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Abstract

The question of whether there is a connection between income and psychological well-being is a long-studied issue across the social, psychological, and behavioral sciences. Much research has found that richer people tend to be happier. However, relatively little attention has been paid to whether happier individuals perform better financially in the first place. This possibility of reverse causality is arguably understudied. Using data from a large US representative panel we show that adolescents and young adults who report higher life satisfaction or positive affect grow up to earn significantly higher levels of income later in life. We focus on earnings approximately one decade after the person's well-being is measured; we exploit the availability of sibling clusters to introduce family fixed-effects; we account for the human capacity to imagine later socio-economic outcomes and to anticipate the resulting feelings in current wellbeing. The study's results are robust to the inclusion of controls such as education, IQ, physical health, height, self-esteem, and later happiness. We consider how psychological well-being may influence income. Sobel-Goodman mediation tests reveal direct and indirect effects that carry the influence from happiness to income. Significant mediating pathways include a higher probability of obtaining a college degree, getting hired and promoted, having higher degrees of optimism and extraversion, and less neuroticism.

JEL-Code: D030, D310, D600.

Keywords: income, life satisfaction, positive affect.

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Author contributions: JDN and AJO jointly designed the research; JDN led the study and wrote the first draft of the paper; JDN analyzed the data; both authors revised the draft. The authors declare no conflict of interest.

Introduction

The relationship between money and human happiness has generated a burgeoning cross-disciplinary literature. Virtually all published research on this matter has considered the effects of income upon subjective well-being (see e.g. 1-9). This study examines—and provides evidence of—the reverse. Using longitudinal information within families (exploiting so-called sibling fixed-effects), it finds that happier people go on, many years later, to earn greater incomes. The results are suggestive of some form of causal relationship between well-being and income.

That the scholarly debate has mostly developed uni-directionally should probably not come as a surprise given that it mirrors both our societal preoccupation with economic development and the conventional wisdom that human well-being follows from high income. The question of whether "money buys happiness" has not only dominated the investigation into the relationship between money and happiness, it has also taken on increasingly causal language as research showed positive (but marginally diminishing) effects of rising income upon well-being, with some differences observed between life satisfaction and emotional well-being (1). However, relatively little attention has been paid to whether happier individuals perform better financially in the first place. This possibility of reverse causality is arguably understudied.

In this study we therefore address the question of whether "happiness pays". We do so in a US representative panel of over 10,000 individuals and explore the potential mediating pathways running from happiness to later income. This work does not intend to undermine the aforementioned literature on the effect of income on well-being. Rather, the goal is to make the case that the relationship between income and happiness is *dynamic* and that effects may run in both directions, thus complementing existing scholarship.

An effect running from subjective well-being to income could exist for a number of

reasons. Happiness has various correlates such as health (10), social networks (11), and self-esteem (12) that, in turn, are known to positively influence labor market outcomes and that may thus play a mediating role. More recent neuroscientific research provides clues that greater subjective well-being is associated with particular neurological variation which, in turn, is associated with improved cognitive skills and economic outcomes. Such neurological mediation pathways centre on the role of positive emotions (reward) in stimulating the dopaminergic system and increasing cognitive capacity for memory tasks and attention span (13-16). These neuroscientific insights and aforementioned correlates provide some reason to believe that there could be an effect running from subjective well-being to economic outcomes.

A handful of studies have previously tried to estimate the influence of subjective well-being on later income. Diener et al. (17) find a positive correlation between "cheerfulness" measured in a sample of elite college students and their income levels some 19 years later. This association is particularly significant for those with below average levels of cheerfulness. Ed Diener and colleagues later expand on this finding to show that individuals who experience the highest levels of happiness do not necessarily perform best in terms of later income and that the "optimal" level of happiness for later income appears to be a moderately high level of happiness (18). Three other studies consider the broader effects of happiness on life events including income, marriage, employment, and health (19-20), as well as consumption and savings behavior (21). The panel studies used in these studies are the British Household Panel Study, Russia Longitudinal Monitoring Survey, German Socio-Economic Panel and the DNB Household Survey in the Netherlands. In a laboratory setting, Oswald, Proto, and Sgroi (22) induce variation in positive mood and find that it is predictive of productivity in a lab task. The promising results from inquiries into the socio-economic and productivity effects of

happiness has led some to speak of a "happiness advantage" (23) in shaping career success (24) and provides further ground for why a deeper investigation is warranted.

Although the aforementioned studies are important, because they point towards a potential role for happiness in shaping socio-economic outcomes, they face a number of methodological difficulties. First, these studies continue to leave room for alternative explanations: cross-sectional results may be the result of genetic confounding and other omitted variables; longitudinal designs have so far not accounted for the human capacity to imagine later socio-economic outcomes and anticipate the resulting feelings in current well-being (25-26); and experimental designs are not in a position to evaluate longer-term effects outside the lab. Second, previous work has separately considered measures of mood, happiness, life satisfaction, and mental health. The more recent literature, however, has argued that emotional well-being and satisfaction with life are two important yet different components of well-being (1). Emotional well-being refers to the frequency and intensity of everyday emotional experiences (both positive and negative). The positive emotions and the experience of feeling happy are commonly referred to as positive affect. Life satisfaction on the other hand refers to a longer-term evaluation of one's life. Although measures of positive affect and life satisfaction correlate—and load onto a common genetic factor (27)—they show varying salience in different circumstances of people's lives, including in their relationship to income and age (1, 28-29). None of the previous studies considered the dual effect of emotional well-being and life satisfaction on later income even though Kahneman and Deaton (1) conclude that the effect of income on positive affect is less pronounced (and ceases beyond an annual income of ~$75,000) compared to the effect of income on life satisfaction. It is therefore necessary to investigate whether a similar distinction can be made in the opposite direction, i.e. the effect running from well-being on income. Finally, if income is indeed endogenous to

