HHS Public Access

Author manuscript

J Behav Exp Econ. Author manuscript; available in PMC 2017 July 14.

Published in final edited form as:

J Behav Exp Econ. 2015 February ; 54: 10–21. doi:10.1016/j.socec.2014.11.002.

What's the good of education on our overall quality of life? A simultaneous equation model of education and life satisfaction for Australia

Nattavudh Powdthavee[a,c,*], **Warn N. Lekfuangfu**[b], and **Mark Wooden**[c]

[a]Centre for Economic Performance, London School of Economics, London WC2A 2AE, United Kingdom [b]University College London, London, United Kingdom, and Chulalongkorn University, Bangkok, Thailand [c]Melbourne Institute of Applied Economic and Social, Research, University of Melbourne, Australia

Abstract

Many economists and educators favour public support for education on the premise that education improves the overall quality of life of citizens. However, little is known about the different pathways through which education shapes people's satisfaction with life overall. One reason for this is because previous studies have traditionally analysed the effect of education on life satisfaction using single-equation models that ignore interrelationships between different theoretical explanatory variables. In order to advance our understanding of how education may be related to overall quality of life, the current study estimates a structural equation model using nationally representative data for Australia to obtain the direct and indirect associations between education and life satisfaction through five different adult outcomes: income, employment, marriage, children, and health. Although we find the estimated direct (or net) effect of education on life satisfaction to be negative and statistically significant in Australia, the total indirect effect is positive, sizeable and statistically significant for both men and women. This implies that misleading conclusions regarding the influence of education on life satisfaction might be obtained if only single-equation models were used in the analysis.

Keywords

Australia; Indirect effect; Education; Structural equation model; Life satisfaction; HILDA

1. Introduction

Many educators favour public support for education on the premise that education improves the overall quality of life of citizens. However, relatively little is known about the mechanisms – and the relative impacts of these different mechanisms – through which more education actually contributes to people's overall life satisfaction. Much of the research in this area typically reports only the estimated contemporaneous relationship between

*Corresponding author. Tel.: +44 7990 815924. powdthavee@lse.ac.uk (N. Powdthavee).

education and life satisfaction once income and other socio-economic variables are controlled for (Frey and Stutzer, 2000; Blanchflower and Oswald, 2004; Headey, Muffels, and Wooden, 2008; Powdthavee, 2008). Unfortunately, since income and other indicators of socio-economic status (e.g., employment and marital status) are themselves a function of education, simply running a single-equation model in which both education and other adult outcomes are entered on the right-hand side tells us little about the relative importance of the different pathways through which education can enhance (or even in some cases, reduce) overall life satisfaction.

While income is naturally viewed as the main mediating factor of education on a person's well-being (Diener et al., 1993; Clark, Frijters, and Shields, 2008a, Powdthavee, 2010a), many scholars have argued that education plays a much more important role in influencing individual's life satisfaction through non-monetary channels than through its impact on one's financial status (Brighouse, 2006; Michalos, 2008). In a comprehensive review of the non-pecuniary benefits of education, Oreopoulos and Salvanes (2011) concluded that education was one of the most important predictors of one's health status, employability, and probability of being married, all well-known predictors of life satisfaction (Oswald, 1997; Layard, 2005; Layard et al., 2013).[1] In a more direct test of the indirect effects of education on happiness, Chen (2012) used data from four East Asian countries to show that the statistical association between education and happiness is mediated more by non-pecuniary factors, such as the strength of social networks and cosmopolitan experiences, than income. Empirical evidence in this area, however, remains scarce, and the extent of any indirect effects of education on life satisfaction remains imperfectly understood.

We aim to fill this research gap by testing whether findings on the overall effect of education on life satisfaction are sensitive to the choice of estimation strategy, and in particular the use of a structural equation model rather than the more conventional single-equation approach. We propose that, in order to better understand the different pathways through which education predicts people's overall quality of life, an empirical test has to have a number of special features. First, we must be able to estimate the amount of variation in the potential mediating factors (which, in our case, are contemporaneous adult outcomes measured at the same time as life satisfaction) explained by education. Second, we must also be able to simultaneously determine how these variations in the potential mediating factors explain life satisfaction.

Using longitudinal data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, and covering the period 2001–2010, we estimate a structural equation model that allows us to simultaneously compare the relative indirect associations between education and life satisfaction through five different adult outcomes: income, employment, marriage, children, and health. In addition to this, we also want to be able to shed some lights on the following two questions:

i. Are the pathways through which education influences life satisfaction the same for men and women?

[1]They also acknowledged that more education might also bring along with it added stress and constraints on time, thus leading to the possibility that education could also have a negative impact on overall life satisfaction.

ii. How stable are these estimated indirect effects over time?

By answering these questions we provide powerful, new and more comprehensive insights into how education can be associated with having a more satisfying life and what matters most in that process.

There is also another important reason for choosing the HILDA Survey for our analysis. Previous studies that have used this popular data set have often found education to be correlated negatively and statistically significantly with life satisfaction in regression equations where income, health, and other socio-economic variables are controlled for in a single-equation model (e.g., Shields, Wheatley-Price, and Wooden, 2009; Green, 2011; Ambrey and Fleming, 2014), which could potentially lead to a loose and largely incorrect interpretation of education being welfare reducing in Australia. Hence, one of our objectives is to test the hypothesis that the combined indirect effect of education on life satisfaction is positive, sizeable and statistically significant even though the direct (or net) effect is not.[2]

The paper is structured as followed. Section 2 summarises previous relevant literature. Section 3 briefly discusses the data and the empirical strategy. Results are reported in Section 4. Section 5 discusses and concludes.

2. Background

2.1. Previous research on the relationship between education and life satisfaction

Previous studies have used single-equation models to establish the link between education and measures of life satisfaction and have produced mixed results. Using highest education qualification dummies as control variables in cross-section regression equations, many scholars have found a positive and statistically significant association between education and self-rated life satisfaction across different international data sets and time periods (e.g., Blanchflower and Oswald, 2004; Easterlin, 2001; Ferrer-i-Carbonell, 2005; Graham and Pettinato, 2002). Yet there have also been other studies that have documented either a negative or a statistically insignificant effect of education on the way people report their satisfaction with life overall (e.g., Melin, Fugl-Meyer, and Fugl-Meyer, 2003; Flouri, 2004; Powdthavee, 2008; Shields, Wheatley-Price, and Wooden, 2009).

One explanation for these mixed findings is that both direction and magnitude of the coefficient on education in a life satisfaction regression equation are often sensitive to the inclusion of other variables in the model (Dolan, Peasgood, and White, 2008). For example, controlling for potential outcomes of education, such as income and health, in a life satisfaction regression equation will tend to produce a coefficient that underestimates the full contribution which education is making to life satisfaction.

While most researchers know this to be the case, little attempt has been made to decompose the overall effect of education on life satisfaction into direct and indirect effects and study them individually. Consequently, previous research tends to refrain from over-interpreting

[2]The negative correlation between education and life satisfaction has also often been found in studies that used the British Household Panel Survey (BHPS). For example, see Powdthavee (2008, 2010a).

the coefficient on education in a life satisfaction regression equation, citing it only as a control variable that needs to be interpreted with caution given the presence of other endogenous variables in the model.

2.2. Accounting for the links between education and different adult outcomes

Previous research, especially by economists, has highlighted financial returns as one of the main benefits that people receive from investing in additional human capital (e.g., Angrist and Krueger, 1991; Harmon and Walker, 1995; Leigh and Ryan, 2008). Using data sets across countries and time periods, researchers have often reported the rate of financial return to education to be economically sizeable, statistically significant, and to have causal interpretations; for example, education allows individuals to become (or at least, be "perceived" as) more efficient and productive in the labor market, leading them to earn more than their less educated counterparts (for a comprehensive review of this literature, see Psacharopoulos and Patrinos, 2004).

