financial assets, but the capitalized value of defined benefit plan income and Social Security benefits is not. For this analysis the unit of observation is the person, but we measure wealth at the household level and then assign it to each household member. We use household measures because it is difficult to assign ownership of assets, such as housing or jointly held financial assets, to each individual household member. Wealth differences by level of education are substantial for both men and women. On average, men (women) with a college degree or more are in the 66th (65th) percentile of the wealth distribution.

Men (women) with less than a high school degree are, on average, in the 30st (28th) percentile of the wealth distribution.

The third panel in Figure 2 shows education-related differences in the percentage of respondents who report that their longest-held job was a blue-collar job. These differences are again large, in part because many jobs have educational entry requirements. Men with less than a high school degree are 69 percentage points more likely to report having worked in a blue-collar job that are men with a college degree or more. For women, the gap is about 45 percentage points.

The final panel in Figure 2 shows the percentage of respondents who are employed when surveyed, by level of education.[1] For men, the employment rate ranges from about 71 percent for men without a high school degree to over 87 percent for those with a college degree. The range for women is quite a bit larger – 44 percent of women with less than a high school degree are employed, but 79 percent of those with a college degree or more are employed.

2. Estimating the Direct and Indirect Effect of Education on DI Participation

We now examine the relationship between education and DI participation in the HRS sample, and then develop an empirical model to estimate the impact of the various pathway variables through which education may affect DI participation. The model is closely related to the model used in Venti and Wise (2015), with modifications that allow us to use the model to analyze historical DI claiming behavior.

The outcome of interest is whether a person who has not previously received DI benefits will begin receiving benefits in a particular year. The process that leads to receipt of disability benefits involves many steps and is complex. A person must have a physical or mental impairment that prevents them from engaging in a "substantial gainful activity" and have a qualifying work history (or be the spouse, child, or caretaker for the children of a disabled worker). Persons with disabilities must then apply and be approved by the local Disability Determination Services office. Our indicator for whether a person who has not previously received DI benefits begins receiving benefits collapses all of these steps into a single outcome.

We restrict the analysis to persons between the ages of 50 and 62 and emphasize the possibility that DI might be used by these persons as a route to early retirement. Persons over the age of 62 are excluded because they become eligible for early Social Security benefits at that age. Estimates are based on the 1992 to 2012 waves of the HRS. There are approximately two years between each of the 11 waves of

[1] Years of labor market experience might be a better indicator of work capacity than the measure of employment used here. A variable measuring work experience is available in the HRS and we used it in early versions of the analysis. However, we dropped it for two reasons. First, the reporting error rate for this variable is apparently very high. Second, the analysis in a later section of this paper requires data (obtained from sources other than the HRS) for each pathway variable back to 1972. There are no data sources that contain useable measures of labor market experience over this time period.

the HRS. For each wave we consider only those persons who have not previously received DI. An important consideration is that DI benefits cannot commence until at least five months after the disability onset.[2] This waiting period means that each pathway variable must be measured at least five months prior to the date at which DI is initially received. The baseline data (including the pathway variables) are only available at the date of each survey interview. We thus ask: Given a person's baseline information (health, wealth, etc.) at the date of the interview, what is the probability that the person will become a first-time DI recipient in the future? Using the date of the initial receipt of DI benefits, we can determine if the respondent began receiving DI in a two year window that commences six months after the survey interview from which the baseline data are obtained. For example, if a respondent is interviewed on June 1, 2000, we collect values of the pathway variables on this date. Our indicator of DI receipt in this case is whether the respondent began receiving DI in the two-year window between December 1, 2000 and December 1, 2002.

Table 1 reports estimates of the relationship between the initial receipt of DI benefits, education, and our four pathway variables. These estimates combine data from the 1992 to 2012 waves of the HRS, so each HRS respondent may contribute multiple observations to the sample. Standard errors are adjusted to reflect this. We included year effects in the specification, but could not reject the null hypothesis that they are zero.

Consider, for example, a respondent first observed in the HRS at age 50 in 1992, who first received DI benefits in 1999 at age 57. Information on the pathway variables and initial DI participation will be obtained at ages 50, 52, 54 and 56. At ages 50, 52 and 54 the respondent is coded as a nonparticipant in DI. At age 56 the respondent is coded as a new DI participant because the respondent begins receiving benefits in the 2 year window that begins six months after the interview date. Subsequent observations for this respondent are excluded from the analysis because the respondent has already commenced receipt of DI benefits.

Estimates are obtained by probit and the marginal effects of each covariate on the probability of initial DI receipt over a two year period are shown in Table 1. To put these estimates in perspective, it is helpful to note that the percentage of persons who become DI recipients in any two year period is quite low – about 1.2% for men and 1.0% for women.

[2] Moreover, not all initial applications are approved. Typically between 40 and 50 percent of all DI recipients were approved after (sometimes multiple) re-application, thus further delaying the receipt of benefits for many eventual recipients.

Table 1. Probit marginal effects for the probability of receipt of DI benefits for persons who did not receive DI benefits in the previous wave.

Variable	Men		Women	
	Estimate	z	Estimate	z
	Education Only			
HS	-0.0023	-1.03	-0.0034	-2.03
Some college	-0.0055	-2.20	-0.0045	-2.38
College or more	-0.0184	-6.06	-0.0141	-5.83
Pseudo R^2	0.0226		0.0133	
	Pathway Variables Only			
Self-reported health	-0.0074	-7.35	-0.0088	-9.97
Wealth percentile	-0.0001	-2.79	-0.0001	-2.96
Married	0.0033	1.38	-0.0022	-1.51
Blue collar occupation	0.0001	3.01	0.0000	1.25
Employment status	-0.0041	-1.99	0.0009	0.58
Pseudo R^2	0.0722		0.1028	
	Pathway and Education Variables			
Self-reported health	-0.0073	-7.22	-0.0089	-9.98
Wealth percentile	-0.0001	-2.37	-0.0001	-2.92
Married	0.0033	1.37	-0.0023	-1.55
Blue collar occupation	0.0000	1.78	0.0000	1.69
Employment status	-0.0041	-1.98	0.0003	0.18
High school degree	0.0030	1.27	0.0043	2.38
Some college	0.0020	0.75	0.0053	2.51
College or more	-0.0051	-1.63	0.0013	0.50
Pseudo R^2	0.0761		0.1058	

Source: Respondents age 50 to 62 with no prior receipt of DI in the 1992 to 2012 waves of the HRS.

The first panel of Table 1 shows estimated marginal effects for three levels of education (the lowest level – less than a high school degree – is excluded). This specification excludes the pathway variables. All but one of the six estimates is statistically significant. The estimated effects in the table pertain to changes in the probability of initially receiving DI benefits. For expositional purposes, the discussion below will multiply these effects by 100 and interpret them as percentage point changes. The estimates suggest that having obtained a high school degree is associated with a reduction in the rate of DI participation of about 0.23 percentage points for men and about 0.34 percentage points for women, relative to the DI participation rate for someone without a high school degree. Higher levels of educational attainment are associated with even lower probabilities of DI claiming. Relative to a person without a high school degree, a man with a college degree or more is 1.84 percentage points less likely to claim DI and a woman with a college degree or more is 1.41 percentage points

less likely to claim. By comparison with the underlying probability of initially receiving DI, these differences by level of education are substantial.