happiness it becomes important to study how happiness may influence income. To address these questions, this paper studies whether life satisfaction and positive affect are predictive of later income—while tackling the endogeneity concerns that were hitherto unaddressed—and investigates potential mediating pathways.

Results

Fig. 1 illustrates the study's key result. It plots the (uncorrected) relationship between subjective well-being and later earnings in a large US representative panel study (Add Health). Reports of positive affect or life satisfaction in adolescence and young adulthood correlate significantly with income around age 29 (all between $r = 0.078$—0.090 with $p < 0.001$, see Table S2 in Supporting Information). Income here is defined in the following way: "Now think about your personal earnings. In {2006/2007/2008}, how much income did you receive from personal earnings before taxes, that is, wages or salaries, including tips, bonuses, and overtime pay, and income from self-employment?" Similar to the finding on "cheerfulness" by Diener et al (17), we observe that the relationship is particularly pronounced for those individuals with lower levels of happiness. In fact, reporting a profoundly unhappy adolescence is associated with an income around age 29 that is ~30% less than average, whereas a very happy adolescence is associated with a later income that is ~10% above average.

Regression analyses reported in Table 1 confirm this pattern. The predictive power of happiness on later earnings depends on the lag time between both variables, e.g. a one standard deviation increase in life satisfaction at the age of 22 is associated with a 5% increase in earnings at the age of 29 (SD = 0.81 on a scale of 5). In absolute terms, a one-point increase in life satisfaction at the age of 22 is associated with almost $2,000 higher earnings at the age of 29 (this $ value is obtained in an empirical model identical to the

one reported in Table 1 except for using income values instead of their natural logarithm). The analyses reported here include the following covariants: age, gender, ethnicity, education, IQ, physical health, height, and self-esteem (for a detailed specification of these variables see Table S1 in SI). Most of these covariates are standard. However, unlike previous longitudinal studies of subjective well-being on later socio-economic outcomes and life events (17-21) the richness of the data set used here allows us to incorporate a measure of self-esteem that is surveyed at the same time as positive affect and life satisfaction. Self-esteem is a psychological construct distinct from happiness (12) and self-esteem is an important driver of labor market outcomes (30). As such, it is an important variable to control for in a study of the effect of happiness on later outcomes as not doing so may otherwise bias the coefficients obtained on happiness (results in Table 2 indicate that self-esteem and subjective well-being have similarly significant effects on later earnings). Furthermore, introducing a measure of self-esteem may also allow us to control for feelings that anticipate happiness related to individual expectations of socio-economic outcomes. The human capacity to imagine later outcomes and anticipate the resulting feelings in current well-being is well-known (25-26). Self-esteem may capture the confidence one has in later earnings potential and thus also account for the positive or negative feelings associated with the anticipated outcomes. Though longitudinal studies allow for measuring subjective well-being prior to the outcome of interest they cannot prevent expectations about those later outcomes from being correlated with an earlier state of mind and thus introduce bias into the earlier measures of happiness. Introducing a concurrent measure of self-esteem alongside subjective well-being in adolescence and young adulthood may therefore also help account for anticipated feelings surrounding earnings potential.

Subjective well-being also has an important latent or stable component that is

considered to be contingent on genetic variation and certain personality traits (27, 31-34). To help distinguish variation in positive affect and life satisfaction—in adolescence and young adulthood—from variation in innate predispositions we also include in our analyses a measure of positive affect that is reported at the same time as income (around age 29). Doing so is important. It allows us to capture the influence of variation in subjective well-being beyond the latent dimensions specific to the individual.

Looking at Models 1—3 in Table 1, we find that positive affect in 1994 (age 16) and 1996 (age 18), as well as life satisfaction in 2001 (age 22), each significantly predict later earnings (age 29). Model 4 jointly considers all these measures of subjective well-being over time and shows that the predictive power of variation in happiness on later income at those time points gradually rises as the time lag shrinks.

The analyses reported in Table 2 go one step further. They exploit the availability of sibling clusters in the data to introduce family fixed effects (for those individuals identified as twin pairs, full-siblings, half-siblings, or unrelated siblings raised together). The siblings' sample is similar in demographic composition to the full Add Health sample (35). The structure of this data allows us to compare siblings to each other while holding the family environment constant (as well as a substantial portion of the genetic variation in most cases) which, in turn, aids our interpretation of the relationship between well-being and income.

