Happiness and the Persistence of Income Shocks

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We reassess the empirical effects of income and employment on self-reported well-being. Our analysis makes use of a two-step estimation procedure that allows us to apply instrumental variable regressions with ordinal observable data. As suggested by the theory of incomplete markets, we differentiate between the effects of persistent and transitory income shocks. In line with this theory, we find that persistent shocks have a significant impact on happiness while transitory shocks do not. This also has consequences for inference about the happiness effect of employment. We find that employment per se is associated with a decline in happiness.

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Do individual economic conditions contribute to a person's well-being or happiness? Frey and Stutzer (2002) and Clark et al. (2008) survey the large body of literature devoted to this question. For our purpose, we may summarize two main findings of this literature. First, in the cross-section, there is a small but significantly positive correlation between household income and self-reported well-being (happiness). Second, employment contributes to happiness per se and not only through providing income.[1] These findings, on the surface, challenge standard (macro-)economics, where, e.g., the costs of a recession are assumed to originate from the decline in consumption but such costs are partly offset by an increase in leisure as employment declines.

Our paper qualifies both findings summarized above, provides an interpretation of the findings in terms of incomplete insurance markets, and thereby contributes to the literature on happiness. We show that the contribution of income shocks to a person's happiness depends crucially on the persistence of these shocks. Persistent shocks translate substantially into happiness, whereas transitory shocks do not. Moreover, taking this differential impact into account changes the inference about the contribution of employment to happiness. The evidence for a positive effect of employment disappears.

At the same time, our paper contributes to the consumption-(self-)insurance literature.[2] Not only do concepts developed in this literature lend themselves naturally to the analysis of happiness data, but also key results found in the consumption literature carry over. This is reassuring for the findings of the consumption literature; previous studies had to regularly rely on imputed consumption data since most household panels offer only limited coverage of consumption (mostly limited to food expenditures); see, e.g., Blundell et al. (2008). Happiness data, by contrast, are observed in the same panel as income. A second key advantage is that, unlike consumption, happiness is measured at the individual and not at the household level, a fact that we exploit when estimating the effect of individual employment and which, more generally speaking, opens up new possibilities for empirical research investigating consumption smoothing beyond the household level.

The starting point of our analysis is to reinterpret the low happiness-income relation found in some studies as a measure of market completeness and insurance. To understand

[1] See in particular Clark and Oswald (1994), Clark et al. (2001), and Clark (2003).
[2] See, e.g., Deaton (1992), Blundell and Preston (1998), and Blundell et al. (2008).

this, consider two opposite extreme models of the world: complete markets and autarky. With complete markets, households face complete consumption insurance with respect to idiosyncratic income shocks, so that the coefficient of a cross-sectional regression of happiness on income should be zero once the aggregate state is controlled for. In the other extreme model of the world, where households do not have access to any storage and cannot trade any claims with each other ("autarky"), consumption equals income, and materialist preferences would predict a strong relationship between happiness and income in the cross-sectional regression.[3]

The modern (macro)economic literature has shown that when moving away from either of the two extreme assumptions – (insurance) markets are neither complete nor completely absent – the persistence of income shocks becomes important for the extent of consumption smoothing. The workhorse of heterogeneous-agent macroeconomics, the standard incomplete markets model (see Bewley (1980), Huggett (1993), and Aiyagari (1994)), assumes that households can only *self-insure* idiosyncratic labor market risk using state-uncontingent assets. Kaplan and Violante (2010), applying a method developed by Blundell et al. (2008), show that both in the standard incomplete markets model and in consumption data for the US, households are better able to smooth transitory than persistent shocks to their incomes.

We show that this point has important consequences for happiness regressions.[4] First, the coefficient in an ordinary regression of happiness on income is a weighted average of the coefficients of transitory and persistent income shocks. Second and consequently, this can introduce an (omitted variable) bias in the estimated coefficients of other variables as persistent and transitory income are latent variables. The estimated effect of employment on happiness is a candidate example for such biased estimates: Suppose unemployment benefits expire after one year. Now consider a person who moves from employment to non-employment. This person experiences a *negative persistent* income shock (due to the drop in labor income) until she manages to move back into employment. During eligibility, unemployment benefits compensate for the immediate drop in income, yet only for 12 months, resulting in a *positive transitory* income shock. Conse-

[3]Parts of the happiness literature (e.g., when calculating income compensation for, say, airport noise; see van Praag and Baarsma (2005)) seem to start out from this setup when interpreting the empirical results, calculating compensating income differentials.

[4]The only paper we are aware of that argues for an insurance interpretation of the low income coefficient in a happiness regression is Dehejia et al. (2007).

quently, if the permanent income change decreases happiness more than the transitory one increases it, the overall drop in happiness will be stronger than what the drop in income per se suggests. An OLS regression that cannot differentiate between transitory and persistent income changes will attribute this drop in happiness from income composition to the change in employment per se. Beyond this effect from benefits of limited duration, skill losses in unemployment (see, e.g., Arulampalam (2001)) and skill gains in employment also introduce systematic differences between the immediate and the long-term change in income through employment. Again, the immediate loss in income due to non-employment is smaller than the long-term loss.

In fact, applying Blundell et al.'s (2008) framework to happiness data from the German Socio-Economic Panel (SOEP) we show: First, persistent income shocks translate significantly more strongly to happiness than do average income shocks (more than twice as much). Second, transitory shocks do not significantly contribute to happiness, i.e., are perfectly insured. Third, this leads to a strong upward bias in the coefficient estimate on employment in a happiness regression. When we control for the bias by differentiating between transitory and persistent shocks, the point estimate for the effect of employment on happiness turns from positive to negative.

The remainder of this paper is organized as follows: Section I develops the econometric model and methodology, Section II introduces the data set, Section III presents results, and Section IV relates our partial insurance results to some existing findings about the differentially strong effects of income and employment on happiness in different economic environments. Section V concludes.

I. Econometric Model and Methodology

The economic analysis of self-reported happiness data usually starts off with applying an ordered probit model to the data and then discussing the effects of various (control) variables on happiness, most importantly income and employment status.[5] We deviate from this tradition only in one, but as it turns out, important point that we borrow

[5]The literature has discussed a number of potential econometric problems in this setup, in particular those stemming from fixed effects in happiness and income, and has proposed solutions thereto; see, e.g., Frijters et al. (2004b).

from the consumption/incomplete-markets literature. We assume that income shocks can be partially insured by the household and we allow shocks of different persistence to be differently insured.

A. *Income Process and Felicity*

To distinguish between shocks of different persistence, we need to put some structure on the income process of a household. We assume that a household i's log income y_{it} at time t is composed of a component $g(z_{it})$ that reflects the deterministic effects of household characteristics z_{it}, a transitory stochastic component ψ_{it}, a persistent stochastic component x_{it}, and a fixed component in income μ_i^y, such that

$$y_{it} = g(z_{it}) + y_{it}^* \tag{1}$$

$$y_{it}^* = x_{it} + \psi_{it} + \mu_i^y \tag{2}$$

$$x_{it} = \rho x_{it-1} + \epsilon_{it}, \tag{3}$$

where ψ and ϵ are i.i.d. shocks. For now, we will assume, for simplicity, that the persistent income component follows a random walk ($\rho = 1$), but we will check the sensitivity of our results with respect to this assumption in Section III.B.