The middle panel of Table 1 shows the estimated marginal effects for each of the pathway variables in a specification that excludes the "direct" effect of education. Pathway variables include the respondent's self-reported health status as measured on a five point scale (1 = poor, 2 = fair, 3 = good, 4= very good, 5 = excellent), the respondent's household wealth percentile in each wave, and indicator variables for whether the respondent was married, whether the respondent's longest tenure job was blue-collar, and whether the respondent was employed.[3] Employment status is measured is at least six months prior to the beginning of the person's first DI episode. The estimated correlation between health and subsequent DI participation is large, negative and statistically significant for both men and women. A higher value of self-reported health indicates better health, so a one unit increase in the subjective health of a male (say from good to very good) is associated with a drop in the likelihood of initial DI receipt by 0.74 percentage points. The comparable reduction for women is 0.88 percentage points. The wealth percentile is negatively related to initial DI participation and statistically significant for both men and women. Moving up 10 percentile points in the wealth distribution (say from the 50^{th} percentile to the 60^{th} percentile) is associated with approximately a 0.1 percentage point reduction in the probability of DI receipt for and women. Marital status is unrelated to DI participation for both men and women and a blue-collar work history has a small positive effect for men, but little effect for women. Prior employment is negatively related to initial DI receipt for both men and does not have any relationship for women.

The specification in the last panel includes the pathway variables as well as indicators for the level of education. This specification provides evidence on the direct effect of education, the component that is independent of the pathway variables. The estimated marginal effects for the education variables suggest little direct effect of education on DI participation for men. For women, the marginal effects associated with a high school degree and college attendance (but no degree) are unexpectedly positive and statistically significant. The effect of having a college degree is not statistically significant. Thus for women, there is some evidence of a direct effect of education, and this effect appears to be nonlinear. Including education measures directly in the specification does not change the estimated coefficients on the pathway variables in most cases. This suggests that although education is closely related to the pathway variables, as illustrated in Figure 2, this association does not prevent reasonably precise estimation of the association between pathway variables and the DI participation rate even when the education variable is included in the specification.

[3] Venti and Wise (2015) use a health index constructed from respondent reported medical conditions and functional limitations. In principal, the constructed index is preferred to the subjective (and ordinal) self-reported health variable used here. However, in a later section of this study we use the estimates from Table 1 to calculate the probability of DI participation back to 1972. To make these calculations we need data for each of the pathway variables. The data required to construct the health index are not available prior to 1992, but self-reported health status is available back to 1972, so we use self-reported health status to obtain the estimates in Table 1.

These results suggest that the direct effect of education, the effect above and beyond whatever indirect effects are absorbed through the four pathway variables, is negligible for men and modest for women. However, the indirect effect through the pathways may be substantial. To explore the indirect effects, we need to consider not just how each pathway variable affects DI, but also how much education affects each pathway variable. This involves combining estimates of the pathway effects in Table 1 with estimates of the effect of education on each of the pathway variables. The simplest way to estimate the effect of education on each of the pathways is to calculate the difference between the means of each pathway variable for those with high and low levels of education. These calculations are shown in Table 2 for men and women. The key calculation is shown in the last column; it is the difference between the mean for those with a college degree or more, and those with less than a high school education.

Table 2. Means of pathway variables by level of education and gender

	Level of education				
	less than high school	high school degree	some college	college or more	Difference (college or more minus < HS)
			Men		
Self-reported health	2.91	3.35	3.51	3.85	0.94
Wealth percentile	30.29	44.98	51.44	66.29	36.0
Percent married	78.9	78.7	79.1	84.4	5.5
Percent blue collar	80.14	68.84	45.92	11.39	-68.8
Percent employed	70.82	79.35	81.37	87.13	16.3
			Women		
Self-reported health	2.72	3.37	3.56	3.89	1.17
Wealth percentile	28.41	44.8	51.71	64.95	36.5
Percent married	65.2	75.2	72.0	75.2	10.0
Percent blue collar	59.87	34.27	18.98	5.46	-54.4
Percent employed	43.86	66.95	73.11	79.14	35.3

Source: Sample combines all respondents age 50 to 62 with no prior receipt of DI in the 1992 to 2012 waves of the HRS.

The indirect effect of education through each of the pathways is the product of the effect of education on a pathway (Table 2) and the effect of each pathway on the probability of initially claiming DI. The difference in the probability of becoming a DI beneficiary for someone with at least a college degree, and someone without a high school degree, operating through pathway "*X*", equals $\frac{dDI}{dX}\frac{dX}{dE} = \frac{dDI}{dX}\left(X_{College} - X_{<HS}\right)$. Here dDI/dX is the estimated marginal effect reported in Table 1 and $\left(X_{College} - X_{<HS}\right)$ is the difference between the mean of the pathway variable for the two education groups.

We illustrate this decomposition for the health pathway. The estimated effect of a one unit increase in self-reported health on the probability of initial DI receipt, the dDI/dX term, is -0.0073 for men (from the last panel of Table 1). The estimate of the

education-related difference in health $\left(X_{College} - X_{<HS}\right)$ is 0.94 percent for men (from the last column of Table 2). Combining these estimates yields the estimated effect of education through the health pathway: -0.0073 x 0.94 = -0.0069 for men or about 0.69 percentage points. This implies that the indirect effect of education through this pathway could account for nearly 40 percent of the 1.84 percentage point difference between the initial DI participation rate of a person with a college degree or more and the rate for someone with less than a high school degree.

Table 3 presents similar calculations for each of the other pathway variables. The first two columns show the result of the calculations described above for men and women. While for men, 0.69 percentage points of the difference between the DI participation rate of those with at least a college degree and those with less than a high school degree could be accounted for by the health pathway, for women, the comparable estimate is 1.05 percentage points. The estimates suggest that the health pathway is the most important, and the wealth pathway is next most important, in linking education and DI participation. The last entry in each of the first two columns shows the sum of the four pathway effects for men and for women. This sum is 1.04 percentage points for men, relative to the 1.84 percentage point difference between the DI participation rates of men with at least a college degree and men with less than a high school degree as estimated in the probit equations that exclude pathway variables. The sum of the pathway effects is nearly equal to the 1.41 percentage point education-related difference for women.

Table 3. Estimates of the effect of education on the probability of initial DI claim through each pathway, by gender.

	Effect of education through each pathway		**Percent of total effect accounted for by each pathway**	
Pathways	Men	Women	Men	Women
Self-reported health	**-0.0069**	**-0.0105**	37.5%	74.2%
Wealth percentile	**-0.0030**	**-0.0034**	16.4%	23.8%
Married	0.0002	-0.0002	-1.0%	1.6%
Blue collar	0.0000	0.0000	0.1%	0.1%
Employment	**-0.0007**	**0.0001**	3.6%	-0.7%
Sum pathway effects	-0.0104	-0.0140	56.7%	99.0%
Total effect of education	-0.0184	-0.0141	100.0%	100.0%

Note: Bold indicates significant at 10% level or better (for included pathway effects).

The last two columns of Table 3 show the percentage of the total effect of education that is accounted for by the sum of the pathway variables. For men, the pathways account for 56.7 percent of the total effect of education on initial DI take-up. Thus the “direct” effect of education – the effect of education not operating through the

pathways – is smaller than the sum of the pathway effects. For women, 99 percent of the total effect is accounted for by the effect of education through the pathways.

3. Accounting for Time Series Variation in the Education/DI Relationship

We now consider how the effect of education on DI participation changes over time by exploring the changing education-related differences in the pathway variables. We cannot reject the null hypothesis that all of the year effects are zero in equations like those in Table 1 linking the four pathway variables to the probability of initial DI receipt. This suggests a relatively stable relationship through time. We therefore assume that the dDI / dX terms are constant for our sample period and for the prior two decades, the 1972-1992 period.

For each year, we can estimate the impact of education on DI claiming by combining our estimate of the effect of a pathway variable with an estimate of the effect of education on that pathway variable in that year. By differencing these estimates across years, we can investigate how much of the change in DI participation over time can be accounted for by education-induced variation in the pathway variables. This measure of the changing effect of education on DI claiming over time is independent of the distribution of changes in the educational attainment of the population. For example, the effect of education on health may vary over time if the more educated become healthier relative to the less educated. This may affect DI participation even if the relative proportions of the population with high and low education remains constant.