Table 2 shows that a one standard deviation difference in life satisfaction as compared to the family mean at age 22 is associated with a 6% difference in earnings as compared to the family mean at age 29. In absolute terms, a one-point difference in life satisfaction (on a scale of 5) as compared to the family mean at age 22 is associated with an almost $4,000 difference in earnings as compared to the family mean at age 29 (this $ value is obtained in an empirical model identical to the one reported in Table 2 except for

using income values instead of their natural logarithm). Looking at Models 1—3 in Table 2 we find that measures of positive affect and life satisfaction in adolescence and early adulthood are positively associated with later earnings. Model 4 jointly considers all these measures of subjective well-being over time and obtains a significant coefficient for life satisfaction on later income. The effect sizes of the well-being measures remain relatively stable between Table 1 (full panel) and Table 2 (sibling panel). The lower significance levels in Table 2 are presumably due to the reduced number of observations in the sibling panel as well as having accounted for family fixed effects.

Tables S7-S8 in Supporting Information present results for an individual fixed effects model and a Granger causality analysis that use the available information on earnings in 2001 (age 22). Both model specifications obtain highly significant results for the effect of lagged subjective well-being on earnings. However, we do not lend these results full credence given that earnings at age 22 may not yet accurately represent individual income and also because these panel data allow for only one time interval and the exogeneity assumption necessary for panel data models is unlikely to be satisfied.

If income is indeed endogenous to happiness, it becomes important to study *how* happiness comes to influence a person's income. Table 3 presents results for our investigation into potential mediating pathways. These univariate Sobel-Goodman mediation tests consider potentially mediating variables that may carry some of the effect from happiness onto income (36). We choose a number of standard socio-economic variables as well as psychological constructs such as personality traits, optimism, and self-esteem. Only measures in 2008 are used—in order to reduce confounding with the earlier measures of subjective well-being. Table 3 shows that most of the chosen variables are correlated with earlier measures of positive affect and life satisfaction and also carry some part of their influence onto income. The most significant mediating pathways include

obtaining a college degree, getting hired and promoted, higher degrees of optimism and extraversion, and less neuroticism. These variables each partially mediate the observed association with income and may represent an indirect effect as large as approximately 38% in the case of positive affect (around age 18) and obtaining a college degree. These results provide the first support for causal mechanisms running from subjective well-being to later income. Table S9 in SI presents the results for a multivariate mediation analysis that considers these mediating variables jointly. The total mediated effect for these variables is estimated between 68%—78% thus revealing an important combined indirect effect, in addition to a direct effect, that carries the influence from happiness to income. These results suggest a relationship that is pleiotropic in nature with psychological well-being having an independent effect on both income and the mediating variables.

Discussion

This study reverses one of the famous questions of social science. It is an attempt to explore the influence not of income upon well-being but instead of well-being upon income. As Figure 1 illustrates, the linkages are estimated to be long and the empirical consequences large.

The paper's contribution is partly substantive and partly methodological. By the nature of its data, the study is able to introduce sibling-fixed effects to account for much potential omitted-variable bias (family-related covariates, including a significant part of genetic endowment). Compared with individual fixed-effects, sibling fixed-effects allows for making inferences about the lagged effects of well-being at particular time points (such as adolescence and young adulthood) instead of having to consider variation between time intervals. This work also applies mediation analysis, and may thus help to uncover the

mechanisms running from well-being to later income. The most significant mediating pathways include obtaining a college degree, getting hired and promoted, and having higher degrees of optimism and extraversion, and less neuroticism. Including current happiness in this longitudinal study allows us to better control for variation in latent well-being predisposition. This enables an examination of the consequences of variation in life satisfaction and positive affect at adolescence and young adulthood above-and-beyond any variation in the stable component of well-being. The use of a large US representative panel on this question also distinguishes this research from prior work that looked at the economic benefits of psychological well-being, as does offering a joint analysis of life satisfaction and positive affect. Finally, the study is the first attempt to account for a person's "anticipated happiness" in this kind of longitudinal analysis (through its use of proxy measures of current self-esteem). This should help to prevent a person's conscious or subconcious expectations about their future earnings from introducing bias into the estimate of the consequences of current psychological well-being.

For researchers who study human well-being, the message of the paper is that well-being regression equations cannot be expected to be estimated in a reliable way unless allowance is made for the endogeneity of income. This study also points to long time-lags between psychological well-being in year T and people's incomes in year T+10 and beyond. Greater knowledge of the underlying causes of these remarkable lags, and their reach in social and economic processes, will be needed. Research that considers the potential benefits of variation in life satisfaction or positive affect is part of a fairly new avenue in the study of human well-being. Although most research in this literature has studied the determinants of happiness, recently has there been growing interest in the broader benefits that happiness may induce (10, 29, 37). For policy-makers, the existence of these mechanisms raises the possibility that a happier society may be one that

intrinsically generates higher incomes for its citizens. Traditional thinking has focused upon the opposite.

Although human well-being is considered instrumentalist in this paper or as a means—rather than an end in itself—it needs to be emphasized that this is not with a view to putting money centre-stage at the expense of happiness. To the contrary, the results indicate that happiness and income are connected by a two-way relationship, and that human well-being can itself be a source of economic dynamism.