Next, we assume that a household has a felicity function that translates market consumption (and leisure) into utility. This felicity u_{it}^{**} is latent and we assume

$$u_{it}^{**} = u_{it}^* + f(z_{it}) \tag{4}$$

$$u_{it}^* = u(c_{it}, n_{it}) + \mu_i^u + \xi_{it}, \tag{5}$$

where $f(z_{it})$ is a function that translates observable characteristics (via consumption or other things) into felicity. For simplicity, we assume that f enters additively into felicity. The fixed effect in the felicity equation, μ_i^u, captures permanent differences in felicity between individuals (partly stemming from permanent consumption and income differences), c_{it} is the part of market consumption not explained by observables z_{it} and fixed differences, n_{it} is hours worked not explained by observables z_{it} and fixed differences, and finally ξ_{it} is a residual that captures any other time-varying influences on felicity not captured in c, n, and z. In addition, it captures all measurement errors introduced when we later link the latent felicity to the self-reported well-being data.

The state variables that determine consumption choice are x and ψ and, in addition, if the agent can accumulate assets a, there is a further unobserved state variable. Hence, we can write the log consumption function as $c_{it} = c\left(x_{it}, \psi_{it}, a_{it}\right)$. Making use of this, we can apply a log-linear Taylor expansion of u around u_{it} and then rewrite (5) in terms of first differences to remove the fixed effect μ_i^u. We do not specify the agent's choice of hours in terms of the underlying state variables since hours worked (unlike consumption) is directly observed in the data:

$$\Delta u_{it}^* = \frac{\partial u}{\partial c}\left[\frac{\partial c}{\partial x}\Delta x_{it} + \frac{\partial c}{\partial \psi}\Delta \psi_{it} + \frac{\partial c}{\partial a}\Delta a_{it}\right] + \frac{\partial u}{\partial n}\Delta n_{it} + \Delta \xi_{it} \tag{6}$$

$$=: \alpha_x \Delta x_{it} + \alpha_\psi \Delta \psi_{it} + \gamma \Delta n_{it} + r_{it}; \quad r_{it} := \alpha_a \Delta a_{it} + \Delta \xi_{it}, \tag{7}$$

where $\alpha_x = \frac{\partial u}{\partial c}\frac{\partial c}{\partial x}$ measures the pass-through of persistent income shocks on felicity and $\alpha_\psi = \frac{\partial u}{\partial c}\frac{\partial c}{\partial \psi}$ measures the pass-through of transitory shocks. The joint residual r_{it} is composed of the original error term $\Delta \xi_{it}$ and the effect of assets, $\alpha_a = \frac{\partial u}{\partial c}\frac{\partial c}{\partial a}$, which cannot be estimated in the absence of asset data.

With u being logarithmic in consumption $\left(\frac{\partial u}{\partial c} = 1, \text{where } c \text{ is log consumption}\right)$ and additively separable in hours worked, this framework is obviously identical to Blundell et al. (2008) or Kaplan and Violante (2010), who estimate the response of log-consumption to persistent and transitory income shocks. These papers also show that a log-linear approximation of the consumption policy function is relatively precise.

B. Moment Conditions

Equation (7) cannot be directly estimated for two reasons. First, the latent felicity level u_{it}^* is not directly observable, and second, we do not separately observe the persistent and the transitory income components, but only observe income y_{it}. Assume for the moment that u_{it}^* was observed – we come back to this in Section I.F. To ease the exposition we also assume that $\gamma = 0$ for the following. We come back to how employment complicates the estimation and how we can identify γ in Section I.E.

To derive an estimation equation for the pass-through of permanent shocks on felicity, replace $\Delta x_{it} = \Delta y^*_{it} - \Delta\psi_{it}$ (see (2)) in (7) to obtain

$$\text{(8)} \qquad \Delta u^*_{it} = \alpha_x \left[\Delta y^*_{it} - \Delta\psi_{it}\right] + \alpha_\psi \Delta\psi_{it} + r_{it} = \alpha_x \Delta y^*_{it} + \underbrace{\left(\alpha_\psi - \alpha_x\right)\Delta\psi_{it} + r_{it}}_{\text{combined residual}}.$$

To derive an estimation equation for the effects of transitory income shocks, replace $\Delta\psi_{it} = \Delta y^*_{it} - \Delta x_{it} = \Delta y^*_{it} - \epsilon_{it}$ in the first-difference equation for Δu^*_{it}, so that

$$\text{(9)} \qquad \Delta u^*_{it} = \alpha_x \epsilon_{it} + \alpha_\psi \left[\Delta y^*_{it} - \epsilon_{it}\right] + r_{it} = \alpha_\psi \Delta y^*_{it} + \underbrace{\left(\alpha_x - \alpha_\psi\right)\epsilon_{it} + r_{it}}_{\text{combined residual}}.$$

Note that the key difference between (8) and (9) is the combined residual, which, however, correlates with the regressor $\Delta y^*_{it} = \epsilon_{it} + \Delta\psi_{it}$ in both cases. Yet, both parameters of interest α_x and α_ψ can be estimated from a method of moments estimator (i.e. instrumental variable regressions) making two additional sets of assumptions.

Following Blundell et al. (2008) and Kaplan and Violante (2010), we assume[6]

$$\text{(No Foresight)} \qquad E\left(\epsilon_{it+1} r_{it}\right) = E\left(\psi_{it+1} r_{it}\right) = E\left(\psi_{it} r_{it}\right) = 0$$

$$\text{(Short Memory)} \qquad E\left(\epsilon_{it-1} r_{it}\right) = E\left(\psi_{it-2} r_{it}\right) = 0.$$

With the "No Foresight" assumptions we can identify α_ψ from the moment condition

$$\text{(10)} \quad E\left[\left(\Delta u^*_{it} - \alpha_\psi \Delta y^*_{it}\right)\Delta y^*_{it+1}\right] = E\left\{\left[\left(\alpha_x - \alpha_\psi\right)\epsilon_{it} + r_{it}\right]\left(\epsilon_{it+1} + \psi_{it+1} - \psi_{it}\right)\right\} = 0,$$

thus using Δy^*_{it+1} as an instrument for Δy^*_{it}. With the additional "Short Memory" assumption, we can obtain an estimate for α_x from (9) by instrumenting Δy^*_{it} by $y^*_{it+1} - y^*_{it-2}$, since the 3-year growth rate between $t-2$ and $t+1$ correlates with the persistent but not the transitory shock in year t. We thus exploit the moment condition

$$\text{(11)} \qquad \begin{aligned} & E\left[\left(\Delta u^*_{it} - \alpha_x \Delta y^*_{it}\right)\left(y^*_{it+1} - y^*_{it-2}\right)\right] \\ =& E\left\{\left[\left(\alpha_\psi - \alpha_x\right)\Delta\psi_{it} + r_{it}\right]\left(\epsilon_{it+1} + \epsilon_{it} + \epsilon_{it-1} + \psi_{it+1} - \psi_{it-2}\right)\right\} = 0. \end{aligned}$$

[6]These papers look at setup analogous to ours where (imputed) consumption is the left-hand-side variable (instead of felicity) and income follows the same process as in (1)-(3).