3.1 Estimates for the 1992-2012 Period

Figures 3a and 3b show the relationship between education and the three most consequential pathway variables – health, wealth and employment status – between 1992 and 2012. We exclude the fourth pathway, the blue-collar occupational indicator, because the estimated effect of this pathway variable in Table 3 was very small for both men and women. For men there is a modest decline in self-reported health at all levels of education. The pattern for women is similar, although the decline in health is more pronounced for women with lower levels of education. For both men and women the wealth percentile of the lowest education group declines over time, which is not unexpected because the fraction of persons without a high school degree has been declining over time. With regard to wealth, the gap between the wealth percentile of those with college or more and those with less than a high school has been widening over time. Both of the profiles for the likelihood of employment also display a widening gap over time between the highest and lowest levels of education.

Figure 3a. Means of pathway variables by level of education, men, 1992-2012

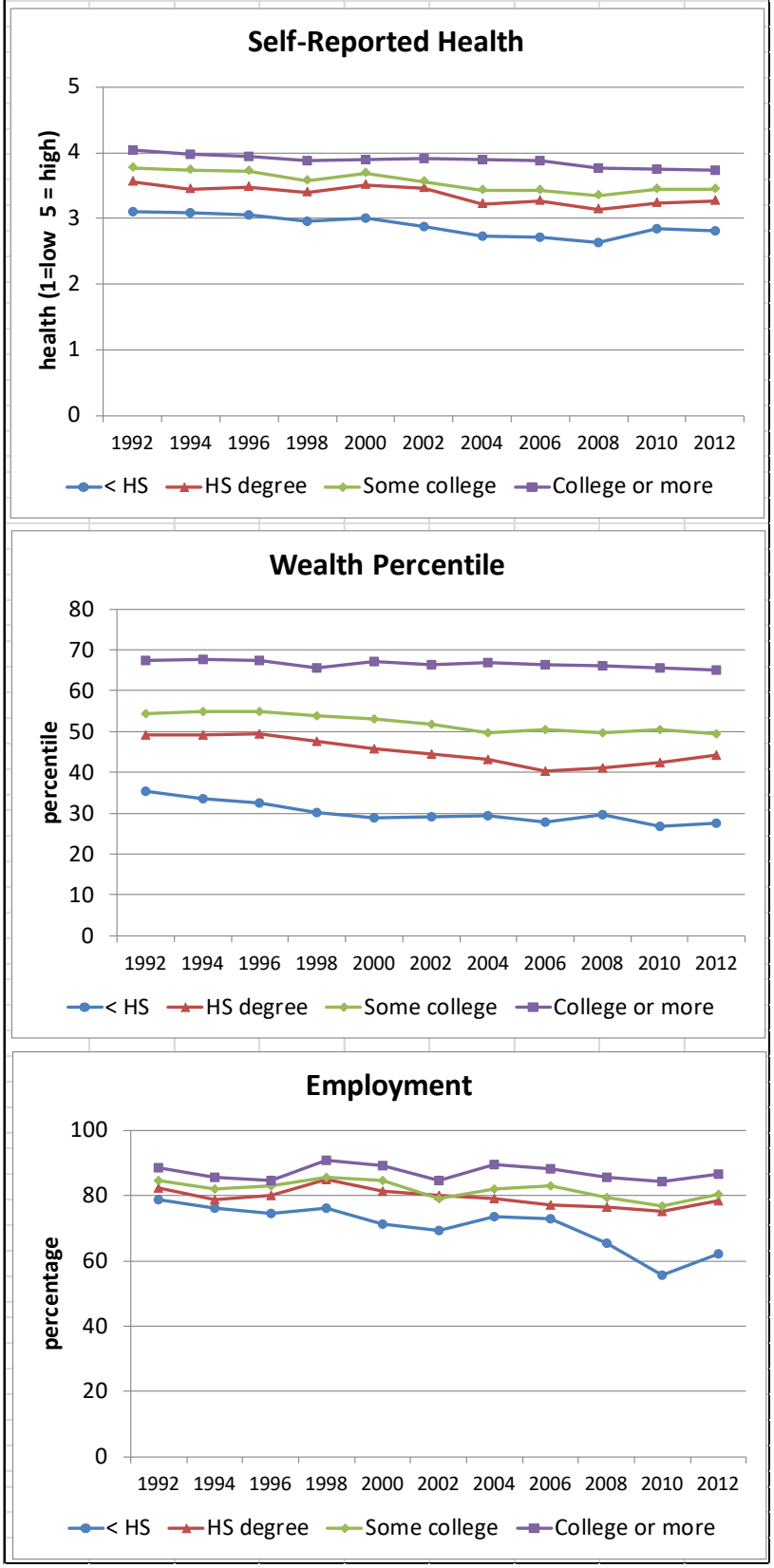
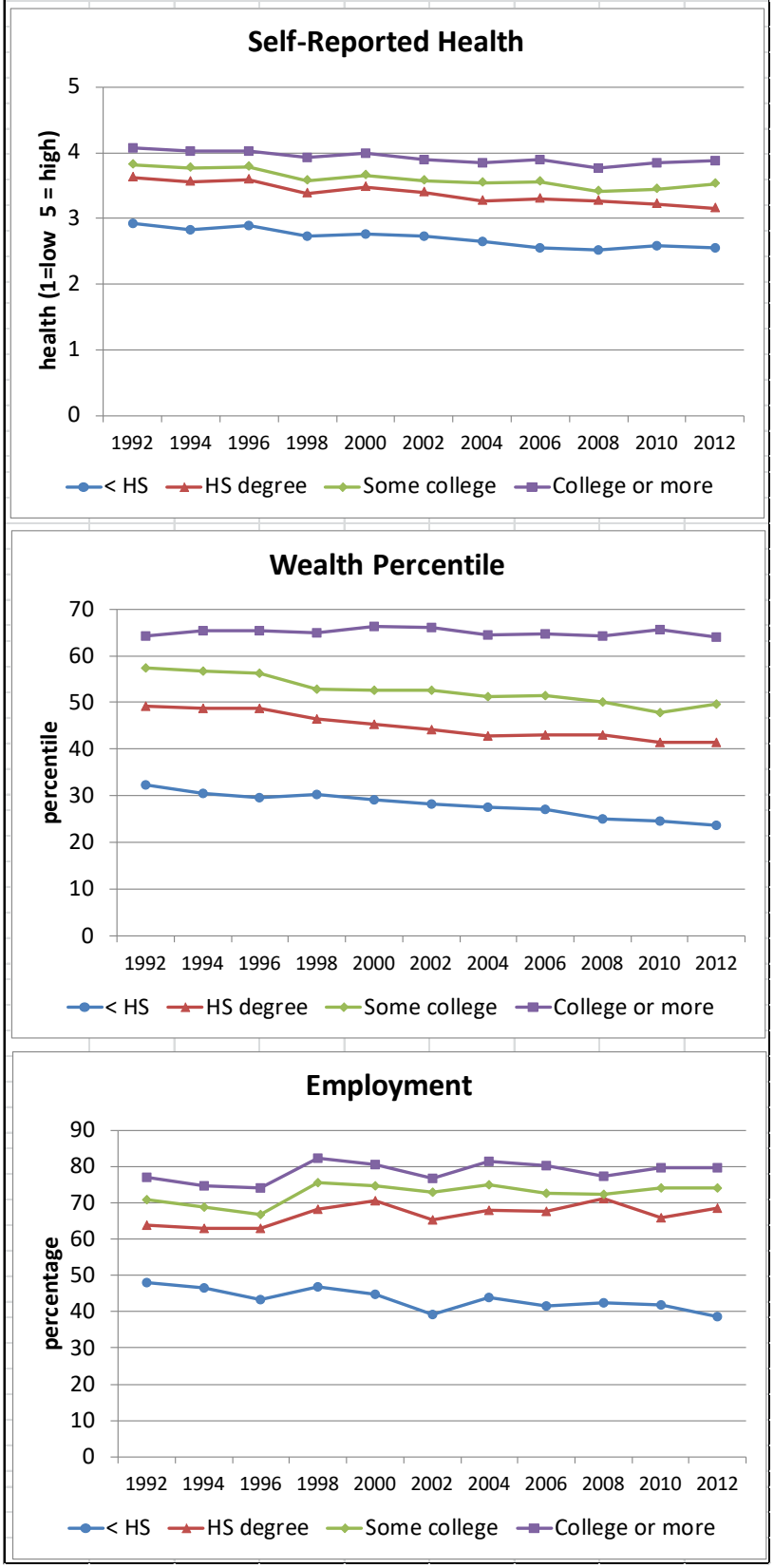
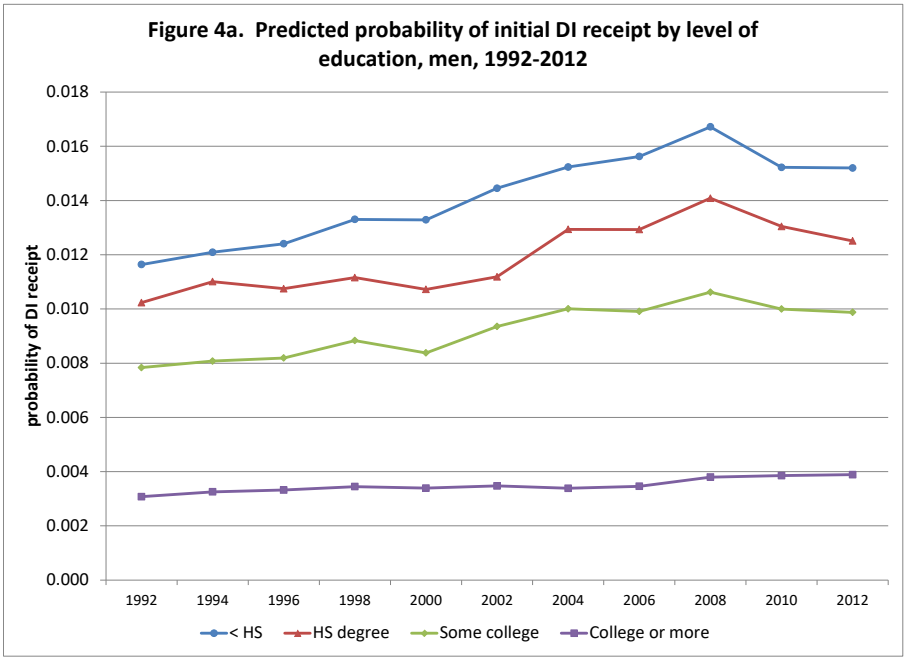
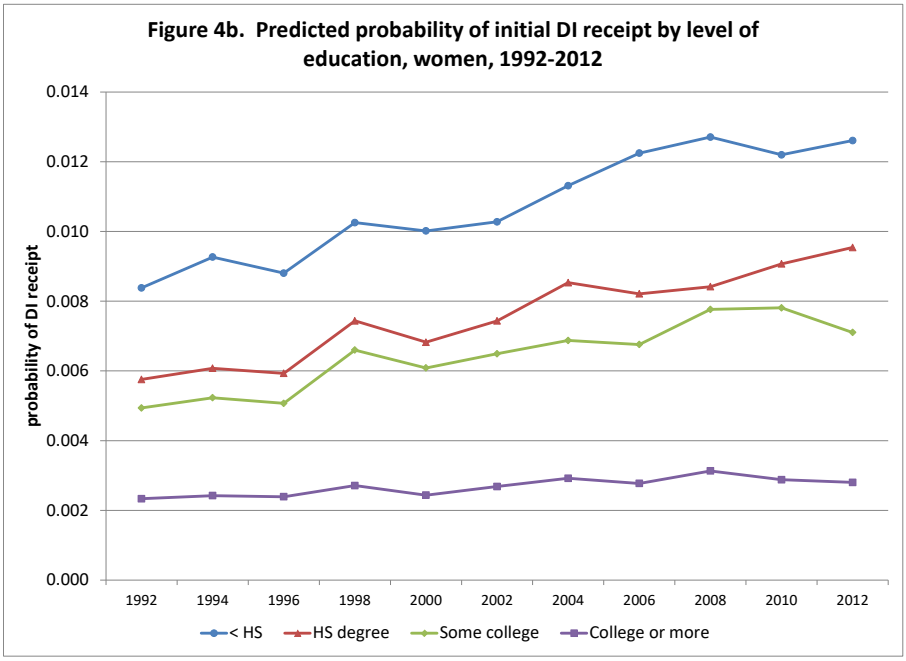