Materials and Methods

Data is from the restricted-use National Longitudinal Study of Adolescent Health (Add Health) sample available by contractual agreement (38). Add Health was started in 1994 in order to explore the health-related behavior of adolescents in grades 7 through 12. By now, 4 waves of data collection have taken place and participating subjects were around 30 years old in Wave IV (2008). The first wave of the Add Health study (1994-1995) selected 80 high schools from a sampling frame of 26,666 schools. The schools were selected based on their size, school type, census region, level of urbanization, and percent of the population that was white. Participating high schools were asked to identify junior high or middle schools that served as feeder schools to their school. This resulted in the participation of 145 middle, junior high, and high schools. From those schools, 90,118 students completed a 45-minute questionnaire and each school was asked to complete at least one School Administrator questionnaire. This process generated descriptive information about each student, the educational setting, and the environment of the school. From these respondents, a core random sample of adolescents in grades 7-12 were drawn plus several over-samples, bringing the total for Wave I to 20,745 adolescents. These students and their parents were administered in-home surveys. Wave II (1996) was

comprised of another set of in-home interviews of 14,738 students from the Wave I sample. Wave III (2001-2002) consisted of an in-home interview of 15,197 Wave I participants. Finally, Wave IV (2008) consisted of an in-home interview of 15,701 Wave I participants. The result of this sampling design is that Add Health is a nationally representative study. Women make up 49% of the study's participants, Hispanics 12%, Blacks 16%, Asians 3%, and Native Americans 2%. Participants in Add Health also represent all regions of the United States.

In Wave I of the Add Health study, researchers screened for sibling pairs including all adolescents that were identified as twin pairs, full-siblings, half-siblings, or unrelated siblings raised together. The sibling-pairs sample is similar in demographic composition to the full Add Health sample (35). Consequently, in all regression models we cluster the standard errors of our estimates in order to better account for the fact that a subset of our observations is not independent. The structure of this data also allows us to compare siblings to each other while holding the family environment constant, which aids our interpretation of the relationship between well-being, childhood context, and income as an adult.

In all four interview waves of Add Health the subjects were asked about their subjective well-being. In particular, in waves I and II, the positive affect sub-scale of the CES-D index (39) was administered. The CES-D index asks how often certain statements were true during the last week. The positive affect sub-scale is additively composed of the responses to the following four particular statements: “You enjoyed life”, “You were happy”, “You felt hopeful about the future”, and “You felt that you were just as good as other people.” The detailed question and answer structure for the four questions that make up this positive affect scale are given in Supporting Information (Table S1). The life satisfaction question was surveyed in wave III only and asked: “How satisfied are you

with your life as a whole?" Income in wave IV was reported as personal earnings before taxes and the mean income in the Add Health sample was approximately $35,000. The measure for self-esteem was derived from the answer to "Compared with other people your age, how intelligent are you?" which was surveyed in all interview waves. Precise variable descriptions and descriptive statistics, as well as distribution scales for the well-being measures, are given in Table S1 for all variables employed in this paper. A correlation matrix for the well-being measures across all interview waves and income in wave IV is also given in SI (Table S2).

The analyses are run using linear regression models with clustering on standard errors in order to better account for the fact that a subset of the Add Health observations are not independent. We also leverage the sibling clusters in the Add Health data by introducing family fixed effects (Table 2). The empirical framework here follows a standard specification where income (in 2008) is regressed on earlier subjective well-being measures and a set of other characteristics. With family fixed effects the empirical model takes the following form:

$$Y_{ij} = \beta_0 + \beta_1(SWB_{ij}) + \beta_k(Z_{kij}) + \mu_j + \varepsilon_{ij}$$

where i and j index individual and family respectively and Y_{ij} is earnings. Z_k is a matrix comprised of variables that may differ between siblings (gender, age, height, self-esteem, etc.). To control for common family attributes family fixed effects are introduced (μ_j) and ε_{ij} represents an individual-specific error. Such family fixed effect analyses are equivalent to differencing all equation variables within sibling pairs in order to account for family-related unobservables. For a discussion of assumptions involved see Griliches (40) and more recent surveys. As compared to individual fixed effect panel studies, the advantage of a family fixed effects model is that it allows for the study of longer-term effects of subjective well-being at a particular time period, here in adolescence and young

adulthood.

To test for mediation we employ the Sobel-Goodman method available in the STATA package that follows the logic described in Baron and Kenny (35). A variable is considered a mediator (M) if it carries some part of the effect from an independent variable (X), here positive affect and life satisfaction, onto a dependent variable (Y), in our case later earnings. Mediation occurs if (i) X significantly predicts M; (ii) X significantly predicts Y in the absence of M; (iii) M significantly predicts Y controlling for X; and (iv) the effect of X on Y shrinks upon addition of M. Description and references for the multivariate mediation test are provided in SI (Table S9).