However, many educational philosophers and researchers (e.g., Brighouse, 2006; Michalos, 2008) have argued that monetary gains are not the main benefit from education. Rather, it is the non-pecuniary gains, such as better health and stability in family life, where the real value of investment in human capital lies. These sentiments are reflected in recent empirical work in economics. According to a review by Oreopoulos and Salvanes (2011, p. 159):

> "In the traditional investment model, [education] itself is treated as a black box: individuals enter, something happens, and productivity (usually defined in terms of one-dimensional skill) increases. A look inside the box, however, reveals that [education] generates many experiences and affect multiple dimensions of skill that, in turn, may affect central aspects of individual's lives both in and outside the labor market."

What researchers in this area have found is that education affects not only individual income, but also enables individuals to make better decisions about health, marriage and family life. For example, studies have found individuals with more schooling to have, on average, better mental and physical health outcomes (Lleras-Muney, 2005; Siles, 2009; Powdthavee, 2010b). More educated individuals are also significantly less likely to be unemployed and when unemployed, do not remain unemployed for very long (Mincer, 1991; Kettunen, 1997).

Some researchers have also found that education not only makes individuals more attractive in the labor market, but also more attractive in other settings. Men and women with more earnings potential or with higher prestige jobs are typically seen as relatively more appealing in a competitive marriage market (Chiappori, Iyigun, and Weiss, 2009; LaFortune, 2013). There is also evidence of substantially lower divorce rates among those with more completed years of schooling of similar age and family background, thus suggesting that the critical thinking and social skills acquired from more education may also translate to more stable marriages (Oreopoulos and Salvanes, 2011).

With respect to the effect of education on people's decision to start a family, the existing empirical evidence mostly seems to suggest that education has a negative effect on women's

fertility rate (Sander, 1992; Martin, 1995; Isen and Stevenson, 2010). One of the reasons for this could be that education increases the value of time in the labor market, thereby significantly raising the opportunity cost of child rearing for women (Becker, 1991) or simply reducing women's preferences for children (Easterlin, 1987).

There are certainly many other non-pecuniary effects of education on life that could also be potentially welfare enhancing, including its effects on the extent of social networks, attitudes towards work and job satisfaction, and even the ability to trust other people (e.g., Oreopoulos and Salvanes, 2011), as well as potentially welfare reducing, including its effects on income aspirations, the tendency to migrate, and the average commuting time to and from work (e.g., McLafferty, 1997; Stutzer, 2004). Education can also be welfare reducing for the individuals in countries where, holding other things constant, there is widespread skill mismatch and/or over-education (Allen and van der Velden, 2001; Chevalier, 2003). However, the current study will focus only on adult outcomes that are both objectively measured and have been found to have some influence on adult life satisfaction in previous research. These are: income, employment, marriage, the number of children, and health.

2.3. Accounting for the links between adult outcomes and life satisfaction

Recent research in economics has distinguished an individual's 'decision' utility, inferred from observed choices, from her 'experienced' utility, which more closely matches the notion of satisfaction and happiness (e.g. Kahneman, Wakker, and Sarin, 1997; Carter and McBride, 2013). According to Daniel Kahneman and colleagues, experienced utility, which has a hedonic quality, can be measured in real time (e.g. moment-to-moment emotions) or in retrospective (e.g. life satisfaction). We follow the tradition in economic research and use life satisfaction as a proxy for an individual's experienced utility (Oswald, 1997; Kahneman and Krueger, 2006).

In a typical life satisfaction regression equation a standard set of control variables will include, among other things, income, employment status, marital status, the number of children, and the health status of the respondent (Layard, 2005; Powdthavee, 2010c).

Based on previous studies, income has generally been found to have a positive and statistically significant relationship with life satisfaction (Diener et al., 1993; Oswald, 1997; Clark, Frijters, and Shields, 2008a, Powdthavee, 2010a). The association, however, is often depicted as small when compared with the effects of other potential mediating factors of education. For example, Blanchflower and Oswald (2004) showed that it would take, on average, US$100,000 extra income per annum to compensate for a marital separation, and US$60,000 extra income per annum to compensate for unemployment. These estimated compensation variations for marital separation and unemployment are also typically larger for men than for women, consistent with previous evidence that men usually have more to gain than women from marriage (perhaps through better lifestyle changes; Gardner and Oswald, 2004) and more to lose from joblessness (especially in terms of loss of self-esteem; Goldsmith, Veum, and Darity, 1997). This broad pattern of comparatively large non-pecuniary effects of marriage and unemployment on life satisfaction holds across different

data sets and analytical methods (e.g., Winkelmann and Winkelmann, 1998; Helliwell, 2003; Powdthavee, 2008).

Much of the evidence on the relationship between having children and life satisfaction suggests that parents are either less satisfied with life or report the same level of life satisfaction as non-parents (Di Tella, MacCulloch, and Oswald, 2003; Smith, 2003; Shields and Wooden, 2003; Clark et al., 2008b, Powdthavee, 2008). One likely explanation for this is the negative impact of children on financial satisfaction, which is a common finding across many different countries around the world (Stanca, 2012). There are, however, a few exceptions to this finding. For example, using data from the 1995–1997 round of the World Values Survey, Haller and Hadler (2006) report a positive and statistically significant effect on life satisfaction after controlling for income and financial satisfaction. Haller and Hadler's explanation is that children put demands on day-to-day positive emotions but nonetheless people still regard them as a positive contribution when providing a cognitive evaluation of well-being.[3] Other studies suggest that the relationship between children and life satisfaction may depend significantly upon broader cultural and social factors. For instance, it has been found that the presence of children has a stronger negative effect on subjective well-being in the UK and the US compared to Europe and Russia (Di Tella, MacCulloch, and Oswald, 2003; Smith, 2003). The relationship may also depend on how the children variable is coded in the life satisfaction equation. A study by Shields and Wooden (2003), for example, finds that the negative relationship between children and life satisfaction is driven more by the children living at home and less by the children who are living elsewhere.

Finally, health, both psychological and physical, has been found to represent one of the largest and most significant contributing factors to higher levels of life satisfaction in many data sets. While different specific health conditions, such as heart attacks and strokes, can have differential negative effects on evaluations of overall quality of life (Shields and Wheatley-Price, 2005; Powdthavee and van den Berg, 2011), having a long-term incapacitating health problem or disability is generally found to be associated with relatively low levels of life satisfaction. Further, adaptation over time to the onset of such serious conditions has been found to be far from complete (Oswald and Powdthavee, 2008).

Based on the review above, different rates of return can be expected in the relationships between education and different adult outcomes, and between different adult outcomes and life satisfaction. The indirectly channelled educational benefits through each of the five adult outcomes may even vary significantly across genders and time periods. The overall direction and the magnitude for each of the indirect effects are, however, unclear on *a priori* grounds. For example, it is entirely possible that the marginal effect of education on the probability of being employed is higher for women than for men. Yet it is also possible that the marginal effect of employment on life satisfaction is higher for men than for women, thus making it difficult to predict whether the indirect effect of education on life satisfaction via employment will be larger for men or for women. Hence, it seems important to analyse these

[3]For a discussion of the potential effects of children on day-to-day positive experiences, see Dolan and White (2009).

channels simultaneously and estimate the relative importance of each of these pathways in order to make sense of how education really affects people's satisfaction with life overall.

3. Data and empirical strategy

3.1. Data

As already noted, the data used in this analysis come from the HILDA Survey, a longitudinal survey that has been tracking members of a nationally representative sample of Australian households since 2001. A total of 7682 households participated in wave 1, providing an initial sample of 19,914 persons (aged 0–93). Of those, 13,969 persons were eligible for the interview (Wooden, Freidin, and Watson, 2002). The members of these participating households form the basis of the panel pursued in subsequent annual survey waves. Interviews are conducted with all adults (defined as persons aged 15 years or older) who are members of the original sample, as well as any other adults who, in later waves, are residing with an original sample member. Annual re-interview rates (the proportion of respondents from one wave who are successfully interviewed the next) are reasonably high, rising from 87% in wave 2 to over 96% by wave 9 (see Watson and Wooden, 2012).