Figure 3b. Means of pathway variables by level of education, women, 1992-2012



Figures 4a and 4b show the result of combining the means of the pathway variables graphed in Figures 3a and 3b as well as marital status and blue-collar occupation with the marginal effects of the pathway variables estimated in the last panel of Table 1 to compute the predicted probability of receiving DI benefits at each level of education for the years 1992 through 2012. We report predicted probabilities, the fitted values from probit equations for each education group evaluated at the year-specific means of the pathway variables, rather than observed probabilities of initiating DI receipt each year. The time series on actual DI initial receipt probabilities is much noisier than the time series of predicted values due to our small samples.





For men and women with college degrees, the profiles are similar, showing a gradual increase in the predicted probability of initial DI receipt that is consistent with the gradual decline in health and employment for this group. However, the profiles for persons with low levels of education are quite different. For example, the predicted probability for men without a high school degree rises steadily between 1992 and 2008 and then falls off sharply in 2010 before leveling out in 2012. The decline can be traced in part to a decline in the number of men in blue-collar occupations and lower levels of employment and to an improvement in health during the Great Recession. The latter reflects a broad tendency, reported for example by Ruhm (2000) and Cutler, Huang and Lieras-Muney (2016), for health to improve during an economic downturn. For women the profile for persons with less than a high school degree displays a less pronounced decline in 2010 and a stronger rebound in 2012. These profiles show that over the past 12 years the likelihood of initial DI receipt for women has increased more for the less educated than for the highly educated. This was also true for men until 2008, although the pattern is not clear after that. This divergence can be attributed in substantial part to the widening gaps in health, wealth and employment between those with more and less education.

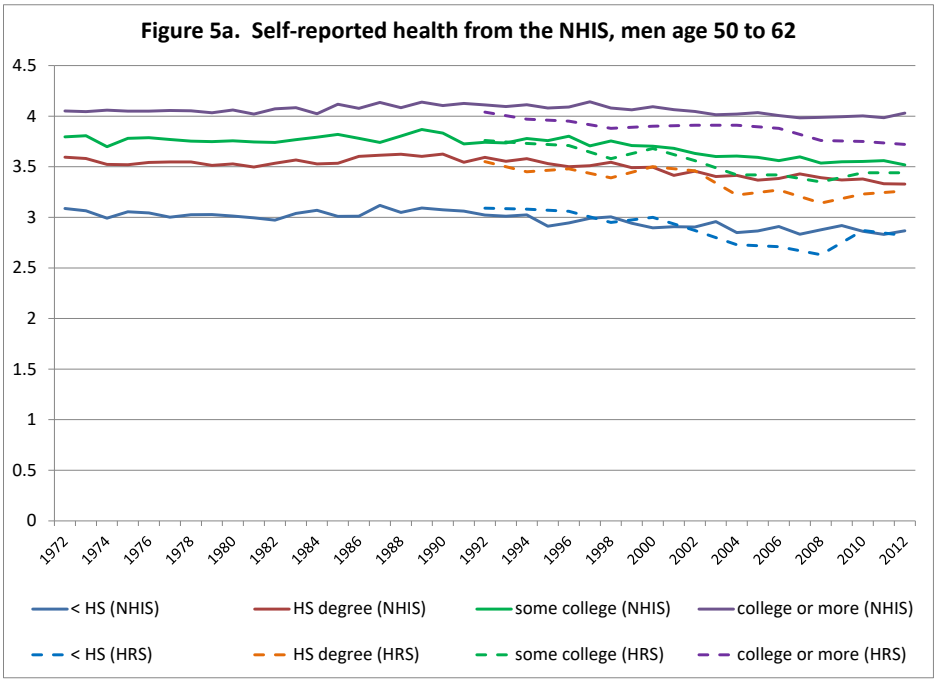
3.2. Estimates for the 1972-1992 Period

The foregoing analysis was for the 1992-2012 period for which HRS data are available. These data provided a strong base for understanding the importance of education in affecting DI claiming. We would nevertheless like to obtain a longer-term perspective on the relationship between education and DI receipt. Unfortunately there is no single data source that includes data, by age and level of education, on DI receipt and all of the pathway variables prior to the HRS, so we must combine data from different sources.