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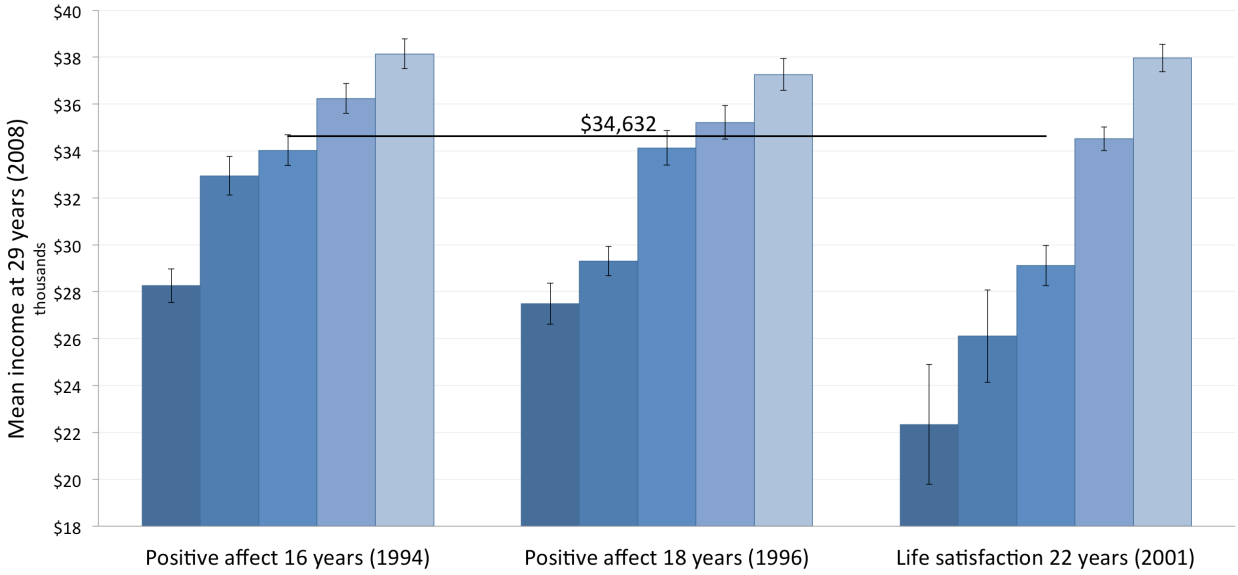
Figure legends

Fig 1. The longitudinal relationship between subjective well-being (at ages 16, 18, and 22) and later earnings (at age 29).



Response categories for positive affect (at ages 16 and 18) and life satisfaction (at age 22) are presented in relationship with their respective mean income levels at about age 29. Mean income across the sample is $34,632 at age 29. N equals 14,867 for positive affect at age 16, N equals 11,253 for positive affect at age 18, and N equals 12,415 for life satisfaction at age 22. The original positive affect variable categories are reshaped to a 5-point scale for ease of comparison. Error bars (2 standard errors) are shown.

Table legends

Table 1. Earnings equations: Linear regression models of log income at age 29 (in year 2008) on lagged subjective well-being (ages 14, 16, and 22) and covariates.

	Model 1		*Model 2*		*Model 3*		*Model 4*	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Positive affect (1994)	0.033	0.002					0.014	0.314
Positive affect (1996)			0.044	0.000			0.030	0.037
Life satisfaction (2001)					0.051	0.000	0.047	0.000
Positive affect (2008)	0.092	0.000	0.089	0.000	0.086	0.000	0.074	0.000
Male	0.149	0.000	0.146	0.000	0.147	0.000	0.145	0.000
Age	0.089	0.000	0.084	0.000	0.088	0.000	0.085	0.000
College	0.210	0.000	0.216	0.000	0.212	0.000	0.201	0.000
IQ	0.038	0.001	0.037	0.004	0.043	0.000	0.030	0.022
Medication	0.013	0.174	0.013	0.253	0.013	0.197	0.014	0.211
Height	0.036	0.008	0.039	0.011	0.035	0.011	0.037	0.016
Self-esteem (1994)	0.057	0.000					0.041	0.003
Self-esteem (1996)			0.044	0.001			0.015	0.306
Self-esteem (2001)					0.054	0.000	0.030	0.017
Black	-0.068	0.000	-0.064	0.000	-0.063	0.000	-0.065	0.000
Hispanic	0.056	0.000	0.065	0.000	0.051	0.000	0.064	0.000
Asian	0.062	0.000	0.063	0.000	0.061	0.010	0.064	0.000
Intercept	10.15	0.000	10.14	0.000	10.15	0.000	10.14	0.000
N	11,080		8,620		11,086		8,585	
R^2	0.12		0.12		0.13		0.13	

Variable coefficients are standardized and p-values are presented. Variable definitions are in Supporting Information (Table S1).

Table 2. Earnings equations: Sibling fixed effects models of log income at age 29 (in year 2008) on lagged subjective well-being (ages 14, 16, and 22) and covariates.

	Model 1		*Model 2*		*Model 3*		*Model 4*	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Positive affect (1994)	0.060	0.044					0.018	0.575
Positive affect (1996)			0.048	0.110			0.035	0.264
Life satisfaction (2001)					0.062	0.026	0.069	0.015
Positive affect (2008)	0.071	0.010	0.062	0.028	0.066	0.016	0.043	0.132
Male	0.119	0.007	0.135	0.003	0.114	0.009	0.134	0.003
Age	0.129	0.000	0.115	0.000	0.127	0.000	0.115	0.000
College	0.166	0.000	0.176	0.000	0.158	0.643	0.162	0.000
IQ	0.003	0.960	0.018	0.660	0.022	0.573	0.017	0.685
Medication	-0.008	0.772	-0.015	0.582	-0.08	0.753	-0.015	0.586
Height	0.081	0.082	0.081	0.082	0.093	0.042	-0.080	0.087
Self-esteem (1994)	0.033	0.271					0.011	0.737
Self-esteem (1996)			0.035	0.244			0.016	0.610
Self-esteem (2001)					0.061	0.042	0.039	0.179
Intercept	10.14	0.000	10.14	0.000	10.13	0.000	9.981	0.000
N	3,216		3,029		3,217		3,017	
R^2	0.11		0.13		0.11		0.13	

Variable coefficients are standardized and p-values are presented. Variable definitions are in Supporting Information (Table S1).