While the instrumental variable regressions identify the two parameters α_x and α_ψ separately, a simple OLS regression $\Delta u^*_{it} = \alpha \Delta y^*_{it} + \upsilon_{it}$ of latent utility on income y^*_{it} yields an estimated coefficient $\hat{\alpha}$ that can be understood as a weighted mean of α_ψ and α_x that ensures

$$(12) \qquad \begin{aligned} & E\left\{\Delta y^*_{it}\left[(\alpha_\psi - \alpha)\Delta\psi_{it} + (\alpha_x - \alpha)\epsilon_{it} + \Delta\xi_{it}\right]\right\} = 0, \\ \Rightarrow \quad & E(\alpha) = \alpha_\psi \frac{2\sigma^2_\psi}{2\sigma^2_\psi + \sigma^2_\epsilon} + \alpha_x \frac{\sigma^2_\epsilon}{2\sigma^2_\psi + \sigma^2_\epsilon}. \end{aligned}$$

The weights on α_x and α_ψ equal the contribution of permanent and transitory shocks to the variance in income growth. In turn, this means that any coefficient estimate on additional variables in an OLS happiness regression is likely to be biased (e.g., the coefficient on employment): we omit a variable, the relative contribution of persistent and transitory shocks to observed income growth. We come back to this issue in Section I.E.

C. *When Will the Moment Conditions Hold?*

Kaplan and Violante (2010) discuss in detail the extra identifying assumptions introduced above for consumption choice in a model of incomplete markets. Similarly, in our setup, the "No Foresight" condition holds whenever the individual has no better information on income growth (in $t+1$) than the econometrician. The "Short Memory" assumption is potentially more problematic. In the log-linear approximation of utility growth (see (7)), we have assumed that the econometrician does not observe assets, so that the effect resulting from changes in asset holdings becomes part of the combined error term, $r_{it} = \frac{\partial u}{\partial c}\frac{\partial c}{\partial a}\Delta a_{it} + \Delta\xi_{it}$. Hence, the condition will be invalidated if past income predicts current consumption growth through past savings behavior and the endogenous state a.

If the asset process generated by the agent's behavior is slowly mean reverting, the moment restrictions derived above are violated. Suppose an agent receives a transitory positive income shock in $t-2$. Then this agent is going to save more in this period. She will then slowly decrease her assets over time if the interest rate is smaller than her time-preference rate. Hence, a positive transitory shock in $t-2$ predicts that assets will decline in t due to the slow mean reversion in assets. Thus, it holds that $cov\,(\Delta a_{it}, \psi_{it-2}) < 0$. A similar argument holds for a persistent shock in $t-1$: an agent who observes a persistent increase in income will lower her assets (non-human wealth) if the interest rate is smaller than her time-preference rate. As the agent observes an increase in human wealth she would like to move consumption forward and decrease assets, so that $cov\,(\Delta a_{it}, \epsilon_{it-1}) < 0$. In both cases, the "Short Memory" condition will be violated. Since ψ_{it-2} and ϵ_{t-1} show up with an opposite sign in the moment restriction (see (11)), the direction of the bias finally depends on the relative importance of both shocks, the strength of the savings reaction to either shock, and the speed of mean reversion in assets; see Kaplan and Violante (2010) for a detailed analysis of various alternative setups. For example, in the setting originally used to motivate the moment restrictions in Blundell et al. (2008)—the permanent income hypothesis model with quadratic preferences and no borrowing constraints—assets follow a random walk; hence, there is no mean reversion and persistent shocks translate fully into consumption. Thus, in this setting, the "Short Memory" condition would be valid.

D. Improving the Estimation Equations: Lagged Felicity

Since the "Short Memory" assumption may be problematic, we go back and rewrite the utility growth equation as surprise growth plus expected utility growth,

$$\Delta u^*_{it} = u_{it} - E_{t-1}u_{it} + E_{t-1}u_{it} - u_{it-1} + \Delta\xi_{it}.$$

Again making use of a first-order approximation for the surprise innovation, we obtain

$$\begin{aligned}\Delta u^*_{it} =& \frac{\partial u}{\partial c}\left[\frac{\partial c}{\partial x}\left(\Delta x_{it} - E_{t-1}\Delta x_{it}\right) + \frac{\partial c}{\partial \psi}\left(\Delta\psi_{it} - E_{t-1}\Delta\psi_{it}\right) + \frac{\partial c}{\partial a}\left(\Delta a_{it} - E_{t-1}\Delta a_{it}\right)\right] \\ &+ \Delta\xi_{it} + E_{t-1}u_{it} - u_{it-1}. \qquad (13)\end{aligned}$$

Since asset holdings a_{it} are planned at time $t-1$ we have $(\Delta a_{it} - E_{t-1}\Delta a_{it}) = 0$.

Making use of $(\Delta x_{it} - E_{t-1}\Delta x_{it}) = \epsilon_{it}$ and $(\Delta\psi_{it} - E_{t-1}\Delta\psi_{it}) = \psi_{it}$, (13) simplifies to

$$\Delta u^*_{it} = \frac{\partial u}{\partial c}\left[\frac{\partial c}{\partial x}\epsilon_{it} + \frac{\partial c}{\partial \psi}\psi_{it}\right] + \Delta\xi_{it} + E_{t-1}u_{it} - u_{it-1}. \tag{14}$$

Note that the coefficients in front of ϵ and ψ are still our coefficients of interest, α_x and α_ψ. The term $E_{t-1}u_{it} - u_{it}$ depends on the agent's information set at time $t-1$. In general, it will depend on the composition of the agent's states. It relates to the Euler equation

$$\frac{1+\rho}{1+r}u'_{c,t-1} = E_{t-1}u'_{c,t},$$

where ρ is the time preference rate and r the market interest rate. If we assume CARA utility functions, then this equation for marginal utility carries over to utility levels, i.e., $E_{t-1}u(c_{it}) - u(c_{it-1}) = \frac{\rho-r}{1+r}u(c_{it-1})$, such that the utility growth equation simplifies to

$$\Delta u^*_{it} = \frac{\partial u}{\partial c}\left[\frac{\partial c}{\partial x}\epsilon_{it} + \frac{\partial c}{\partial \psi}\psi_{it}\right] + \Delta\xi_{it} + \frac{\rho - r}{1+r}\left[u^*_{it-1} - \xi_{it-1} - \mu^u_i\right]. \tag{15}$$

From (15) it can be seen that last period's felicity from consumption is a sufficient statistic for *expected* felicity growth from consumption, $E_{t-1}u(c_{it}) - u(c_{it-1})$. In other words, for CARA utility and non-binding borrowing constraints, the utility level captures the entire relevant history of states.