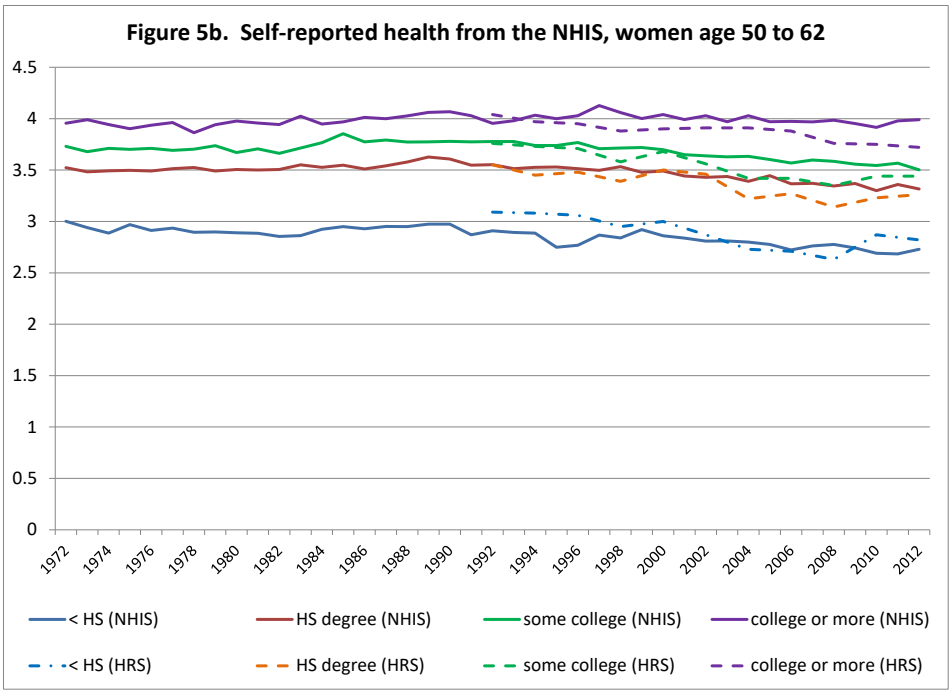
We make use of three: the National Health Interview Survey (NHIS), the Current Population Survey (CPS), and the Survey of Consumer Finance (SCF).[4] Neither these data sources nor any other publicly available data source contains information on DI participation by age and level of education for years before 1988. The NHIS only began collecting information on DI participation in 1998 and the CPS only includes information on DI benefit receipt beginning in 1988. However, it is important to realize that if we had data prior to 1992 on the pathway variables by age and level of education, from any source, we would be able to impute DI participation in earlier years, even without data on DI participation—if we assume that the education effects that we estimate for the post-1992 period also apply to earlier years. That is, if we had differences in health, wealth, occupation and employment by age and level of education from any source, we could estimate DI participation. We could then compare our estimates with aggregate (over all ages and levels of education) administrative data on DI participation.

[4] Both the NHIS and CPS data were obtained from the IPUMS-USA project. See Flood et al. (2015) for details on the NHIS and Minnesota Population Center (2015) for details on the CPS. The SCF data were downloaded from the FRB website.

We begin with the NHIS which includes data on health since 1972 by level of education. The NHIS includes self-reported health measured using the same five category scale used in the HRS since 1982 and using a four point scale in earlier years.[5] The mean of self-reported health for persons in the NHIS between the ages of 50 and 62 for each year between 1972 and 2012 is shown in Figure 5a for men and Figure 5b for women. The mean of self-reported health for persons age 50 to 62 in the HRS is also shown for alternate years between 1992 and 2012. Both figures suggest that the health "gap" between those with high levels of education and those with low levels of education that was evident in the HRS data has persisted over time. For both men and women the health gap between those with a college degree or more and those with less than a high school degree has widened over time – mean health for those with more education has held steady at about 4 (on the five point scale), but the mean reported health of those with less education has dropped from slightly over 3 to under 3. This decline over time is more pronounced for women than for men. Beginning in 1992, self-reported health is shown for respondents in both the NHIS and the HRS. In general, the trends and levels evident in the NHIS data are similar to those in the HRS data in the years that the two surveys overlap, but there are some discrepancies. In particular, men and women with a college degree or more in the NHIS report better health than their counterparts in the HRS.



[5] Prior to 1982 the scale was poor, fair, good and excellent. A fifth category, very good, was added in 1982. To make the two scales compatible we applied the proportions for good, very good and excellent in 1982 to the sum of good and excellent in 1981 (and earlier years) to create three categories. Calculations are made for cells defined by year, gender and level of education. As Figure 5 shows, the "seam" effect between 1981 and 1982 is minimal.