Table 3. Univariate Sobel-Goodman mediation tests on log income at age 29 (2008).

Independent variable	*Positive affect (1994)*			*Positive affect (1996)*			*Life Satisfaction (2001)*		
Mediating variable	Coeff.	p-value	%	Coeff.	p-value	%	Coeff.	p-value	%
Job (2008)	0.017	0.000	15	0.025	0.000	22	0.019	0.000	18
Supervision (2008)	0.006	0.000	5	0.006	0.000	5	0.006	0.000	6
College (2008)	0.039	0.000	36	0.043	0.000	38	0.032	0.000	28
Married (2008)	0.004	0.000	4	0.004	0.000	4	0.014	0.000	12
Optimism (2008)	0.032	0.000	29	0.036	0.000	32	0.029	0.000	25
Self-esteem (2008)	0.017	0.000	15	0.018	0.000	16	0.005	0.000	4
Openness (2008)	0.004	0.003	4	0.005	0.010	4	-0.000	0.651	0
Conscientiousness (2008)	0.003	0.000	3	0.003	0.000	3	0.004	0.000	3
Extraversion (2008)	0.006	0.000	5	0.006	0.000	5	0.004	0.000	4
Agreeableness (2008)	-0.001	0.181	-1	-0.002	0.126	-2	-0.000	0.672	0
Neuroticism (2008)	0.028	0.000	25	0.031	0.000	27	0.028	0.000	25

Presented are the Sobel test coefficient, p-value, and the proportion of the total effect that is mediated (%). All variable coefficients are standardized. Variable definitions are in Supporting Information (Table S1). To test for mediation we employ the Sobel-Goodman method available in the Stata package that follows the logic described in Baron and Kenny (35). A variable is considered a mediator (M) if it caries some part of the effect from an independent variable (X), here positive affect and life satisfaction, onto a dependent variable (Y), in our case later earnings. Mediation occurs if (i) X significantly predicts M; (ii) X significantly predicts Y in the absence of M; (iii) M significantly predicts Y controlling for X; and (iv) the effect of X on Y shrinks upon addition of M.

Supporting Information (SI)

Estimating the influence of life satisfaction and positive affect on later income using sibling fixed-effects

Jan-Emmanuel De Neve and Andrew J. Oswald

Tables S1-S9
Figures S1-S2

Table S1 Variable descriptions	Source	Range	N	Mean	SD
Income (2008)	Now think about your personal earnings. In {2006/2007/2008}, how much income did you receive from personal earnings before taxes, that is, wages or salaries, including tips, bonuses, and overtime pay, and income from self-employment?	$0 – $920,000	14,914	34,632	38,284
Positive affect (1994)	CES-D sub-index additively composed of: How often was each of the following true during the last week? You felt that you were just as good as other people You felt hopeful about the future You were happy You enjoyed life	0. never or rarely 1. sometimes 2. a lot of the time 3. most of the time or all of the time additive index 0 to 12	20,648	7.96	2.70
Positive affect (1996)	Idem	Idem	14,698	8.08	2.69
Life satisfaction (2001)	How satisfied are you with your life as a whole?	1. very satisfied 2. satisfied 3. neither satisfied n or dissatisfied 4. dissatisfied 5. very dissatisfied	15,157	4.15	0.81
Positive affect (2008)	CES-D sub-index additively composed of: How often was each of the following true during the last week? You felt that you were just as good as other people You were happy You enjoyed life [“You felt hopeful about the future” is not available]	0. never or rarely 1. sometimes 2. a lot of the time 3. most of the time or all of the time additive index 0 to 9	15,687	6.67	2.06
Male		dummy	20,743	0.49	0.50
Age (2001)		18 - 27	15,170	22.0	1.77
White		dummy	20,704	0.62	0.49
Black		dummy	20,704	0.23	0.42
Hispanic		dummy	20,745	0.17	0.38
Asian		dummy	20,704	0.08	0.27
Job (2008)	Are you currently working for pay at least 10 hours a week?	dummy	13,016	0.78	0.41
Supervision (2008)	Thinking about your official job duties, which of the following statements best describes your supervisory responsibilities at your (current/most recent) primary job?	0. I (do/did) not supervise anyone 1. I (supervise/supervised) other employees 2. I (supervise/supervised) other employees,	15,447	0.46	0.67