Of course, for general utility functions we cannot simply replace marginal utility by utility levels. Yet, the consumption Euler equation suggests that we can improve the estimation by first conditioning out lagged felicity from felicity growth.[7] The procedure then is: First, estimate $\hat{\tau}$ from: $E\left[\left(\Delta u^*_{it} - \tau u^*_{it-1}\right)u^*_{it-2}\right] = 0$. Second, estimate α_x, α_ψ from:

$$\begin{aligned} E\left[\left(\Delta u^*_{it} - \hat{\tau}u^*_{it-1} - \alpha_x \Delta y^*_{it}\right)\left(y^*_{it+1} - y^*_{it-2}\right)\right] &= 0 \\ E\left[\left(\Delta u^*_{it} - \hat{\tau}u^*_{it-1} - \alpha_\psi \Delta y^*_{it}\right)\Delta y^*_{it+1}\right] &= 0. \end{aligned} \tag{16}$$

[7]In this step, we need to use u^*_{it-2} as an instrument for u^*_{it-1} because of the over-differenced error term.

E. Employment

So far, we have assumed that the effect of hours worked/employment on felicity, γ, is zero. We now come back to the estimation of γ. Inspecting equations (8) and (9) (augmented by $\gamma\Delta n_{it}$), we see that the (not instrumented) least squares estimate of γ will be biased under the instrumentation for transitory and persistent shocks, respectively, if

$$cov(\Delta n_{it}, (\alpha_\psi - \alpha_x)\Delta\psi_{it} + r_{it}) \neq 0, \tag{17}$$

$$cov(\Delta n_{it}, (\alpha_x - \alpha_\psi)\epsilon_{it} + r_{it}) \neq 0. \tag{18}$$

Asset accumulation might introduce some correlation between r_{it} and Δn_{it}. We want to assume that this effect is negligible,[8] but focus instead on the correlation between Δn_{it} and $\Delta\psi_{it}$ and ϵ_{it}. Recall that ϵ_{it} and $\Delta\psi_{it}$ measure the persistent and transitory *changes in income*, respectively. This introduces some mechanical correlation with changes in employment. If employment drops, then income permanently drops until employment returns to its initial value. At the same time, if there are unemployment benefits or short-time work benefits that expire after a period, the initial drop in income is smaller than the long-term drop in income (keeping hours worked at the now lower level), hence $\Delta\psi > 0$ when $\Delta n < 0$. Therefore, the mechanical relation between hours worked, income, and unemployment benefits implies $cov(\Delta n_{it}, \epsilon_{it}) > 0$ and $cov(\Delta n_{it}, \Delta\psi_{it}) < 0$.

Importantly, these likely correlations introduce an upward bias of the least squares estimate of γ in *any* specification that does not instrument employment change if persistent income shocks translate more strongly into felicity than do transitory ones, $\alpha_x > \alpha_\psi$, which, e.g., holds under market incompleteness.

However, if hours worked exhibit serial autocorrelation such that

$$n_{it} = \rho_h n_{it-1} + \omega_{it}; \quad \rho_h < 1,$$

[8] If one is willing to assume GHH preferences, the effect is strictly zero.

we can identify γ from the moment conditions:[9]

$$
\begin{aligned}
&E\left[\left(\Delta u_{it}^* - \gamma\Delta n_{it} - \alpha_x \Delta y_{it}^*\right) n_{it-2}\right] = 0 \\
\text{or } &E\left[\left(\Delta u_{it}^* - \gamma\Delta n_{it} - \alpha_\psi \Delta y_{it}^*\right) n_{it-2}\right] = 0
\end{aligned} \tag{19}
$$

using the other moment conditions (11) and (10) to identify α_x and α_ψ maintaining the "No Foresight" and "Short Memory" assumptions, and adding a further assumption

(No Tenure Effects) $$E(n_{it-j}\epsilon_{it}) = E(n_{it-j}\Delta\psi_{it}) = 0 \text{ if } j \geq 2.$$

One can understand these conditions as a particular version of the "No Foresight" condition. The number of hours worked in $t-2$ neither changes the persistent income shock in period t nor the transitory shocks in periods $t-1$ and t. If the "No Tenure Effects" condition is violated, it means past employment predicts current income growth; hence, the agent has some foresight about income growth. For example, if there is sluggish learning on the job or skill losses in unemployment, the condition $E(n_{it-j}\epsilon_{it}) = 0$ might be violated. Similarly, if the size of unemployment benefits in t depends on employment histories beyond $t-1$, the condition $E(n_{it-j}\Delta\psi_{it}) = 0$ can be violated.[10]

Since there is evidence for skill losses in unemployment and skill gains in employment,[11] we take it to be more likely that the condition $E(n_{it-j}\epsilon_{it}) = 0$ is violated, which means that it is potentially problematic to identify the effects of transitory income shocks along with employment. We therefore focus on identification of the employment effect from an IV-regression that identifies the pass-through of permanent shocks, α_x, using the moment conditions:[12]

$$
\begin{aligned}
&E\left[\left(\Delta u_{it}^* - \alpha_x \Delta y_{it}^* - \gamma\Delta n_{it}\right) n_{it-2}\right] &&= 0, \\
&E\left[\left(\Delta u_{it}^* - \alpha_x \Delta y_{it}^* - \gamma\Delta n_{it}\right)\left(y_{it+1}^* - y_{it-2}^*\right)\right] &&= 0.
\end{aligned} \tag{20}
$$

[9]Technically, we also need to assume that innovations to hours ω_{it} are not perfectly correlated with income shocks, such that there is independent variation in hours.

[10]The duration of unemployment benefits in Germany depends on the length of the previous employment spell and increases to a maximum of 12 months (for those under 50 years old) after 24 month of employment. Hence, there might be some correlation, which, however, should vanish if using n_{it-3} as an instrument instead of n_{it-2}; yet this implies losing additional observations. In the appendix we provide results for this specification.

[11]See Jacobson et al. (1993), Neal (1995), and Couch and Placzek (2010).

[12]Results for γ using the alternative moment condition that identifies α_ψ are qualitatively similar.

F. Constructing Latent Felicity from Observed Happiness

So far, we have established an instrumental variable regression to estimate the effects of persistent and transitory income shocks and employment on latent utility, assuming this latent utility is observable. While latent utility is not observable, we do observe self-reported life satisfaction in the data we use. This variable is reported on a scale of 0 to 10. We assume that this happiness variable is generated from an ordered probit model, where happiness h_{it} is determined by

$$h_{it} = j \text{ if } u^{**}_{it} \in (\bar{c}_j, \bar{c}_{j+1}] \tag{21}$$

The latent u^{**}_{it} is determined as in (4) and all error terms $\mu^y_i, \mu^u_i, \epsilon_{it}, \psi_{it}, \xi_{it}$ are normally distributed. Moreover, we assume that u^{**}_{it} is scaled such that u^*_{it} has unit variance.