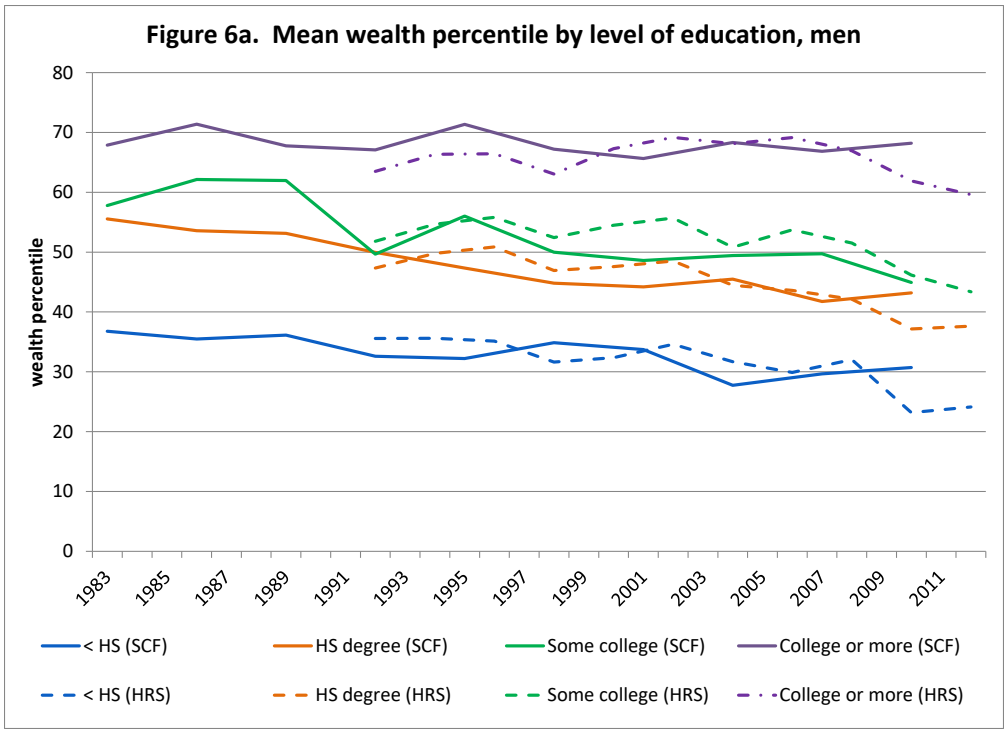


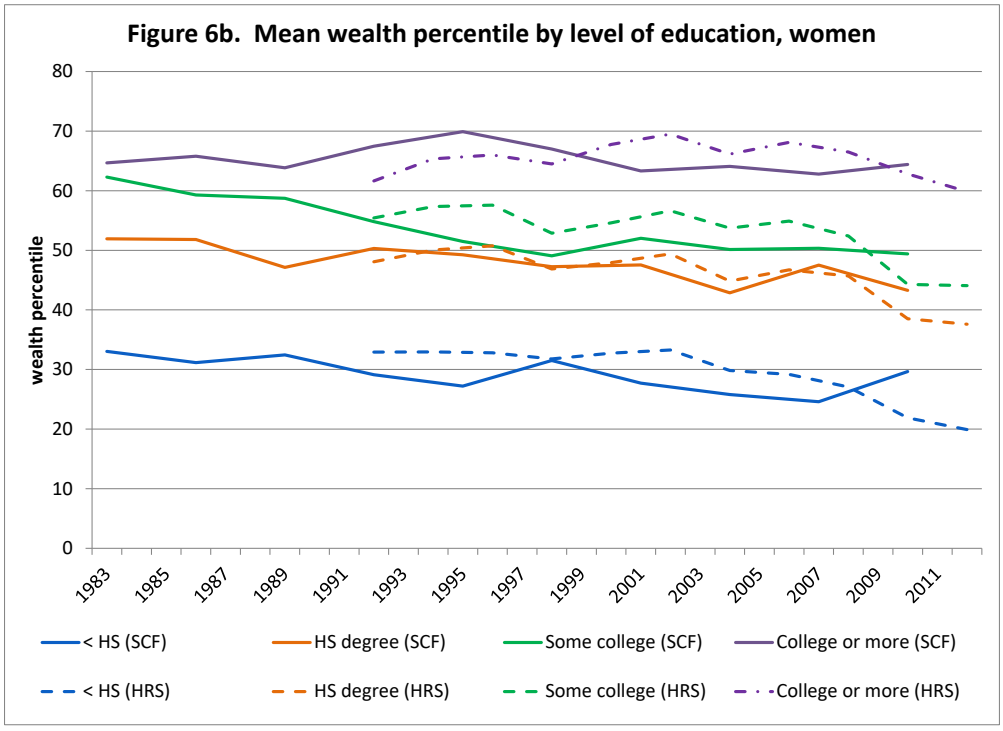
We use the CPS to obtain information for several other pathway variables by age and level of education for the 1972 to 2012 period. These include marital status, a blue-collar job indicator, and employment status. The blue-collar variable used in the estimated model (using data from the HRS) was based on each respondent's occupation in the longest tenure job held, something that we can only approximately match in the CPS data. The CPS definition for the blue-collar occupation is based on the respondent's occupation in the prior year.

Wealth is not available in either the NHIS or CPS. Sources of data on wealth by level of education include the Survey of Consumer Finances (approximately every three years since 1983), the Survey of Income and Program Participation (for most years since 1984), and Panel Study on Income Dynamics (1984, 1989, 1994, and every other year beginning 1999). We use the SCF because it offers the most comprehensive measure of wealth and because it provides us with the earliest start date, 1983.

Figures 6a and 6b show profiles for the wealth percentile by level of education for persons age 50 to 62 in each year since 1972. Estimated wealth percentiles from the SCF were calculated for the years 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2004, 2007, and 2010 and values for other years are imputed.[6] The figures also show wealth percentiles from the HRS for 1992 through 2012. The longer-term trends are similar, but some shorter-term cyclical differences are evident.

[6] Years between the SCF surveys are interpolated. We use year-to-year changes in aggregate household net worth from the FRB balance sheet to extend the SCF wealth series back from 1983 to 1972 and forward from 2010 to 2012. This procedure implicitly assumes that the ratio of the wealth percentile of the high education group to the wealth percentile of the low education group remains constant over the imputation period.



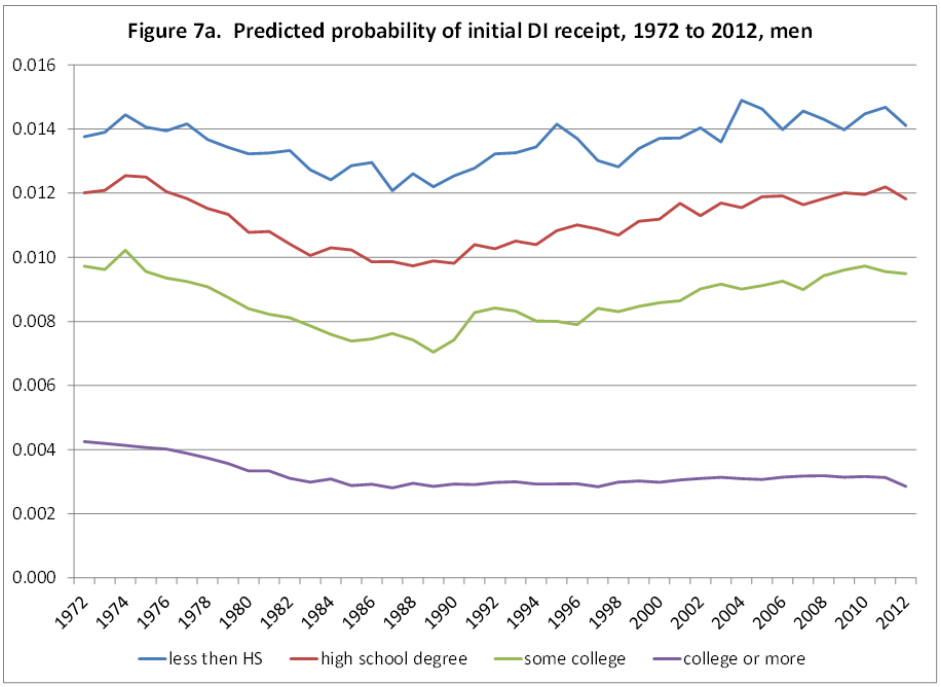


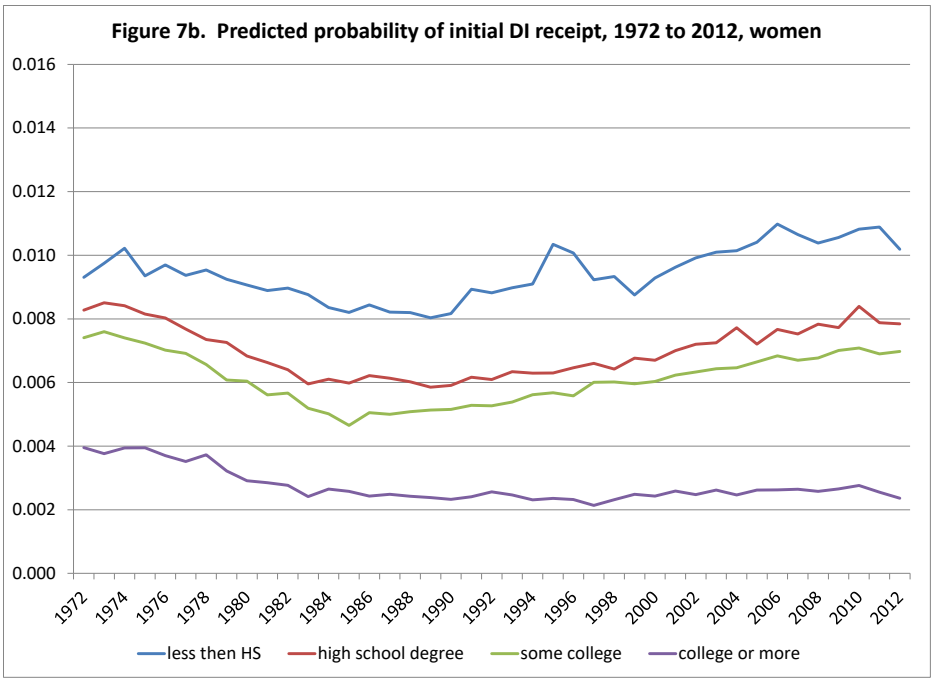
Taken together, Figures 5a-b and 6a-b suggest that the differences across education groups in the two principal pathway variables have not been constant over time. The gap between the health of the high and low education groups widens over time as does (to a lesser extent) the gap between the wealth of these two education groups. An analysis of the blue-collar occupation pathway (not shown) shows a

narrowing of gap between high and low education groups for men and women. For employment, the gap has been widening over time, particularly for men. The results shown earlier based on the more recent HRS data suggest that these trends in pathway variables may have important implications for the DI participation of each education group.