		some of whom (supervise/supervised) others			
Married (2008)	What is the current status of your marriage to {initials}? 1. living together 2. living apart because of legal separation 3. living apart because of other reason such as career, military service, family illness, etc. 4. legitimate skip	Dummy (loading respondents of categories 1 and 3)	15,216	0.42	0.49
College (2008)	College degree or higher	dummy	15,697	0.32	0.46
Medication (2001)	In the past 12 months, have you taken any prescription medication—that is, a medicine that must be prescribed by a doctor or nurse?	dummy	15,150	0.61	0.49
Optimism (2008)	LOT-R Optimism index additively composed of: 1. I'm always optimistic about my future* 2. I hardly ever expect things to go my way 3. Overall, I expect more good things to happen to me than bad* 4. I rarely count on good things happening to me *reverse coded	1. strongly agree 2. agree 3. neither agree nor disagree 4. disagree 5. strongly disagree additive index 4 to 20	15,672	14.88	2.45
Self-esteem (1994)	Compared with other people your age, how intelligent are you?	1. moderately below average 2. slightly below average 3. about average 4. slightly above average 5. moderately above average 6. extremely above average	20,644	3.85	1.10
Self-esteem (1996)	Idem	Idem	14,704	3.94	1.10
Self-esteem (2001)	Idem	Idem	15,121	3.96	1.07
Openness (2008)	Openness to experience index additively composed of: I have a vivid imagination* I am not interested in abstract ideas I have difficulty understanding abstract ideas I do not have a good imagination *reverse coded	1. strongly agree 2. agree 3. neither agree nor disagree 4. disagree 5. strongly disagree additive index 4 to 20	15,509	14.50	2.45
Conscientiousness (2008)	Conscientiousness index additively composed of: I get chores done right away* I often forget to put things back in their proper place I like order* I make a mess of things	Idem	15,657	14.64	2.70

	*reverse coded				
Extraversion (2008)	Extraversion index additively composed of: I am the life of the party* I don't talk a lot I talk to a lot of different people at parties* I keep in the background *reverse coded	Idem	15,634	13.22	3.06
Agreeableness (2008)	I sympathize with others' feelings* I am not interested in other people's problems I feel others' emotions* I keep in the background *reverse coded	Idem	15,644	15.24	2.41
Neuroticism (2008)	I have frequent mood swings* I am relaxed most of the time I get upset easily* I seldom feel blue *reverse coded	Idem	15,652	10.45	2.74

Table S2. Correlations table for income and subjective well-being in Add Health data. Significance levels (p-value) are given below correlation coefficients.

	Income	PA1994	PA1996	LS2001	PA2008
Income (2008)	**1.0000**				
Positive affect (1994)	**0.0777**	**1.0000**			
	0.0000				
Positive affect (1996)	**0.0905**	**0.4892**	**1.0000**		
	0.0000	0.0000			
Life satisfaction (2001)	**0.0856**	**0.1357**	**0.1730**	**1.0000**	
	0.0000	0.0000	0.0000		
Positive affect (2008)	**0.0950**	**0.2529**	**0.2887**	**0.2505**	**1.0000**
	0.0000	0.0000	0.0000	0.0000	

Table S3. Distribution table positive affect (1994)

Positive affect (1994)	Freq.	Percent	Cum.
0	84	0.41	0.41
1	127	0.62	1.02
2	308	1.49	2.51
3	661	3.20	5.71
4	1,268	6.14	11.86
5	1,563	7.57	19.43
6	2,167	10.49	29.92
7	2,405	11.65	41.57
8	2,810	13.61	55.18
9	2,659	12.88	68.06
10	2,270	10.99	79.05
11	2,103	10.19	89.23
12	2,223	10.77	100.00
Total	20,648	100.00	

Table S4. Distribution table positive affect (1996)

Positive affect (1996)	Freq.	Percent	Cum.
0	34	0.23	0.23
1	108	0.73	0.97
2	198	1.35	2.31
3	421	2.86	5.18
4	867	5.90	11.08
5	1,092	7.43	18.51
6	1,423	9.68	28.19
7	1,641	11.16	39.35
8	2,080	14.15	53.50
9	1,906	12.97	66.47
10	1,662	11.31	77.78
11	1,543	10.50	88.28
12	1,723	11.72	100.00
Total	14,698	100.00	

Table S5. Distribution table life satisfaction (2001)

Life satisfaction (2001)	Freq.	Percent	Cum.
1	92	0.61	0.61
2	534	3.52	4.13
3	1,908	12.59	16.72
4	7,097	46.82	63.54
5	5,526	36.46	100.00
Total	15,157	100.00	

Table S6. Distribution table positive affect (2008)

Positive affect (2008)	Freq.	Percent	Cum.
0	48	0.31	0.31
1	95	0.61	0.91
2	306	1.95	2.86
3	1,019	6.50	9.36
4	1,156	7.37	16.73
5	1,552	9.89	26.62
6	2,694	17.17	43.79
7	2,410	15.36	59.16
8	2,186	13.94	73.09
9	4,221	26.91	100.00
Total	15,687	100.00	

Table S7. Individual fixed-effects models of log income on lagged subjective well-being and covariates.

	FE		*Prais (Cochrane-Orcutt)*	
	Coeff.	P-value	Coeff.	P-value
SWB (lagged)	0.50	0.000	0.136	0.000
Intercept	7.55	0.000	9.66	0.000
N	20,436		7,035	
$Ngroups$	13,401			
R^2	0.03		0.01	
$Durbin-Watson$	0.82			

Note that this time series only covers 2 time periods for which earnings are available (2001 and 2008). Subjective well-being variables are transformed into 5-point scales.