Our main dependent variable comes from responses to a question about overall life satisfaction. The question reads: "All things considered, how satisfied are you with your life? Again, pick a number between 0 and 10 to indicate how satisfied you are." A visual aid is used in the administration of these questions, which involves a pictorial representation of the scale with the extreme points labelled "totally dissatisfied" and "totally satisfied".

The measure of education is a continuous variable representing the number of years spent in education, which is commonly used as a proxy of education in the field of labor economics (e.g., Oreopoulos and Salvanes, 2011). This "Years of education" variable is derived from respondents' highest educational attainment. Thus a respondent reporting having completed secondary school (Year 12) is assumed to have completed 12 years of education, a person completing an ordinary university degree is assumed to have completed 15 years of education, and so on. As is conventional, we are not measuring actual years spent in education (which would vary with the time with which qualifications are completed, the number of qualifications obtained, and time spent studying that did not lead to a qualification) but instead the time typically taken to obtain the highest qualification reported.

Turning to the other adult outcomes that are also potentially mediating factors of education on life satisfaction, we have income being represented by the log of real equivalised household income.[4] Employment is a binary variable representing whether the person was employed or not during the week preceding interview (0 = not employed; 1 = employed). Marriage is also a binary variable representing whether or not the person is currently married, where marriage is defined to include both registered and de facto unions (0 = not married; 1 = married). Number of children is the total number of children the respondent has, including children that no longer live at home. And health status is a binary variable

[4]Equivalised real annual household income is calculated using the following formula: real annual household income/(1 + 0.5*(number of adult household members − 1) + 0.3*(number of children aged less than 15 in the household)).

identifying whether the respondent has no long-term health condition, disability or impairment (0 = has long-term health problems; 1 = has no long-term health problems).

Our control variables in all regression equations include gender, birth year, and regional (or state) dummies.[5] This permits comparisons of effects to be made within the same gender, same cohort, and same Australian state.

Pooling data across ten survey waves, there were 135,964 observations of people who were eligible for the interview. However, our analysis of indirect effects of education is restricted to individuals aged 16–64 who participated in any of the first ten survey waves, and responded to the questions from which the life satisfaction and the five adult outcome variables (income, employment, marriage, children, and health) were constructed. This reduces our sample to 76,622 observations; 36,208 males and 40,414 females. Table 1 presents the mean unadjusted scores on life satisfaction and other adult outcomes. However, to aid the interpretation of our results we standardize all variables in the regression equation to have a mean of zero and a standard deviation of one.

3.2. Empirical strategy

We adopt the multiple mediation analysis method (Baron and Kenny, 1986; Hayes, 2009) to study the indirect effects of education on life satisfaction through the five different channels of income, employment, marriage, children, and health (see Fig. 1). A standard structural equations model (SEM) is estimated, thereby allowing a non-zero correlation between the residuals of the equations for each dependent variable. Note that failure to allow for the interdependence across equations could be benign or it could confound the correlation of residuals with the effects of the independent variables (Greene, 2002).

The model is:

$$\begin{aligned} LS_{it} &= \alpha_0 + \sum_{s=1}^{5} \beta_s X_{sit} + \gamma_0 EDUC_{it} + Z_{it}^{'}\theta_0 + \mu_{0i} + u_{0it}, \\ X_{1it} &= \alpha_1 + \gamma_1 EDUC_{it} + Z_{it}^{'}\theta_1 + \mu_{1i} + u_{1it}, \\ &\vdots \\ X_{5it} &= \alpha_5 + \gamma_5 EDUC_{it} + Z_{it}^{'}\theta_5 + \mu_{5i} + u_{5it}. \end{aligned} \quad (1)$$

where LS_{it} denotes standardized life satisfaction, with a mean of zero and a standard deviation of 1, of individual i at time t; X_{sit} represents the standardized adult outcome s, where 1 = log of real equivalised household income, 2 = in employment, 3 = married, 4 = number of children, and 5 = no long-term health problems; $EDUC_{it}$ is standardized years of education; Z_{it} represents a vector of control variables; μ_{si} represents the unobserved individual-specific effect; and u_{ist} denotes the error term in each equation. The SEM equation was estimated with robust standard errors, which also allowed for clustering at the individual level. Assuming that the adult variables and the education variable are not

[5]Note that the broad results are unaffected without controlling for these variables.

correlated with μ_{si} and u_{ist}, unbiased estimates of β and γ can be obtained from running the SEM model on the pooled sample.

Based on the equations above, the indirect effect of $EDUC_{it}$ on LS_{it} through X_{sit} for each s is given by $\beta_s \times \gamma_s$. As recommended by Hayes (2009), bootstrapping (with 200 replications) is used to estimate the standard errors for all of the estimated indirect effects. The model is estimated using the SEM command in STATA 13.

One objection to the naïve estimation of (1) is that both education and other adult outcomes are likely to be correlated with the unobserved individual-specific component, μ_{si}. This includes, for example, personality traits and/or ability. It is well known that if researchers fail to appropriately controlling for these important heterogeneous factors, then ordinary least squares (OLS) can produce biased estimates (Ferrer-i-Carbonell and Frijters, 2004).

A typical approach to correct for the unobserved heterogeneity bias is to exploit panel data and estimate a fixed effects (FE) model on the pooled sample. The FE model works by focusing solely on the within-person variation in the data set and thus eliminating any variables that do not have any within-person information from the estimation process. Consequently, it is not possible to obtain any reliable estimates on characteristics that have zero or little within-person variation, such as gender or education, using the typical FE estimator (Plumper and Troeger, 2007).

Hence, the second part of our empirical analysis applies the empirical strategy outlined in Boyce (2010) and estimates Plumper and Troeger's (2007) fixed effects vector decomposition (FEVD) model with personality traits as additional determinants of individual fixed effects in an SEM setting. More formally, the FEVD method allows researchers to estimate a FE model without the loss of information on variables that have zero or little within-person variation via the three following steps. The first step involves estimating a conventional FE model of LS_{it} with no other covariates and obtaining the estimate of the FE residual ($\hat{\mu}_{0i}$) from the model. In principal, this FE residual includes all observable and unobservable between-person information. From Eq. (1), we can represent $\hat{\mu}_{0i}$ as

$$\hat{\mu}_{0i} = \overline{LS}_i - \sum_{s=1}^{5} \rho_s \overline{X}_{si} - \pi \overline{EDUC}_i - \overline{Z}_i' \tau - \overline{u}_{0i}, \quad (2)$$

where $\overline{LS}_i$ is a within-person average of LS_{it}, $\bar{X}_i$ is a within-person average of X_{ist}, $\overline{EDU}_i$ is a within-person average of EDU_{it} and Z_i is a within-person average of Z_{it}, from each wave, t.

The second step of the FEVD involves decomposing the fixed residual into a part that is observable and a part that is not. The inclusion of personality variables, P_i, at this stage then helps to reduce the size of the unobservable component of the FE residual, which will effectively reduce the correlation between any covariates with potentially low within-person variation and the true unobservable component, thus allowing many slow moving variables to be favourably estimated using the FEVD model (Boyce, 2010). The decomposition can

then take place using observable characteristics and a set of personality traits in a pooled OLS setting to predict the FE residual obtained from (2).

$$\hat{\mu}_{0i}=\sum_{s=1}^{5}\sigma_s X_{sit}+\vartheta EDUC_{it}+Z_{it}^{'}\varphi+P_i^{'}\zeta+\eta_{0i}. \quad (3)$$

where the vector of personality variables, P_i, are taken from measures of Big-5 personality traits from wave 5 in the survey. This model therefore leaves the true unobservable component of $\hat{\mu}_{0i}$ captured in the predicted error term of (3) and denoted here as $\hat{\eta}_{0i}$.