Under these assumptions we can estimate the cutoff values $\bar{c}_j$ and the statistical (not necessary causal) effect of controls $f(z_{it})$ by a standard ordered probit estimator. Note that we should not give causal interpretation to these estimates, since they will also include correlations of controls with fixed effects and income shocks.[13] The cutoff values are scaled appropriately to be compatible with u^*_{it} having a unit variance. Since we obtain an estimate $\widetilde{f(z_{it})}$ for each household-year, we can infer an interval $U_{it} = (\tilde{\bar{c}}_{h_{it}} - \widetilde{f(z_{it})}, \tilde{\bar{c}}_{h_{it}+1} - \widetilde{f(z_{it})}]$ in which u^*_{it} must have been fallen. Together with the normality assumption for u^*_{it} this means we can calculate the conditional expected value $\overline{u^*_{it}}$ for residual latent utility

$$\overline{u^*_{it}} = \frac{\int_{u \in U_{it}} u\phi(u)}{\Phi(U_{it})}, \tag{22}$$

where ϕ is the density and $\Phi(U)$ the probability of U for a standard normal distribution.

Replacing u^*_{it} with $\overline{u^*_{it}}$ in the estimation equations derived in Section I.A renders the previously derived estimators feasible. It introduces measurement error, but only to

[13] Frijters et al. (2004b) suggest an estimator to obtain consistent estimates in the presence of fixed effects for the ordered probit setup. We do not employ their estimator in our first-stage regression since we are not interested in obtaining structural estimates in this first stage. While their estimator is more efficient in the presence of fixed effects than our estimation procedure, the advantage of the latter is that it is easily extended to the IV regressions we need to do.

the dependent variable, which does not bias estimations. The huge advantage of this procedure is that we can apply standard linear regression techniques once $\overline{u_{it}^*}$ is estimated, and hence, we can, e.g., use first differences to control for fixed effects. It can be understood as a generalization of van Praag's (2004) probit-OLS procedure; see also van Praag and Ferrer-i Carbonell (2006). In contrast to the pure probit-OLS procedure, we do not need to assume normality for $f(z_{it})$ in the first-stage ordered probit regression.

G. *Felicity vs. Utility*

So far, we have interpreted the response to the life-satisfaction question as reflecting the felicity of the interviewee. There is an alternative way to read the life-satisfaction question, which has some consequence for the interpretation of the estimated coefficients. The interviewee's answer (with S years of life expectancy) could also reflect her utility level $U_{it} = E_t \sum_{s=0}^{S} \beta^s u(c_{it+s}, n_{it+s})$. In this case, finding a higher effect of persistent shocks may simply reflect the fact that the present value of the persistent income shock is larger and not necessarily differences in the ability to insure against the different shocks.

This can be seen most easily by considering a Robinson Crusoe economy *without storage* and log utility. In this "autarky" setup, consumption equals income and

$$U_{it} = E_t \sum_{s=0}^{S} \beta^s y_{it+s}^* = E_t \sum_{s=0}^{S} \beta^s (x_{it+s} + \psi_{it+s}) = \frac{1-\beta^{S+1}}{1-\beta} x_{it} + \psi_{it}. \tag{23}$$

Thus, even in the total absence of insurance possibilities the effect of persistent income shocks would be much stronger, simply because they last longer. Letting $S \to \infty$ and writing the discount factor as $\beta = \frac{1}{1+\delta}$, where δ is the time preference rate, yields $\frac{\partial U}{\partial \psi} / \frac{\partial U}{\partial x} = \frac{\delta}{1+\delta}$.[14] In Appendix A, we show that the relative pass-through of transitory shocks decreases further if agents have access to some insurance.

Importantly, this means that irrespective of whether the happiness data refer to utility or felicity, there is a potential bias in the estimated coefficient of hours worked. Under the utility interpretation, persistent and transitory income shocks have a differential impact on self-reported well-being even in the absence of any (self)insurance, so that the

[14]For a setup with CARA utility and (2) in levels, one can show that the relative marginal effect is approximately $\frac{\delta+\lambda\sigma_\epsilon^2/2}{1+\delta}$ if both transitory and persistent shocks have approximately the same variance.

estimation bias would be an even more severe problem.

One potential way to discriminate a time-horizon explanation–as in (23)–from an insurance explanation of a potential difference in α_x and α_ψ is to look at the interaction of non-human wealth and the pass-through of income shocks. Blundell et al. (2008) show that the pass-through of income shocks into consumption decreases in the fraction of total wealth of a household that comes from non-human wealth. While we do not observe wealth in every year, we observe wealth in some years and we can use household characteristics to impute wealth in the other years and estimate the interaction of wealth with income shocks. If the explanation for differences in α_x and α_ψ lies entirely in the different horizons over which they affect the household, this wealth interaction should be insignificant.

II. Data

We use data on subjective well-being from the German annual socio-economic panel (SOEP). The SOEP is a representative longitudinal study of households and individuals and covers information on household composition, employment, incomes, health and satisfaction indicators. Our analysis uses data from 1984-2010. In the baseline specification, we restrict the sample to household heads and spouses between 25-55 years of age, consider West German households only, and drop observations from the migrant and high-income samples. In an alternative specification, we split the sample by gender. To control for outliers, we drop those households that fall in the top-bottom 0.25 percentiles of residual incomes from a first stage regression (see below) in each year. We then re-estimate the first-stage income regression for the cleaned sample. Table 1 shows summary statistics of the variables used in the final estimation sample. We provide further information on the data in Appendix B.

Individual happiness is measured on an integer scale from 0 to 10.[15] To measure income, we use post-government income in real terms, which represents the combined income after taxes and government transfers in the previous year of all individuals in the

[15] The survey question is: "How satisfied are you with your life, all things considered?" 0 means completely dissatisfied, 10 means completely satisfied.

TABLE 1—DESCRIPTIVE STATISTICS

Variable	Mean	Std. Dev.	Min	Max
Happiness (0-10)	7.14	1.74	0	10
Income (in logs)	10.44	0.50	7.10	12.64
Age (in years)	40.84	8.29	25	55
Household size	3.03	1.25	1	6
No. of children	0.88	1.01	0	4
Schooling (semesters)	24.10	5.19	14	36
Satisfaction with health (0-10)	6.94	2.12	0	10
Fraction of Respondents who are ...				
Living with a spouse	84%	Employed		80%
Female	51%	Disabled		6%

household. In our baseline specification, we estimate the happiness effect of employment by coding a dummy variable e_{it} that defines a person as being employed if supplying more than 520 hours of market work per year, being equivalent to more than a quarter of full-time employment. Alternatively, we use a broader definition, where persons having positive wages and working at least 52 hours are classified as employed, or estimate the effect of variations in log-hours worked for those persons who supply positive hours.