Table S8. Granger causality tests.

	Log income (2008)		*Positive affect (2008)*	
	Coeff.	P-value	Coeff.	P-value
Log income (lagged, 2001)	0.033	0.000	0.002	0.643
Life satisfaction (lagged, 2001)	0.113	0.000	0.262	0.000
Intercept	9.92	0.000	-0.00	0.000
N	9,090		10,024	
R^2	0.02		0.07	
F-test Life satisfaction (p-value)	0.000			
F-test Log income (p-value)			0.643	

Granger causality tests analyze whether lagged observations of income (2001) and life satisfaction (2001) have incremental forecasting power when added to a univariate autoregressive representation of income (2008) and positive affect (2008).

Table S9. Multivariate mediation test on log income (2008).

Independent variable	*Positive affect (1994)*		*Positive affect (1996)*		*Life satisfaction (2001)*	
Mediating variables	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Job (2008)	0.013	0.000	0.020	0.000	0.017	0.000
Supervision (2008)	0.005	0.000	0.005	0.000	0.004	0.001
College (2008)	0.032	0.000	0.036	0.000	0.026	0.000
Married (2008)	0.002	0.001	0.003	0.002	0.011	0.000
Optimism (2008)	0.010	0.000	0.009	0.006	0.008	0.001
Self-esteem (2008)	0.004	0.012	0.005	0.014	0.001	0.040
Openness (2008)	-0.001	0.624	-0.000	0.812	-0.000	0.998
Conscientiousness (2008)	0.001	0.283	0.005	0.537	0.001	0.248
Extraversion (2008)	0.005	0.000	0.005	0.001	0.003	0.001
Agreeableness (2008)	-0.008	0.000	-0.009	0.000	-0.003	0.001
Neuroticism (2008)	0.013	0.002	0.015	0.000	0.014	0.000
Proportion of total effect that is mediated:						
	68%		77%		78%	

Multivariate mediation tests for multiple potentially mediating variables (MV) considered jointly. These variables may carry the effect from lagged positive affect or life satisfaction (IV) to later earnings (DV). Presented are the mediation test coefficient, p-value, and the proportion of the total effect that is mediated (%). All variable coefficients are standardized. The mediated (indirect) effect is tabulated using the product of the coefficients method that multiplies the regression coefficients from the IV on MV and MV on DV regressions. These sets of coefficients and their standard errors are obtained using "seemingly unrelated regression" (sureg in Stata). The mediated effect is obtained by multiplying the coefficients using the "non-linear combination" command (nlcom in Stata) and these single mediated effects are considered additively when tabulating the total indirect or mediated effect (also using nlcom in Stata). For a detailed description and example please see http://www.ats.ucla.edu/stat/stata/faq/mulmediation.htm

Fig S1. Sibling fixed effects model (Table 2) predicted values. Quadratic fits with 95% confidence intervals.

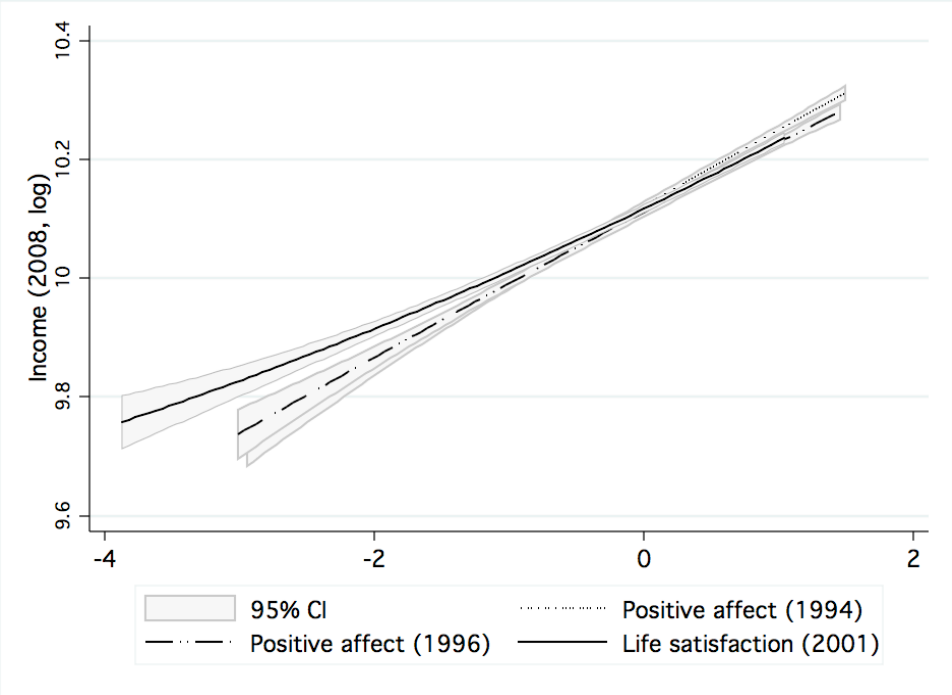


Fig S2. Sibling fixed effects model predicted values using identical specification as in Table 2 except taking absolute income values instead of natural log. Quadratic fits are presented with 95% confidence intervals.