The third and last stage involves using $\hat{\eta}_{0i}$ as an explanatory variable in a pooled OLS regression:

$$LS_{it}=\alpha_0+\sum_{s=1}^{5}\beta_s X_{sit}+\gamma_0 EDUC_{it}+Z_{it}^{'}\theta_0+\varpi_0\hat{\eta}_{0i}+u_{0it} \quad (4)$$

Although education may be correlated with μ_{0i}, it is not correlated with $\hat{\eta}_{0i}$. Therefore, by including $\hat{\eta}_{0i}$ we can obtain reliable estimates on both zero within-person variation variables, such as gender, and very slow moving variables, such as education (as well as other time-varying variables, such as income and employment).

We repeat the same steps for other subsidiary equations in the SEM model. Hence, the FEVD version of (1) is

$$\begin{aligned} LS_{it}&=\alpha_0+\sum_{s=1}^{5}\beta_s X_{sit}+\gamma_0 EDUC_{it}+Z_{it}^{'}\theta_0+\varpi_0\hat{\eta}_{0i}+u_{0it},\\ X_{1it}&=\alpha_1+\gamma_1 EDUC_{it}+Z_{it}^{'}\theta_1+\varpi_1\hat{\eta}_{1i}+u_{1it},\\ &\vdots\\ X_{5it}&=\alpha_5+\gamma_5 EDUC_{it}+Z_{it}^{'}\theta_5+\varpi_5\hat{\eta}_{5i}+u_{5it}. \end{aligned} \quad (1')$$

Again, the model can be estimated using the SEM command in STATA 13.

4. Results

4.1. Direct and indirect associations between education and life satisfaction

Table 2 first reports single-equation model of life satisfaction with education and other variables appearing on the right-hand side. Here, we include as control variables gender, age, age-squared, state of residence dummies, and wave dummies.

Looking at the estimates taken from the full sample – i.e., combining males and females samples together – (column 1), we can see that years of education is negatively and statistically significantly correlated with life satisfaction. The coefficients on the other

variables of interest are all positive, with the largest coefficient coming from being married; a one standard deviation increase in the marriage variable is associated with a 0.18 standard deviation increase in life satisfaction. This is followed, in order of size of association, by health (the absence of long-term health problems), household income, employment, and the total number of children (the coefficient for which is insignificant and close to zero in magnitude). Note that the negative and statistically significant coefficient on years of education is consistent with previous studies employing HILDA Survey data (e.g., Shields, Wheatley-Price, and Wooden, 2009).

Splitting the sample into male and female sub-samples, we can see that, consistent with previous studies, men generally derive more satisfaction from being employed and from being married than women. Women, on the other hand, report a slightly higher level of life satisfaction from the same increase in log of real equivalised household income than men. In addition, having no long-term health problems is associated with more satisfaction for women than for men. Further, the total number of children is positively associated with life satisfaction for women but negatively associated with life satisfaction for men, although both correlations are not statistically significantly different from zero. More importantly, years of education enter both gender-specific life satisfaction equations in a negative and statistically significant manner.

Table 3 moves on to present the estimates obtained from running the SEM model specified in the previous section. We begin by observing that the first panel of Table 3 (i.e., Equation 1) is an exact replication of Table 2's single-equation estimates. With respect to Equations 2–6 (or equations in which variations in different adult outcomes are explained by education), an increase in years of education is associated positively and statistically significantly with income, the likelihood of being employed, and the likelihood of having no long-term health problems in the combined samples. By contrast, there is strong evidence to suggest that more educated Australian adults tend to have fewer children on average. Moreover, there is evidence that more years of education is associated with a higher probability of being married in the combined sample. The largest positive contribution from an increase of one standard deviation in the years spent in education is in the income domain, then employment, health, and the probability of being married.

When splitting the sample by gender, we can see that a one standard deviation increase in education is associated with a greater increase in the likelihood of being employed for women than for men. In contrast, education is found to be a good predictor of the probability of being married for men but not women. Men also typically enjoy a slightly higher rate of return to education when it comes to health. On the other hand, there is very little gender difference in the effect of education on the log of real equivalised household income. Finally, the previously observed negative association between standardized years of education and standardized total number of children is negative and statistically significant for both men and women, although the estimated coefficient size is larger for women than for men.

By combining all of the above estimates together we are able to estimate and report each of the indirect effect of years of education on life satisfaction. These indirect effects are reported in Table 4.

Looking across columns, we can see that all but one of the estimated indirect effects are positive and statistically significant. Only the indirect associations between education and life satisfaction via income (0.021), employment (0.006), marriage (0.013), and health (0.014) are statistically well determined at conventional statistical levels in the combined sample.

Interesting results emerge when we compare these indirect relationships between men and women. For men, the largest indirect association between education and life satisfaction is through income (0.018). For women, the largest indirect association between education and life satisfaction is also through income (0.022). Further, while men seem to have enjoyed the indirect benefit of education through its positive effect on the probability of being employed, the same cannot be said for women. Indeed, the indirect effect of education through being employed is insignificantly different from zero for women.

A closer look at the estimates in Table 4 also suggests a noticeable gap in the size of the total indirect effects between men and women (total indirect relationship for men = 0.057; total indirect relationship for women = 0.037).

As explained earlier, to deal with potential heterogeneity bias, we adopt Boyce's (2010) FEVD model and use it in the SEM setting. On the assumption that personality is mostly stable across ten waves, we used the personality traits variables collected in wave 5 of the HILDA Survey (measuring the Big Five personality traits of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience) to assist us in the second step of the FEVD estimation.[6] The estimates obtained from this second stage are reported in Table A1. Consistent with Boyce (2010), we find that personality explains a great deal of the individual heterogeneity in life satisfaction (as well as in other outcomes). Interestingly, it is worth noting that, other things held constant, the years of education variable is not strongly correlated with the FE residual obtained from the life satisfaction equation. This implies that, given a specification that includes other individual characteristics and personality variables, education is unlikely to have suffered from unobserved heterogeneity bias in a pooled OLS estimation.

We report the third stage FEVD estimates in the SEM setting in Table 5 and the implied indirect effects in Table 6. Inclusion of the estimated η_i in each SEM equation has very little impact on the size of the estimated coefficients and the relative trade-offs between coefficients in the same equation. For example, in Table 5's Equation 1, the coefficient on education is only slightly more negative than the coefficient reported in Table 3; −0.034 compared to −0.028. Although part of these differences in the SEM estimates is attributed to the smaller sample used in the FEVD estimation (not everyone who appeared in waves 1–10 was surveyed in wave 5), it is reassuring to see in Table 6 that qualitatively similar indirect effects can still be obtained with or without the use of FEVD method. For instance, the total indirect effects of education on life satisfaction in the combined sample with and without the use of FEVD are 0.049 and 0.048, respectively. The only clear difference is that the total

[6]Qualitatively the same results can be obtained using the personality data collected in wave 9 (or the averages from both waves) in the second stage of FEVD.

indirect effects with the use of FEVD are statistically the same for men (0.050) as for women (0.048).

Finally, as a robustness check, we tested whether our results were sensitive to the specification of the education variable, replacing years of education with a dummy variable representing whether the individual had completed at least a university degree. The estimated indirect effects on life satisfaction from this alternative specification are reported in Table 7.[7] As can be seen, it makes virtually no difference to our results whether one uses years of education or a "Graduates versus non-graduates" dummy as a proxy of education. For example, a large part of the positive indirect effect of education on life satisfaction still comes from the higher levels of incomes being earned among the graduates compared to the non-graduates.

4.2. Time-profiles of the indirect effects by gender

To obtain a complete picture of the direct and indirect associations between education and life satisfaction, we next explore the time-profiles of these estimated coefficients, using data for each year over the period 2001–2010. This involves re-estimation of the SEM equations with FEVD presented in Tables 5 and 6 for each of the ten survey waves used here. A graphical summary of the results is presented in Fig. 2A–G.