We define employment on the basis of hours worked, categorizing respondents into two labor-market states employed/non-employed instead of using a multi-state labor force status. We do so to avoid the difficulties involved in interpreting the various labor market transitions a multi-state labor force status brings. For example, in our data 50% of out- and in-flows from/to employment involve "non-participation" when using a multi-state measure. So it is hard to argue that all of these persons are indeed not participating in the labor market at least in some form. Importantly, the binary employment measure is closer to a standard formulation of preferences–orderings over bundles of consumption and leisure (we also consider a specification with hours worked). Of course, one needs to take into account in the interpretation of our results that some of the non-working persons may be voluntarily unemployed, while others are not, such that our results may mask some underlying heterogeneity. However, when a person can be classified as an obvious non-participant, she should be dropped from the analysis. Therefore, we drop individuals who are on maternity leave, in school, or in the military.

As a robustness check, we also provide results using data from the British Household Panel Survey (BHPS). Since the BHPS includes only household gross income variables, but not household net income, we extend the data by the estimates for net annual household incomes provided by Jenkins (2011). Appendix C provides further details.

III. Estimation Results

The first step of our analysis is to regress household incomes on a large set of control variables z_{it}, i.e., to estimate (1). The controls include year-dummies, dummies for each year of schooling, dummies for age, for marital status, for living with a spouse, for the number of children, for the various levels of self-reported health status, number of hospital days (in 6 groups), for disability and interaction terms of schooling coded in 5 levels with a second order age polynomial. We include information on both spouses in cases where a household is composed of more than one adult. We use the same set of variables for our first step ordered probit regression of happiness, i.e., to estimate (4). This gives us estimates of $\overline{u_{it}^*}$ and y_{it}^* as defined in Section I. Also for employment e_{it}, we condition out the effect of observables z_{it}.

A. Happiness, Income, and Employment

We then use these data to estimate the effect of income and employment on happiness, i.e., we regress $\overline{u_{it}^*}$ on y_{it}^* and e_{it}. Table 2 summarizes the main results of this exercise. While the simple OLS regression (Column i) suggests some significant positive effect of income on happiness (a 40% increase in income has roughly the same effect as living with a spouse), this coefficient drops significantly when using first differences to control for

Table 2—Happiness, Income, and Employment

	i	ii	iii	iv	v	vi	vii	viii
Estimation Method	OLS	FD	FD	IV	IV	IV	IV	IV
Moment				(10)	(11)	(20)	(20)	(16)
Restriction(s)							& wealth	& empl.
Income Shocks								
- all, y^*_{it} (α)	0.32	0.24	0.23					
	(0.01)	(0.02)	(0.02)					
- transitory, ψ_{it} (α_ψ)				0.07				
				(0.05)				
- persistent, x_{it} (α_x)					0.45	0.49	0.45	0.52
					(0.07)	(0.09)	(0.11)	(0.08)
Employment, e_{it} (γ)			0.06			-0.11	-0.11	-0.18
			(0.01)			(0.15)	(0.18)	(0.14)
Persist. income $\times$ wealth							-0.17	
							(0.09)	

Note: Standard errors are in parenthesis. OLS refers to an OLS estimation of $\overline{u^*_{it}}$ on y^*_{it}, FD to the same regression using first-differences to control for fixed household effects; in Column iii we include an employment dummy e_{it} as an additional regressor. The IV-regressions in Columns iv - viii refer to the method of moments estimators for transitory and persistent shocks discussed in Section I, with the moment restrictions given in the equations referred to in the third row of the table. The IV-regressions all control for fixed effects by first-differencing. Column vii augments the regression from vi by an interaction of persistent income shocks and wealth. Column viii refers to a regression where we first condition out lagged happiness from happiness growth. Both the income and employment variables have been regressed on the same set of controls we included in the first-stage ordered probit regression for happiness. Residuals from these regressions are used as regressors.

fixed household effects (Column ii).[16] This finding is in line with what other researchers have found (see Ferrer-i Carbonell and Frijters (2004)): there are households that are both permanently more happy and permanently earn more. Since these differences are fixed, we cannot identify what causes what and causation may go either way. A household may permanently earn more because its members are permanently happy or may be permanently more happy because its members permanently earn more.

The instrumental variable regressions in Table 2 show that, in fact, persistent shocks influence happiness more strongly than transitory ones (Columns iv and v). When instrumenting in order to identify the effect from permanent income shocks (Column v), the income coefficient is 0.45 and hence twice as large as for the average income shock (Column

[16]Table D1 in Appendix D shows that the coefficient estimates from the OLS estimator are not significantly different from a one-step ordered probit estimation including not only the controls but also income.

ii), while transitory income shocks have no (significant) impact on happiness (Column iv). Note that our IV-regressions still control for fixed effects by first-differencing.

Since we find a strong difference in the effects of transitory and persistent income shocks on happiness, our theoretical considerations from Section I suggest an upward biased estimate of the effect of employment on happiness. In fact, this is the case, as a comparison of Columns iii and vi in Table 2 reveals, which present the estimates from regressions augmented by employment. In Column vi employment is instrumented as discussed in Section I.E.

A naive interpretation of the OLS estimate in first differences (Column iii) suggests that a household suffers from losing employment just as much as from a $\hat{\gamma}/\hat{\alpha} \approx 30\%$ extra decline in income beyond the one caused by employment loss. In other words, a non-employed person would be indifferent between working and earning 70% of the unemployment benefits or not working and earning full unemployment benefits. Yet, as our IV procedure (in Column vi) shows, this finding is just an artifact of not controlling for the correlation of non-employment spells with permanent and transitory income shocks. Once we do so, the effect of employment on happiness becomes negative but insignificant. The point estimate suggests that a household needs to be compensated permanently by an income exceeding unemployment benefits by $-\hat{\gamma}/\hat{\alpha}_x \approx 20\%$ (Column vi) in order to be indifferent between working and not working. Of course, one needs to be careful in interpreting this number since there is much estimation uncertainty with an insignificant estimate for γ.

This caveat arises from the need to instrument employment change by past employment; see (20). For our dummy variable approach to employment, this means that identification comes from comparing the growth in happiness of persons who are employed with those who are not employed in period $t-2$, controlling for income and characteristics. The idea behind this is that those who work in $t-2$ lose their job with some probability, while those who do not work pick up work with some probability. Since we control for all other characteristics and income, the difference in the growth of happiness of the two groups must be due to changes in employment. Of course, this is a fairly indirect identification, which is reflected in the wide confidence bounds.

Column vii of Table 2 shows the results for the estimation where we interact the persistent income shock and wealth as discussed in Section I.E. In the 2002 and 2007 surveys, households were asked about their wealth, and we use this information to impute wealth in all other years by making use of the individual's characteristics z_{it} and income two years earlier. While we cannot interpret the direct effect of wealth,[17] the imputation summarizes household characteristics according to their wealth prediction, and the IV-regression then asks whether the pass-through of persistent shocks systematically varies with these characteristics.[18] We find that the higher the imputed wealth, the lower the pass-through of shocks α_x. For the income-consumption pass-through, this is one of the key predictions of the permanent income hypothesis with finite life; see Blundell et al. (2008).