Given data for 1972 to 2012 on the pathway variables by level of education, and assuming that the education effects for the post-1992 period also apply to earlier years, we can predict DI participation by level of education in earlier years. We emphasize that these predictions isolate the changing effect of education on DI claiming over time, i.e. the changing differences between those with high and low education levels, and do not account for the changing distribution of educational attainment in the population. The profiles only reflect trends in DI claiming that are the consequence of changes over time in the health, wealth, occupation and employment by level of education.

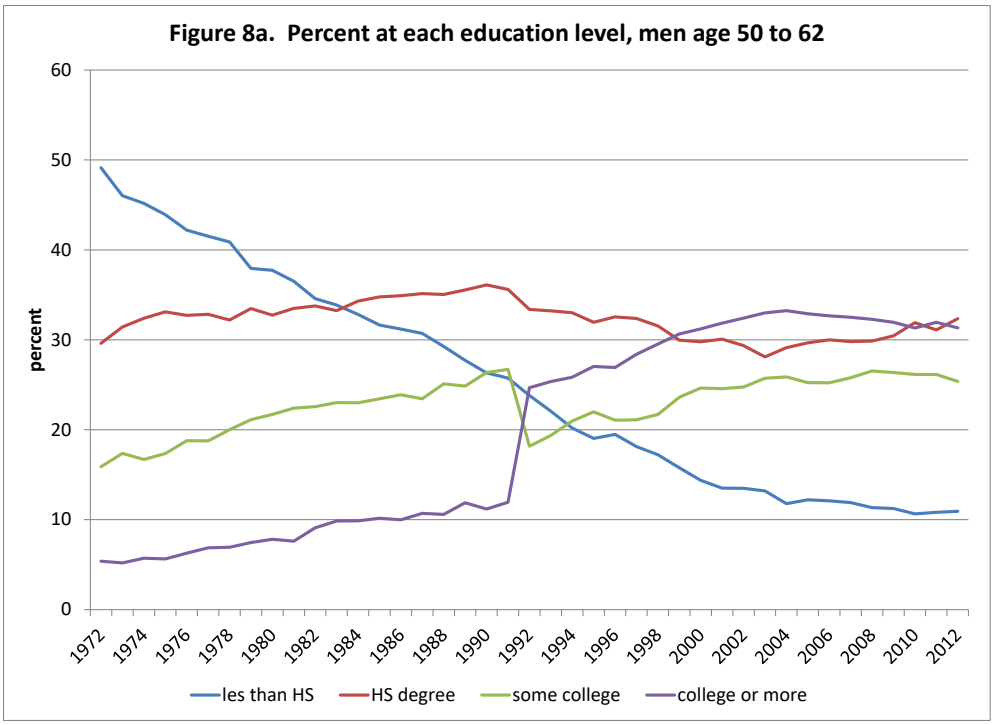
Figures 7a and 7b present the results. For both men and women with a college degree or more, the predicted probability of initial claiming declines through the early 1990's and then levels off. The profiles for the other education groups have more of a "U" shape, reaching a minimum typically in the mid to late 1980's. It does appear that, for either men or women, the probabilities of making an initial claim for high and low education persons have diverged over the past 20 years. In 1990 the initial claim rate of men with a college degree or more was about 4.28 times the claim rate of men without a high school degree. By 2012 this ratio is 4.94 for men. For women the gap between those with high education and those with low education increased even more, from 3.51 to 4.31.

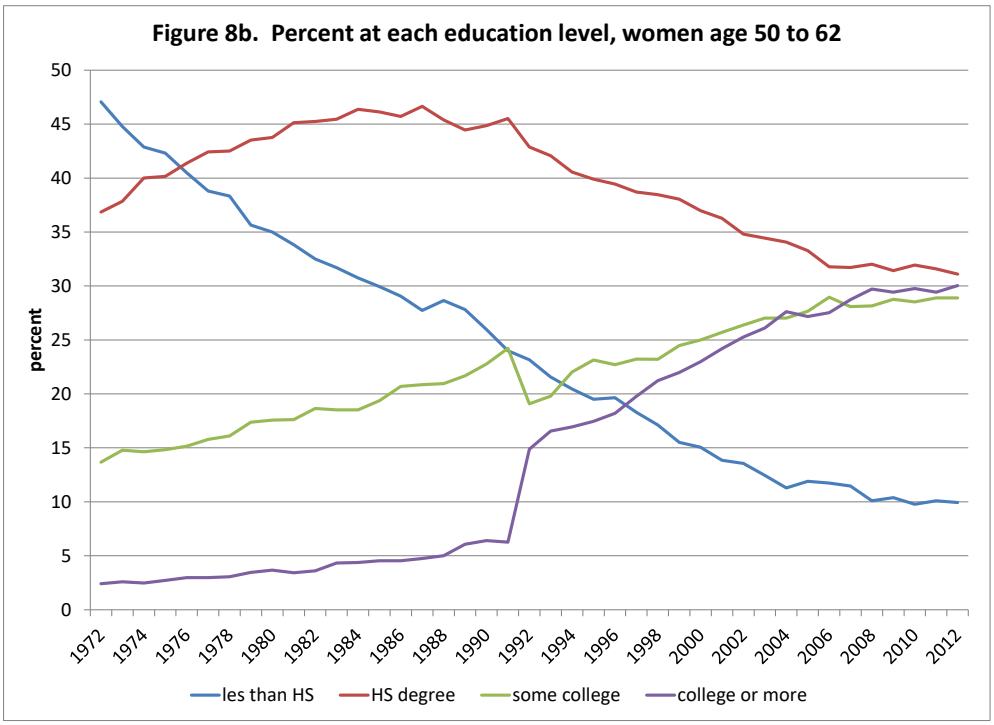




The estimated profiles in Figures 7a and 7b hold the educational composition of the population constant. However, the change in the educational composition of the population over the past 40 years has been dramatic. CPS estimates of the percentage of the population age 50 to 62 at each level of education in each year is shown in Figures 8a and 8b.[7] The fraction of this age group with less than a high school degree has fallen sharply for both men and women. The proportion with a terminal high school degree has also declined, substantially for women and marginally for men, since the late 1980's. For both men and women the percentage with at least some college and the percentage with a college degree or more has increased.

[7] There is a discontinuity between 1991 and 1992 caused by a shift of emphasis from years of education to degree receipt in the education question asked in the CPS.





We also examine how the probability of initial claiming changes over time if we allow for changes in the distribution of education in the population. Our analysis uses the percentages graphed in Table 8 to weight the calculations from Table 7, which hold education composition constant. The resulting profiles are shown by the solid lines in Figure 9. Comparing Figures 7 and 9 suggests that the changing educational composition of the population is an important driver of the overall trend in DI claiming.

The upward sloping profile over the past 20 years that is evident in Figure 7 flattens out in Figure 9 as the number of persons in the population with low levels of education declines.