What we learn from looking at these figures can be summarised as follows:

- Not all positive indirect associations are positive in all years, and vice versa for the negative indirect associations.
- Controlling for other adult outcomes, the negative direct association between education and life satisfaction has been declining over time (Fig. 2G). We are not certain why this is, given that we cannot directly explain the direct effect. It could have simply been caused by the time effect, cohort effect, or changes in the unobserved relationship between education and life satisfaction.
- The indirect association between education and life satisfaction through employment is U-shaped for women.
- There is an increasing trend in the indirect effect of education through marriage for both men and women over time.
- There appears to be relatively little difference in the estimated indirect effects between men and women, and this mostly does not change over time.

5. Discussions and conclusions

According to the traditional human capital model, people invest in education in hopes of greater lifetime wealth and consumption. While evidence of a significant financial return to schooling is well documented in the education literature, we still know very little about how this effect might contribute to individual evaluations of overall quality of life.

[7]See Table A2 for the corresponding SEM model with FEVD.

In this paper, we empirically demonstrate that, for adults living in Australia between 2001 and 2010, education is likely to be positively related to overall life satisfaction through many different channels even when *ceteris paribus* education itself has a negative and statistically significant relationship with overall life satisfaction. For both men and women, the largest estimated indirect effect of education on life satisfaction is through income. This is followed by its positive effect on long-term health. On average, men tend to benefit slightly more than women from education, in part because education is more strongly associated with a greater likelihood of employment for men. There is no statistically important indirect benefit (or cost) from what education does to either men's or women's decision over the number of children to have on life satisfaction.

Why are these results important? First, if an aim of educational policy is to maximize well-being, the pre-requisite is a model that captures in a quantitative way the relative impact of all the main influences of education on subsequent well-being. Separate studies of the effect of education on life satisfaction with different choices of control variables are of little use in helping us understand how education operates in a well-being function. These indirect effects need to be estimated together and then compared. Second, our results provide important information for people who have been thinking about whether or not to invest in more education if their ultimate goal is not in a particular area but to have a satisfied life as a whole.

The analyses presented here are, of course, not without limitations. Ideally what we would like to present is a fully causal model of education on life satisfaction. The ability to overcome the issue of unobserved heterogeneity is simply not enough. It requires running controlled experiments on a grand scale – not only on education, but also on every other aspect of a person's life – which is both expensive and requires long time horizons. Future research will have to return to address the issues of causality related to these estimated direct and indirect effects.

Another potential shortcoming is in the model's assumption of how different mechanisms work. Here, we assume that there are only two distinct channels through which education can separately influence life satisfaction: (i) the financial channel, and (ii) the non-financial channel. Yet in reality the two channels are likely to be interwoven. For example, there is a large literature in economics showing income to be a strong predictor of health and mortality, holding education constant (e.g., Gardner and Oswald, 2004). Given the complex relationships between financial and non-financial pathways of education, a multilevel mediation analysis – which is beyond the scope of this paper – might be more suitable for analysing the direct and indirect effects of education on life satisfaction. Finally, it might also be worthwhile for future researchers to test whether these direct and indirect effects of education on life satisfaction can be found in data from countries other than Australia.

References

Allen J, van der Velden R. Education mismatches versus skill mismatches: Effects on wages, job satisfaction, and on-the-job search. Oxford Economic Papers. 2001; 53(3):434–452.

Ambrey CL, Fleming CM. Life satisfaction in Australia: Evidence from ten years of the HILDA Survey. Social Indicators Research. 2014; 115(2):691–714.

Angrist JD, Krueger AB. Does compulsory school attendance affect schooling and earnings? Quarterly Journal of Economics. 1991; 106(4):979–1014.

Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology. 1986; 51(6):1173–1182. [PubMed: 3806354]

Becker, GS. A Treatise on the Family. Harvard University Press; Cambridge, MA: 1991.

Blanchflower D, Oswald AJ. Well-being over time in Britain and the USA. Journal of Public Economics. 2004; 88(7):1359–1386.

Boyce CJ. Understanding fixed effects in human well-being. Journal of Economic Psychology. 2010; 31(1):1–16.

Brighouse, H. On Education. Routledge; New York: 2006.

Carter S, McBride M. Experienced utility versus decision utility: Putting the 'S' in satisfaction. Journal of Socio-Economics. 2013; 42:13–23.

Chen W. How education enhances happiness: Comparison of mediating factors in four East Asian countries. Social Indicators Research. 2012; 106(1):117–131.

Chevalier A. Measuring over-education. Economica. 2003; 70(279):509–531.

Chiappori P, Iyigun M, Weiss Y. Investment in schooling and the marriage market. American Economic Review. 2009; 95(5):1689–1713.

Clark AE, Frijters P, Shields MA. Relative income, happiness, and utility: An explanation for the Easterlin paradox and other puzzles. Journal of Economic Literature. 2008a; 46(1):95–144.

Clark AE, Diener E, Georgellis YE, Lucas RE. Lags and leads in life satisfaction: A test of the baseline hypothesis. Economic Journal. 2008a; 118(529):F222–F243.

Diener E, Sandvik E, Seidlitz L, Diener M. The relationship between income and subjective well-being: Relative or absolute. Social Indicators Research. 1993; 28(3):195–223.

Di Tella R, MacCulloch R, Oswald AJ. The macroeconomics of happiness. Review of Economics and Statistics. 2003; 85(4):809–827.

Dolan P, Peasgood T, White M. Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. Journal of Economic Psychology. 2008; 29(1):94–122.

Dolan P, White MP. Accounting for the richness of daily activities. Psychological Science. 2009; 20(8):1000–1008. [PubMed: 19549079]

Easterlin, RA. Fertility. In: Eatwell, J.Milgate, M., Newman, P., editors. The New Palgrave, A Dictionary of Economics. The Stockton Press; New York: 1987. p. 302-308.

Easterlin RA. Income and happiness: Towards a unified theory. Economic Journal. 2001; 111(473): 465–484.

Ferrer-i-Carbonell A. Income and well-being: An empirical analysis of the comparison income effect. Journal of Public Economics. 2005; 89(5–6):997–1019.

Ferrer-i-Carbonell A, Frijters P. How important is methodology for the estimates of the determinants of happiness. Economic Journal. 2004; 114(497):641–659.

Flouri E. Subjective well-being in midlife: The role of involvement of and closeness to parents in childhood. Journal of Happiness Studies. 2004; 5(4):335–358.

Frey BS, Stutzer A. Happiness, economy and institutions. Economic Journal. 2000; 110(466):918–938.

Gardner J, Oswald AJ. How is mortality affected by money, marriage and stress. Journal of Health Economics. 2004; 23(6):1181–1207. [PubMed: 15556242]

Goldsmith AH, Veum JR, Darity W Jr. Unemployment, joblessness, psychological well-being and self-esteem: Theory and evidence. Journal of SocioEconomics. 1997; 26(2):133–158.

Graham, C., Pettinato, S. Happiness and Hardship: Opportunity and Insecurity in New Market Economies. Brookings Institution Press; Washington DC: 2002.

Green F. Unpacking the misery multiplier: How employability modifies impacts of unemployment and job insecurity on life satisfaction and mental health. Journal of Health Economics. 2011; 30(2): 265–276. [PubMed: 21236508]

Greene, WH. Econometric Analysis. Prentice Hall; Upper Saddle River, NJ: 2002.

Haller M, Hadler M. How social relations and structures can produce happiness and unhappiness: An international comparative analysis. Social Indicators Research. 2006; 75(2):169–216.

Harmon C, Walker I. Estimates of the return to schooling for the United Kingdom. American Economic Review. 1995; 85(5):1278–1286.

Hayes AF. Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. Communication Monographs. 2009; 76(4):408–420.

Headey B, Muffels R, Wooden M. Money does not buy happiness: Or does it? A reassessment based on the combined effects of wealth, income and consumption. Social Indicators Research. 2008; 87(1):65–82.