Column viii in Table 2 repeats the estimation from Column vi but first eliminates the growth in happiness that is predictable from past happiness as described in Section I.D. The point estimate for the pass-through of persistent income shocks increases slightly, and the effect of employment on happiness becomes a little more negative and is now marginally significant.

B. *Robustness*

Next, we perform several robustness checks for our findings. First, we relax the random-walk assumption for income and assume a lower-bound estimate of $\rho = 0.9$ in line with what Bayer and Juessen (2012) report as an estimate from SOEP data and construct pseudo-differences of $\overline{u_{it}^*}$, y_{it}^* and e_{it}. Results are shown in Table 3. We instrument with the instruments for income suggested in Kaplan and Violante (2010), i.e., with $y_{it+1}^* - \rho y_{it}$ in Column i and by $y_{it+1} - \rho^3 y_{it-2}^*$ in Columns ii and iii (and employment change with e_{t-2}). Using pseudo-differences yields basically the same picture as under the unit-root assumption for income.

As a second set of robustness checks, we use an average annual employment of 1 hour per week as an indicator of being employed or replace the employment measure with the number of log hours worked (Columns iv and v of Table 3). Our results

[17]The direct effects are included in the regression but not reported in the table. Also Headey and Wooden (2004) look at the happiness effects of income and wealth for a sample of Australian households and find that wealth affects happiness more strongly than income does. They do not look at wealth-income interactions.

[18]To exclude the effects of household composition, we focus on stable marriages in this specification.

TABLE 3—ROBUSTNESS CHECKS I

	Pseudo-Differences for $\rho = 0.9$			lower empl. cutoff	log hours	un-emp.	un-emp. e_{t-2}=1	BHPS	
	i	ii	iii	iv	v	vi	vii	viii	ix
Moment Restriction(s)	(10)	(11)	(20)	(20)	(20)	(20)	(20)	FD	(20)
Income shocks									
- all, y^*_{it} (α)								0.00	
								(0.02)	
- transitory, ψ_{it} (α_ψ)	0.05								
	(0.05)								
- persistent, x_{it} (α_x)		0.45	0.52	0.47	0.59	0.42	0.49		0.31
		(0.06)	(0.22)	(0.08)	(0.10)	(0.08)	(0.09)		(0.10)
Employment, e_{it} (γ)			-0.22	-0.06	-0.18			0.06	-0.15
			(0.72)	(0.12)	(0.13)			(0.02)	(0.19)
Fraction of Yr. in Unempl.						-0.23	0.11		
						(0.16)	(0.30)		

Note: See notes to Table 2. In i we instrument $y^*_{it} - \rho y_{it-1}$ by $y^*_{it+1} - \rho y_{it}$ and in ii and iii, we instrument $y^*_{it} - \rho y_{it-1}$ by $y_{it+1} - \rho^3 y^*_{it-2}$. In Column iv, we define a person to be employed if working more than 52 hours in the reporting year; in Column v we replace the employment indicator with log hours worked. This restricts the sample to persons who have worked at least one hour. In Columns vi and vii we replace employment with time spent in unemployment in the current year. In Column vii we restrict the sample to persons who have worked at least 520 hours in $t-2$. Columns viii and ix report results using BHPS data.

remain qualitatively unchanged; the negative effect of hours worked is even marginally significant. Our results change somewhat if we replace employment with time spent in unemployment. We find that a person becomes less happy the more time she spends in unemployment (but again the result is insignificant; see Column vi), but for those who are employed in $t-2$, more time in unemployment actually increases happiness; see Column vii. This suggests that unemployment is particularly depressing for persons who are only weakly attached to the labor market. In another (unreported) specification, we augment the regression from Column vi with an indicator of long-term unemployment and observe that this indicator picks up all of the negative effect of unemployment.

Additionally, we repeat our estimations using household data from the UK. In Columns viii and ix, we report the results for the non-instrumented first difference estimator and the IV estimator that identifies the effects of persistent shocks and employment,

Table 4—Robustness Check II: Sample Splits

	Men			Women			Public Employees		
	FD	IV-t	IV-p	FD	IV-t	IV-p	FD	IV-t	IV-p
Income	0.25	0.09	0.40	0.22	0.05	0.59	0.28	0.37	0.28
(all / t. / p.)	(0.02)	(0.07)	(0.13)	(0.02)	(0.06)	(0.13)	(0.05)	(0.15)	(0.20)
Employment	0.19		-0.11	0.02		-0.16			
	(0.03)		(0.34)	(0.02)		(0.17)			

Note: See notes to Table 2. IV-t refers to the transitory shock instrumentation (10), and IV-p to the persistent shock instrumentations (11) and (20). In the last three columns we restrict the sample to public employees.

respectively. While the first-differenced OLS results suggest that income does not affect happiness, our IV results confirm once more that this is driven by transitory income shocks. In fact, our IV regressions show that the pass-through of persistent income shocks in the UK is actually very similar to what we estimated for Germany. Also for the effect of employment on happiness we find the same picture as before. While the first-differenced OLS suggests a significant increase in happiness from employment, the point estimate under IV estimation is negative.

In a third set of robustness checks, we split the sample into men and women, and look at public employees only. The results are reported in Table 4. Qualitatively, the results for the sample split according to gender do not differ from our estimates when pooling men and women.

What is interesting from a theoretical point of view is that women not only exhibit a higher disutility from work (in line with the data on female labor market participation), but they also seem to be comparatively less able to insure against permanent income shocks, i.e., they have a much higher pass-through of persistent income shocks on happiness. Being able to differentiate between gender in the pass-through from income to happiness shows a further strength of the happiness data: we have information at the individual level, which is typically not the case for consumption data where some consumption goods are public goods within the household. In substance, the finding that women are less able to insure against permanent income shocks might call for a careful future analysis, since this may be related to differences in insurance abilities within or outside the household (e.g., due to differences in household bargaining power), differences that should be reflected in the consumption data. Of course, it could also be that deep psychological factors (preferences) explain the differences: women may suffer more from fluctuations in available economic resources.

The results for public employees are reconfirming our identification idea. For civil servants, transitory income shocks can be considered fairly unimportant given the nature of the compensation schemes in the German civil service. Hence, we expect the IV and FD estimates to be similar and this is what we find.

IV. Discussion

How do our findings relate to the previous economic literature on happiness? Most closely related is Dehejia et al. (2007), who show that households that have access to informal insurance markets through religious organizations show both a weaker consumption-income and a weaker happiness-income relationship.

The insurance mechanism we highlight suggests an interpretation of some of the cross-country differences in the income-happiness pass-through found in a number of studies. The general pattern is that the income-happiness pass-through is larger in less developed or transition economies; see, e.g., Graham and Pettinato (2002). If less developed economies have less developed financial markets, there is less (self-)insurance, and consumption, happiness, and income co-move more strongly. Similarly, we can reinterpret the findings of Frijters et al. (2004a, 2006) and Caporale et al. (2009), who show relatively strong income effects on happiness for Russia and East Germany, and for the Czech Republic, Poland, and Hungary, respectively. In particular, Caporale et al. (2009) explicitly compare these transition economies to Western Europe, and they find lower income effects on happiness in the latter group of countries.