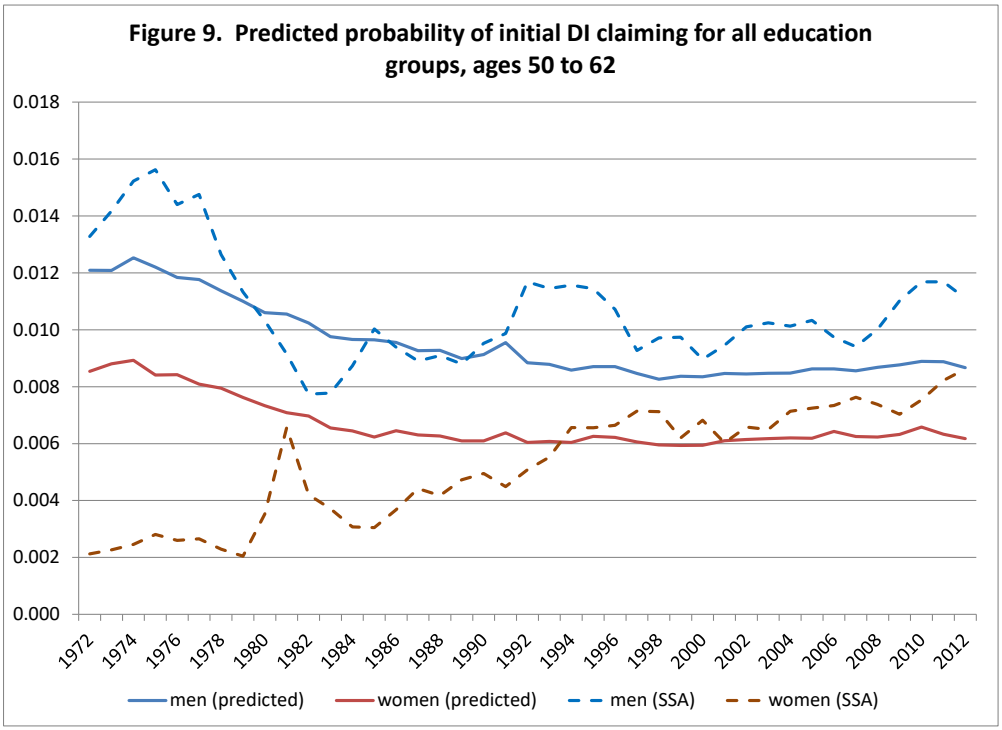


Figure 9 also shows data from the Social Security Administration (SSA) for the percent of the population between the ages of 50 to 62 who are awarded disabled worker benefits each year.[8] The administrative data show much more year-to-year variation than our calculations, which are based on the education-related changes in the pathway variables and changes in the educational composition of the population, both of which move gradually over time. As Liebman (2015) points out, major reforms to the DI system in the late 1970's and mid-1980's had large effects on the incidence of new claims. Some variation related to the business cycle is also evident.

There are several other, more technical, reasons why our predicted DI initiation probabilities may not track the observed aggregates. The estimates used to produce the calculated profiles are based on all DI claimants, but the SSA profile pertains only to awards (and not necessarily new awards) to disabled workers. SSA data by age and year for new awards to qualifying spouses of disabled workers or for the caretakers for the children of disabled workers are not publicly available and thus not included in the

[8] The calculations use data from Table 39 of SSA (2014) and Table 6.C7 of SSA (2015). The former source provides DI awards by age and gender for 1970, 1975 and annually thereafter. Awards for 1972-1974 and 1976 to 1979 were imputed using the rate of growth of awards for all ages in the latter source.

dashed lines in Figure 9. This omission may be the source of the large discrepancy for women in the first part of the figure. Another difference that may affect the fit is that the "denominator" in the estimated rate excludes persons already receiving benefits in each year, but the denominator in the SSA rate is the entire population age 50 to 62.

We also caution that during the four decades that are spanned by the data in Figure 9, there are potential changes in the meaning of different educational attainment levels. It is possible that the relative skills associated with each of the four levels of education may have changed over time—a high school degree in 1970 may not represent the same skill set as a high school degree in 2014. Thus, the increasing DI claiming rates over time that we see for persons with less than a high school degree may reflect declining skill levels as those without a high school degree become a smaller and more select group. Bound et al. (2015) raise a similar point with respect to apparent declines in longevity among persons with less than a high school education, and they propose replacing the level of education with the quantile in the education distribution as a way of accounting for the changing meaning of a high school degree over time. Applying a similar strategy here is a topic for future research.

4. Conclusion

The likelihood that a person will be a Social Security Disability Insurance (DI) beneficiary is strongly related to that person's educational attainment. There are several potential explanations for this relationship. On the one hand, education may have "direct" effects on DI behavior – for example, persons with more education may be more knowledgeable of the DI system, or be better able to navigate the DI application process. A more likely explanation is that education has indirect effects: education affects characteristics of individuals which in turn affect DI participation. Persons with higher levels of education may be in better health, and thus be less likely to become disabled. Those with more education may work in certain jobs that make them less likely to become disabled. We refer to these indirect channels through which education may affect disability claiming as pathways, and we focus on four: health, wealth, occupation and employment. We estimate the relative strength of the four pathways and use our estimates to explore how education has affected DI participation over the past four decades.

We focus on factors influencing the probability that persons age 50 to 62 will make a first-time claim for DI benefits. Among women, nearly all of the strong negative relationship between educational attainment and DI claiming can be attributed to the indirect effect of education through the pathway variables. Roughly three-quarters of the DI participation "gap" between women with high and low levels of education is due to health, that is, those with lower levels of education have poorer health that results in higher initial DI claiming rates than persons with higher levels of education. A little under one-quarter of the "gap" is accounted for by differences in wealth associated with different levels of education. The effects of the other pathway variables and the direct effect of education are minimal.

For men, the pathway variables as a group account for more than half of the total effect of education on initial DI take-up. Health is also the most important pathway, accounting for 37.5 percent of the difference between the DI participation rates of persons with high levels of education and persons with low levels of education. Again, wealth is the second most important pathway, accounting for about 16.4 percent of the "gap." In contrast to the results for women, we find a large direct effect of education on DI participation for men, about 43.3 percent of the "gap." Because it is never possible to empirically account for all of the indirect pathways, and we consider only four, the direct effect we identify may include the indirect effect of omitted pathways.

We also use our estimates to predict the probability of a first-time DI claim, by level of education, within our sample period, 1992-2012, and in the previous two decades. Our predicted profiles show the relationship between education and DI claiming holding the distribution of educational attainment in the population constant; they highlight the change in DI participation over time attributable to education-induced variation in pathway variables. Widening health, wealth and employment disparities between persons with high and low levels of education during our sample period generate higher rates of growth of initial DI claiming for the less educated than for the more highly educated during our sample period.

We also extend the analysis by using several other data sets to estimate the effect of education on our four pathway variables for the 1972-1992 period. The predicted probabilities of DI claiming for this earlier period again show that education-related changes in the pathway variables are important contributes to trends in initial DI claiming. These predicted probabilities do not account for changes in the distribution of educational attainment in the population over time, but only for the changing differences in the pathway variables between education groups.

We also consider how changes over time in the distribution of educational attainment in the population have affected DI claiming. Between 1972 and 2012, the fraction of the population with low levels of education has declined dramatically and the fraction with higher levels of education has increased. This change in the composition of educational attainment in the population places downward pressure on disability rates. Our estimates suggest that over the past two decades, the upward pressure on DI rates arising from increasing educational disparities in health, wealth and employment has been roughly offset by the downward pressure arising from the declining fraction of the population with low levels of education.

We caution that the relationships that we estimate are not necessarily causal. Differences in educational attainment across individuals in our sample may not be exogenous. There may be unobserved factors – childhood health, for example – that affect educational attainment, each of the pathway variables, and the likelihood of disability claiming. Our findings of the potential empirical magnitude of the pathway effects suggest the need for further exploration of these issues, with attention to identification strategies.

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