Helliwell JF. How's life? Combining individual and national variables to explain subjective well-being. Economic Modelling. 2003; 20(2):331–360.

Isen, A., Stevenson, B. NBER Working Paper Series No. 15725. Cambridge, MA: National Bureau of Economic Research; 2010. Women's education and family behavior: trends in marriage, divorce, and fertility.

Kahneman D, Krueger AB. Development in the measurement of subjective well-being. Journal of Economic Perspectives. 2006; 20(1):3–24.

Kahneman D, Wakker PP, Sarin R. Back to Bentham? Explorations of experienced utility. Quarterly Journal of Economics. 1997; 112(2):375–405.

Kettunen J. Education and unemployment duration. Economics of Education Review. 1997; 16(2): 163–170.

LaFortune J. Making yourself attractive: Pre-marital investments and the returns to education in the marriage market. American Economic Journal: Applied Economics. 2013; 5(2):151–178.

Layard, R. Happiness: Lessons from a New Science. Penguin Press; London and New York: 2005.

Layard, R., Clark, AE., Cornaglia, F., Powdthavee, N., Vernoit, J. IZA Discussion Paper No. 7682. University of Bonn; 2013. What predicts a successful life?.

Leigh A, Ryan C. Estimating returns to education using different natural experiment techniques. Economics of Education Review. 2008; 27(2):149–160.

Lleras-Muney A. The relationship between education and adult mortality in the United States. Review of Economics Studies. 2005; 72(1):189–221.

Martin TC. Women's education and fertility: Results from 26 demographic and health surveys. Studies in Family Planning. 1995; 26(4):187–202. [PubMed: 7482677]

McLafferty S. Gender, race, and the determinants of commuting: New York in 1990. Urban Geography. 1997; 18(3):192–212.

Melin R, Fugl-Meyer KS, Fugl-Meyer AR. Life satisfaction in 18- to 64-year-old Swedes: In relation to education, employment situation, health and physical activity. Journal of Rehabilitation Medicine. 2003; 35(2):84–90. [PubMed: 12691338]

Michalos AC. Education, happiness and well-being. Social Indicators Research. 2008; 87(3):347–366.

Mincer, J. NBER Working Paper Series No. 3838. Cambridge, MA: National Bureau of Economic Research; 1991. Education and unemployment.

Oreopoulos P, Salvanes K. Priceless: The nonpecuniary benefits of schooling. Journal of Economic Perspectives. 2011; 25(1):159–184.

Oswald AJ. Happiness and economic performance. Economic Journal. 1997; 107(445):1815–1831.

Oswald AJ, Powdthavee N. Does happiness adapt? A longitudinal study of disability with implications for economists and judges. Journal of Public Economics. 2008; 92(5–6):1061–1077.

Plumper T V, Troeger E. Efficient estimation of time-invariant and rarely changing variables in finite sample panel analyses with unit fixed effects. Political Analysis. 2007; 15(2):124–139.

Powdthavee N. Putting a price tag on friends, relatives, and neighbors: Using surveys of life-satisfaction to value social relationships. Journal of SocioEconomics. 2008; 37(4):1459–1480.

Powdthavee N. How much does money really matter? Estimating the causal effects of income on happiness. Empirical Economics. 2010a; 39(1):77–92.

Powdthavee N. Does education reduce the risk of hypertension? Estimating the biomarker effect of compulsory schooling in England. Journal of Human Capital. 2010b; 4(2):173–202.

Powdthavee, N. The Happiness Equation: The Surprising Economics of our Most Valuable Asset. Icon Books; London: 2010c.

Powdthavee N, van den Berg B. Putting different price tags on the same health condition: Re-evaluating the well-being valuation approach. Journal of Health Economics. 2011; 30(5):1032–1043. [PubMed: 21715036]

Psacharopoulos G, Patrinos HA. Returns to investment in education: A further update. Education Economics. 2004; 12(2):111–134.

Sander W. The effect of women's schooling on fertility. Economics Letters. 1992; 40(2):229–233. [PubMed: 12286970]

Shields MA, Wheatley-Price S. Exploring the economic and social determinants of psychological well-being and perceived social support in England. Journal of the Royal Statistical Society Series A. 2005; 168(3):513–537.

Shields MA, Wheatley-Price S, Wooden M. Life satisfaction and the economic and social characteristics of neighborhoods. Journal of Population Economics. 2009; 22(2):421–443.

Shields, MA., Wooden, M. Marriage, children and subjective well-being. Paper presented at the Eighth Australian Institute of Family Studies Conference; 12–14 February; Melbourne Exhibition Centre; 2003. (URL: http://www.melbourneinstitute.com/downloads/hilda/Bibliography/Conference_Papers/Shields_etal_Marriage,_Children_and_Subjective_Well-being.pdf)

Siles MA. The causal effect of education on health: Evidence from the United Kingdom. Economics of Education Review. 2009; 28(1):122–128.

Smith K. Individual welfare in the Soviet Union. Social Indicators Research. 2003; 64(1):75–105.

Stanca L. Suffer the little children: Measuring the effects of parenthood on well-being worldwide. Journal of Economic Behavior and Organization. 2012; 81(3):742–750.

Stutzer A. The role of income aspirations on individual happiness. Journal of Economic Behavior and Organization. 2004; 54(1):89–109.

Watson N, Wooden M. The HILDA Survey: A case study in the design and development of a successful household panel study. Longitudinal and Life Course Studies. 2012; 3(3):369–381.

Winkelmann L, Winkelmann R. Why are the unemployed so unhappy? Evidence from panel data. Economica. 1998; 65(257):1–15.

Wooden M, Freidin S, Watson N. The household, income and labor dynamics in Australia (HILDA) Survey: Wave 1. The Australian Economic Review. 2002; 35(3):339–348.