Against the backdrop of our analysis, there are two additional effects that should increase the happiness-income correlation for the transition economies: first, income changes as a result of economic transition are likely persistent (e.g., human capital that was valuable in communist times might have become obsolete, overall productivity catches up, etc.), and second, the within-country asset distribution is not yet in the steady state, such that self-insurance abilities are below their long-run level; see, e.g., Fuchs-Schündeln (2008). In particular, the results by Lelkes (2006) are reassuring for this interpretation. Lelkes (2006) provides evidence for the happiness-income relation in Hungary in 1992 and 1998 and shows that during transition the income-happiness relation declined over time.

With respect to our results concerning the happiness effects of being employed, some comments may be in order. One should not read the results as "unemployment does no harm". First, the strong difference between the IV and FD estimates points to important long-run income effects of unemployment; see, e.g., Arulampalam (2001) and, in the happiness context, Knabe and Rätzel (2011). Second, our regressions control for the happiness effects of health, and given that there is a literature that discusses the effects of unemployment on health, there may be indirect effects of unemployment on happiness through health, which we keep constant. Third, our two-state description of the labor market in employment/non-employment does not allow us to discriminate well between non-participation and unemployment and the degree of detachment from the labor market, and all may have different effects on happiness.[19]

V. Conclusion

This paper has reassessed the link between household income, employment and happiness in light of an incomplete markets setup, where households can only self-insure against income shocks. This limited ability to insure predicts a positive relationship between income and happiness. More important, it predicts that shocks with different persistence have a different impact on happiness. This is exactly what we find in the happiness data we analyze. While persistent income shocks have an impact on happiness, transitory income shocks do not and are hence perfectly insured. In addition to this point, we show that disregarding the differential impact of income shocks with different persistence also biases inference on the impact of other factors on happiness, in particular employment. We show that once one controls for the differential effects of persistent and transitory income shocks, employment per se no longer contributes to a persons's well-being.

[19]See also Knabe et al. (2010), who find that the unemployed spend more time on activities they consider enjoyable.

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Appendices

CARA Utility and Insurance

In Section I.G, we have shown that, for log-utility and in the absence of insurance possibilities the relative effect of transitory shocks on utility is $\frac{\partial U}{\partial \psi} / \frac{\partial U}{\partial x} = \frac{\delta}{1+\delta}$. This difference in the pass-through of permanent and transitory shocks is amplified by insurance possibilities. Assume for analytical tractability CARA utility and (2) in levels instead of logs. Then, we obtain (making use of the consumption Euler equation)

(A1)

$$U_{it} = E_t \sum_{s=0}^{S} \beta^s u(c_{it+s}) \overset{\text{CEE}}{=} \sum_{s=0}^{S} \left(\frac{1}{1+\delta}\right)^s \left(\frac{1+\delta}{1+r}\right)^s u(c_{it}) = \frac{1 + r - \left(\frac{1}{1+r}\right)^S}{r} u(c_{it}).$$

Since the consumption function is linear in human wealth for CARA utility (see, e.g., Wang (2003)), we have that $\frac{\partial U}{\partial \psi} / \frac{\partial U}{\partial x} = \frac{r}{1+r}$ for $S \to \infty$. Since $r < \delta$ in equilibrium (see again Wang (2003)), the relative effect of transitory shocks on utility is hence even smaller if agents have access to some insurance.

SOEP data

Table B1 summarizes the variables used in the baseline estimations and their keys in the SOEP data. Table B2 provides information on the number of observations as well as on the number of observations we lose due to sample selection.

BHPS Data

The BHPS data we use provide annual information for the years 1991-2008. However, the question on life satisfaction is available only for the years 1996-2008 and is missing in 2001. We keep only households living in England.[21] In the BHPS, the life satisfaction

[21] The BHPS started with mainly households living in England. In later sample waves, households from Wales, Scotland, and Northern Ireland were added to the BHPS, which implies that these economically diverse parts of the UK do not have a constant sampling weight.

TABLE B1—VARIABLES AND THEIR KEYS

Variable	Key	Variable	Key
Overall life satisfaction	p11101	Indicator - wife/spouse in HH	h11112
HH post-government income	i11102	Subjective satisfaction with health	m11125
Employment status of individual	e11102	Disability status	m11124
Annual work hours of individual	e11101	Age of individual	d11101
Relation to HH head	d11105	Marital status	d11104
Number of persons in HH	d11106	Number of years of education	d11109
Number of children in HH	d11107[20]		

Note: The variables are from the 100%-sample version of the Cross-National Equivalent File of the SOEP ($PEQUIV-files).

TABLE B2—SAMPLE SELECTION

Initial number of observations	224,127
After constraining to ages 25-55	134,494
After accounting for missings in	
education	132,554
income	132,524
happiness	132,173
health satisfaction	131,989
After taking out persons in maternal leave, education, military service	127,799
After removing outliers: Final number of observations for first-stage regressions	127,185
Final number of observations for which all instruments can be constructed	77,112

question takes the form: "How dissatisfied or satisfied are you with your life overall?" and is coded on a scale from 1 (not satisfied at all) to 7 (completely satisfied).

Similarity of second step OLS and single step ordered probit estimators

We check the robustness of our two-step estimation procedure by comparing two-step OLS estimates on income and a standard single-step ordered probit regression. As Table D1 shows, running a two-step estimation procedure instead of a single-step one does not significantly change results.

Further Robustness Checks

Table E1 provides estimation results from regressions excluding self-reported health status in the first stage, from a version that uses e_{t-3} as an instrument for employment, and from using the transitory shock identification to estimate the employment coefficient.

Table D1—Similarity of Two-step and One-step Estimation

	OLS	O-Probit
Income	0.32	0.32
	(0.01)	(0.01)

Note: Standard errors are in parentheses. OLS refers to the two-step estimation described in the main text, where we first estimate a model for happiness using ordered probit and a model for income using an OLS estimator using the same set of control variables in both regressions. We then generate residuals that we regress on each other linearly. O-probit refers to a single-step ordered-probit estimation that includes income along with the control variables. The table reports only the coefficient estimate on income.

Table E1—Further Robustness Checks

	w/o health satisfaction in first stage			Using e_t-3 as Instrument	Transitory shock analogue to (20)
	FD	IV-t	IV-p	IV-p	IV-t
Income	0.14	-0.08	0.52	0.54	0.07
(all / t. /p.)	(0.01)	(0.04)	(0.07)	(0.11)	(0.05)
Employment	0.03		-0.13	-0.24	-0.02
	(0.01)		(0.13)	(0.26)	(0.14)

Note: See Notes to Table 4. The first three columns exclude self-reported health satisfaction from the first stage regressions. The fourth column uses e_{t-3} instead of e_{t-2}. The final column uses the transitory shock analogue to moment condition (20) together with (10).