Appendix A

Tables A1 and A2

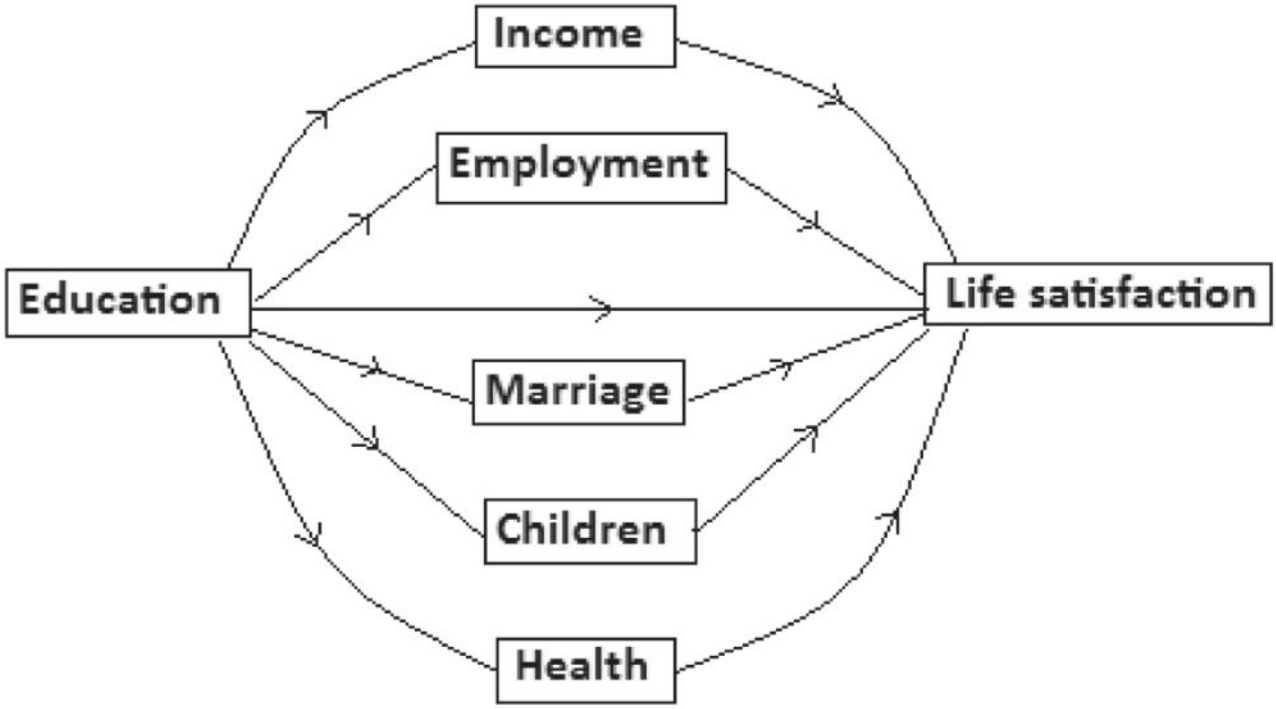

Fig. 1.
A multiple mediation model of education on life satisfaction

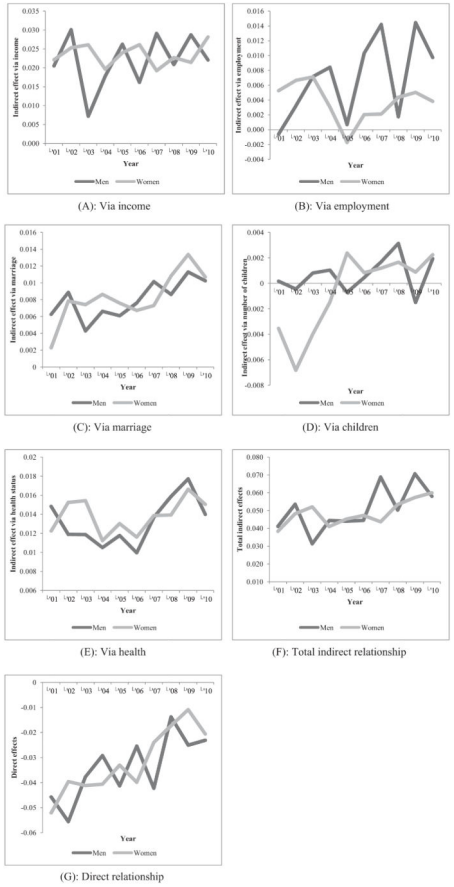

Fig. 2.

(A–G) Time profiles of the estimated implied indirect effects of a one standard deviation increase in the standardized years of education on standardized life satisfaction.

Table 1

Descriptive statistics, HILDA 2001 and 2010.

	All	Men	Women
Life satisfaction	7.83 (1.47)	7.78 (1.47)	7.88 (1.47)
Years of education	12.39 (2.29)	12.39 (2.22)	12.41 (2.36)
Log of real HH income per capita	10.17 (0.69)	10.21 (0.67)	10.14 (0.70)
Employment	0.77 (0.42)	0.85 (0.36)	0.70 (0.46)
Married	0.68 (0.46)	0.68 (0.47)	0.69 (0.46)
Number of children	1.59 (1.45)	1.48 (1.45)	1.69 (1.44)
No long-term health problems	0.81 (0.39)	0.80 (0.39)	0.81 (0.39)
Female	0.53 (0.49)		
Age	40.15 (12.76)	40.10 (12.83)	40.20 (12.71)
N	76,622	36,208	40,414

Note: Standard deviations are in parentheses. All figures are unadjusted (i.e., not standardized).

Table 2

Single-equation model of the relationship between education and life satisfaction, HILDA Survey 2001–2010.

Dependent variable: life satisfaction	All	Men	Women
Years of education	−0.028*** (0.007)	−0.026** (0.011)	−0.025*** (0.010)
Log of real equivalised household income	0.065*** (0.007)	0.055*** (0.010)	0.070*** (0.009)
Employed	0.033*** (0.007)	0.095*** (0.013)	0.005 (0.008)
Married	0.169*** (0.007)	0.168*** (0.012)	0.167*** (0.010)
Total number of children	0.003 (0.009)	−0.017 (0.014)	0.012 (0.013)
No long-term health problems	0.131*** (0.007)	0.098*** (0.009)	0.153*** (0.009)
Female	0.089*** (0.014)		
Age	−0.070*** (0.004)	−0.086*** (0.005)	−0.057*** (0.005)
Age-squared	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
N	76,622	36,208	40,414

Note:

*** <1%;

** <5%;

* <10%.

Robust standard errors are in parentheses. All regressions controlled for gender, age and age-squared, state of residence dummies, and wave dummies. All regressions also allowed for clustering at individual level. All variables are standardized with a mean of zero and a standard deviation of one.

Table 3

Structural equation modelling of the indirect effects of years of education on life satisfaction, HILDA Survey 2001–2010.

	All	Men	Women
Equation 1: Life satisfaction			
Years of education	−0.028*** (0.007)	−0.026** (0.011)	−0.025*** (0.010)
Log of real equivalised household income	0.065*** (0.007)	0.055 (0.010)	0.070 (0.009)
Employed	0.033*** (0.007)	0.095*** (0.013)	0.005 (0.008)
Married	0.169*** (0.007)	0.168*** (0.012)	0.167*** (0.010)
Total number of children	0.003 (0.009)	−0.017 (0.014)	0.012 (0.013)
No long-term health problems	0.131*** (0.007)	0.098*** (0.009)	0.153*** (0.009)
Equation 2: Log of real equivalised household income			
Years of education	0.318*** (0.007)	0.321*** (0.011)	0.316*** (0.010)
Equation 3: Employed			
Years of education	0.198*** (0.007)	0.141*** (0.010)	0.246*** (0.011)
Equation 4: Married			
Years of education	0.046*** (0.008)	0.079*** (0.011)	0.011 (0.012)
Equation 5: Total number of children			
Years of education	−0.133*** (0.009)	−0.052*** (0.013)	−0.203*** (0.012)
Equation 6: No long-term health problems			
Years of education	0.105*** (0.007)	0.121*** (0.011)	0.095*** (0.010)
N	76,622	36,208	40,414

Note: See Table 2.

Table 4

Implied indirect associations between years of education and life satisfaction, HILDA Survey 2001–2010.

Indirect effects	All	Men	Women
Log of real equivalised household income	0.021*** (0.001)	0.018*** (0.002)	0.022*** (0.002)
Employed	0.006*** (0.001)	0.013*** (0.001)	0.001 (0.001)
Married	0.008*** (0.001)	0.013*** (0.001)	0.002** (0.001)
Total number of children	−0.0003 (0.001)	0.001** (0.000)	−0.003* (0.001)
No long-term health problems	0.014*** (0.001)	0.012*** (0.001)	0.015*** (0.001)
Total indirect effects	0.048*** (0.002)	0.057*** (0.003)	0.037*** (0.002)

Note:

*** <1%;

** <5%;

* <10%.

Bootstrap standard errors (200 replications) are in parentheses. The *t*-statistics are based on the test that the two coefficients between males and females within the same year are equal. All variables are standardized with a mean of zero and a standard deviation of one.

Table 5

Structural equation modelling with the application of the fixed effects vector decomposition method, HILDA Survey 2001–2010.

	All	Men	Women
Equation 1: Life satisfaction			
Years of education	−0.034*** (0.002)	−0.035*** (0.004)	−0.033*** (0.003)
Log of real equivalised household income	0.072*** (0.003)	0.069*** (0.005)	0.074*** (0.005)
Employed	0.024*** (0.004)	0.036*** (0.007)	0.019*** (0.004)
Married	0.171*** (0.003)	0.173*** [0.005)	0.168*** (0.004)
Total number of children	0.0001 (0.003)	−0.005 (0.005)	0.003 (0.004)
No long-term health problems	0.130*** (0.003)	0.125*** (0.005)	0.133*** (0.004)
Fixed effect residual (life satisfaction)	0.985*** (0.004)	0.990*** (0.006)	0.978*** (0.006)
Equation 2: Log of real equivalised household income			
Years of education	0.317*** (0.001)	0.315*** (0.002)	0.318*** (0.002)
Fixed effect residual (income)	0.994*** (0.002)	0.992*** (0.003)	0.995*** (0.002)
Equation 3: Employed			
Years of education	0.193*** (0.001)	0.192*** (0.002)	0.193*** (0.002)
Fixed effect residual (employed)	0.993*** (0.002)	0.987*** (0.003)	0.996*** (0.002)
Equation 4: Married			
Years of education	0.048*** (0.001)	0.047*** (0.002)	0.048*** (0.002)
Fixed effect residual (married)	0.993*** (0.002)	0.989*** (0.003)	0.996*** (0.002)
Equation 5: Total number of children			
Years of education	−0.127*** (0.001)	−0.126*** (0.001)	−0.129*** (0.001)
Fixed effect residual (children)	0.994*** (0.001)	0.996*** (0.001)	0.991*** (0.001)
Equation 6: No long-term health problems			
Years of education	0.102*** (0.001)	0.103*** (0.002)	0.102*** (0.002)
Fixed effect residual (health)	0.999*** (0.002)	0.995*** (0.003)	1.001*** (0.003)
N	60,211	27,945	32,266

Note: See Table 2.

Table 6

Implied indirect associations between years of education and life satisfaction obtained from Table 5's FEVD estimates, HILDA Survey 2001–2010.

Indirect effects	All	Men	Women
Log of real equivalised household income	0.023*** (0.001)	0.022*** (0.001)	0.023*** (0.002)
Employed	0.005*** (0.001)	0.007*** (0.001)	0.004*** (0.001)
Married	0.008*** (0.000)	0.008*** (0.000)	0.008*** (0.001)
Total number of children	4.35e-06 (0.0004)	0.001 (0.001)	−0.0003 (0.001)
No long-term health problems	0.013*** (0.000)	0.013*** (0.001)	0.014*** (0.001)
Total indirect effects	0.049*** (0.001)	0.050*** (0.002)	0.048*** (0.002)

Note: See Table 4.

Table 7

Implied indirect associations between completing at least a university degree and life satisfaction, HILDA Survey 2001–2010.

Indirect effects	All	Men	Women
Log of real equivalised household income	0.043*** (0.002)	0.040*** (0.003)	0.045*** (0.003)
Employed	0.008*** (0.001)	0.013*** (0.002)	0.006*** (0.001)
Married	0.016*** (0.001)	0.016*** (0.001)	0.016*** (0.001)
Total number of children	−0.000 (0.001)	0.001 (0.001)	−0.001 (0.001)
No long-term health problems	0.025*** (0.001)	0.025*** (0.002)	0.026*** (0.001)
Total indirect effects	0.092*** (0.002)	0.095*** (0.004)	0.091*** (0.003)

Note: See Table 4.

J Behav Exp Econ. Author manuscript; available in PMC 2017 July 14.

Table A1

Predicting the fixed effect residuals using various objective characteristics and personality variables.

Variables	Fixed effect residual obtained for each dependent variable					
	Life satisfaction	**Log of real equivalised household income**	**Employment**	**Married**	**Total number of children**	**No long-term health problems**
Years of education	−0.014 (0.009)	0.326*** (0.009)	0.200*** (0.009)	0.066*** (0.010)	−0.109*** (0.010)	0.114*** (0.009)
Log of real equivalised household income	0.058*** (0.007)					
Employed	0.007 (0.007)					
Married	0.130*** (0.008)					
Total number of children	0.004 (0.010)					
No long-term health problems	0.102*** (0.007)					
Other control variables (non-standardized)						
Female	0.026 (0.017)	−0.120*** (0.017)	−0.388*** (0.018)	−0.054*** (0.021)	0.114*** (0.021)	−0.014 (0.018)
Age	−0.054*** (0.004)	0.018*** (0.004)	0.059*** (0.004)	0.100*** (0.005)	0.122*** (0.004)	0.008* (0.004)
Age-squared	0.001*** (0.000)	−0.000*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)
Personality measures from W5 (non-standardized)						
Extraversion	0.040*** (0.008)	0.036*** (0.008)	0.035*** (0.008)	0.037*** (0.009)	0.034*** (0.009)	0.024*** (0.008)
Agreeableness	0.068*** (0.011)	−0.031*** (0.010)	−0.005 (0.011)	−0.006 (0.012)	0.012 (0.012)	−0.015 (0.010)
Conscientiousness	0.027*** (0.009)	0.061*** (0.009)	0.042*** (0.009)	0.069*** (0.010)	−0.009 (0.010)	0.049*** (0.009)
Emotional stability	0.084*** (0.009)	0.003 (0.008)	0.011 (0.009)	−0.018* (0.010)	−0.012 (0.009)	0.027*** (0.008)
Openness	−0.100*** (0.009)	−0.052*** (0.009)	−0.051*** (0.010)	−0.080*** (0.010)	−0.044*** (0.010)	−0.070*** (0.009)
Constant	0.285** (0.117)	−0.368*** (0.092)	−0.893*** (0.098)	−2.125*** (0.110)	−2.883*** (0.093)	−0.009 (0.092)
Observations	59,915	59,957	60,211	60,199	60,211	60,180
R-squared	0.16	0.209	0.197	0.088	0.263	0.113

Note:

*** <1%;

** <5%;

* <10%.

Robust standard errors are in parentheses. All regressions controlled for state of residence dummies and wave dummies, and allowed for clustering at individual level. All variables are standardized with a mean of zero and a standard deviation of one. Personality traits come from wave 5 in the HILDA Survey and assumed to be mostly stable across all ten waves.

Table A2

Structural equation modelling with the application of the fixed effects vector decomposition method and completing at least a university as a proxy for education, HILDA Survey 2001–2010.

	All	Men	Women
Equation 1: Life satisfaction			
Completed at least a university degree	−0.069*** (0.005)	−0.067*** (0.008)	−0.069*** (0.008)
Log of real equivalised household income	0.069*** (0.003)	0.066*** (0.005)	0.072*** (0.005)
Employed	0.023*** (0.004)	0.034*** (0.007)	0.017*** (0.004)
Married	0.170*** (0.003)	0.173*** (0.005)	0.168*** (0.004)
Total number of children	0.001 (0.003)	−0.005 (0.005)	0.005 (0.004)
No long-term health problems	0.129*** (0.003)	0.124*** (0.005)	0.132*** (0.004)
Fixed effect residual (life satisfaction)	0.985*** (0.004)	0.990*** (0.006)	0.979*** (0.006)
Equation 2: Log of real equivalised household income			
Completed at least a university degree	0.617*** (0.005)	0.611*** (0.008)	0.620*** (0.007)
Fixed effect residual (income)	0.995*** (0.003)	0.995*** (0.005)	0.995*** (0.005)
Equation 3: Employed			
Completed at least a university degree	0.373*** (0.004)	0.371*** (0.006)	0.371*** (0.005)
Fixed effect residual (employed)	1.001*** (0.003)	0.989*** (0.005)	1.007*** (0.003)
Equation 4: Married			
Completed at least a university degree	0.092*** (0.004)	0.091*** (0.005)	0.093*** (0.005)
Fixed effect residual (married)	0.993*** (0.002)	0.989*** (0.003)	0.995*** (0.002)
Equation 5: Total number of children			
Completed at least a university degree	−0.248*** (0.002)	−0.244*** (0.004)	−0.249*** (0.003)
Fixed effect residual (children)	0.994*** (0.001)	0.991*** (0.002)	0.995*** (0.002)
Equation 6: No long-term health problems			
Completed at least a university degree	0.197*** (0.003)	0.197*** (0.005)	−0.249*** (0.003)
Fixed effect residual (health)	1.002*** (0.002)	0.999*** (0.003)	0.997*** (0.002)
N	60,211	27,945	32,266

Note: See Table 2.