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Happiness and the Persistence of Income Shocks

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Happiness and the Persistence of Income Shocks

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Abstract

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 applying 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 has consequences also for inference about the happiness effect of employment. We find that employment per se is rather associated with a decline in happiness.

KEYWORDS: incomplete markets, happiness, income persistence

JEL-codes: E21, D12, D60

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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 itself 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 are at face value a challenge to standard (macro-)economics, where e.g. the costs of a recession are assumed to originate from the decline in consumption which however 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 happiness literature. We show that the contribution of income shocks on 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, where previous studies had regularly to rely on imputed consumption data as most household panels offer only a limited coverage of consumption (mostly limited to food expenditures), see e.g. Blundell et al. (2008). Happiness data by contrast is 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, which 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 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 relation of happiness and income in

¹See in particular Clark and Oswald (1994), Clark et al. (2001), and Clark (2003).

²See e.g. Deaton (1992), Blundell and Preston (1998), and Blundell et al. (2008).

the cross-sectional regression.³

The modern (macro)economic literature has shown that when moving away from either two extreme assumptions – neither are (insurance) markets 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 as well as 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 also 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 estimate: 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. Consequently, 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, also skill losses in unemployment, see e.g. Arulampalam (2001), and skill gains in employment 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, we show, applying Blundell et al. (2008)'s framework to happiness data from the German Socio-Economic Panel (SOEP): First, persistent income shocks translate significantly stronger to happiness than 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

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

⁴The 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).

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 1 develops the econometric model and methodology, Section 2 introduces the data set, Section 3 presents results, Section 4 relates our partial insurance results to some existing findings about differently strong effects of income and employment on happiness in different economic environments. Section 5 concludes.

1 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 the employment status.⁵ We deviate from this tradition only in one, but as it turns out, important point which we borrow from the consumption / incomplete markets literature. We assume that income shocks can be partially insured by the household and allow that shocks of different persistence can be differently insured.

1.1 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 a household i 's log income y_{it} at time t is composed of a component $g(z_{it})$ that reflects 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 the persistent income component to follow a random walk ($\rho = 1$) but we will check the sensitivity of our results with respect to this assumption in Section 3.2.

⁵The 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 thereof, see e.g. Frijters et al. (2004b).

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

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

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

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 and fixed differences, n_{it} is hours worked not explained by observables and fixed differences, and finally ξ_{it} is a residual that captures any other time varying influence on felicity not captured in c , n , and z . In addition, it captures all measurement error 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. We hence can write the log consumption function as $c_{it} = c(x_{it}, \psi_{it}, a_{it})$. 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 hours choice of the agent in terms of the underlying state variables as hours worked (unlike consumption) is directly observed in the data.

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

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

where $\alpha_x = \frac{\partial u}{\partial c} \frac{\partial c}{\partial x}$ measures the pass-through of persistent 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.

For u being logarithmic in consumption ($\frac{\partial u}{\partial c} = 1$, where c is log consumption) 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.

1.2 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 observe separately the persistent and the transitory income components, but only observe income y_{it} . Assume for the moment u_{it}^* was observed – we come back to this in Section 1.6. To ease the exposition we also assume $\gamma = 0$ for the following. We come back to how employment complicates the estimation and how we can identify γ in Section 1.5.

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

$$\Delta u_{it}^* = \alpha_x [\Delta y_{it}^* - \Delta \psi_{it}] + \alpha_\psi \Delta \psi_{it} + r_{it} = \alpha_x \Delta y_{it}^* + \underbrace{(\alpha_\psi - \alpha_x) \Delta \psi_{it} + r_{it}}_{\text{combined residual}}. \quad (8)$$

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

$$\Delta u_{it}^* = \alpha_x \epsilon_{it} + \alpha_\psi [\Delta y_{it}^* - \epsilon_{it}] + r_{it} = \alpha_\psi \Delta y_{it}^* + \underbrace{(\alpha_x - \alpha_\psi) \epsilon_{it} + r_{it}}_{\text{combined residual}}. \quad (9)$$

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. here instrumental variable regressions) making two additional sets of assumptions.

Following Blundell et al. (2008) and Kaplan and Violante (2010), we assume⁶

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

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

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

$$E[(\Delta u_{it}^* - \alpha_\psi \Delta y_{it}^*) \Delta y_{it+1}^*] = E\{[(\alpha_x - \alpha_\psi) \epsilon_{it} + r_{it}] (\epsilon_{it+1} + \psi_{it+1} - \psi_{it})\} = 0, \quad (10)$$

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

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

$y_{it+1}^* - y_{it-2}^*$ and exploit the moment condition

$$\begin{aligned} & E [(\Delta u_{it}^* - \alpha_x \Delta y_{it}^*) (y_{it+1}^* - y_{it-2}^*)] \\ &= E \{[(\alpha_\psi - \alpha_x) \Delta \psi_{it} + r_{it}] (\epsilon_{it+1} + \epsilon_{it} + \epsilon_{it-1} + \psi_{it+1} - \psi_{it-2})\} = 0. \end{aligned} \quad (11)$$

While the instrumental variable regressions identify the two parameters α_x and α_ψ separately, a simple OLS regression $\Delta u_{it}^* = \alpha \Delta y_{it}^* + v_{it}$ 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

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

The weights on α_x and α_ψ equal the contribution of permanent and transitory shocks to the variance of income growth. In turn, this means that any coefficient estimate on additional variables in an OLS happiness regression is likely biased (e.g. the coefficient on employment) – we omit a variable, the relative contribution of persistent and transitory shock to observed income growth. We come back to this issue in Section 1.5.

1.3 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. 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 assets to 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 that 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 pre-poned consumption and decreases 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 of which, 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 which was 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.

1.4 Improving the Estimation Equations: Lagged Felicity

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

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

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

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

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

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

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 information set of the agent 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

$$\Delta u_{it}^* = \frac{\partial u}{\partial c} \left[\frac{\partial c}{\partial x} \epsilon_{it} + \frac{\partial c}{\partial \psi} \psi_{it} \right] + \Delta \xi_{it} + \frac{\rho - r}{1 + r} [u_{it-1}^* - \xi_{it-1} - \mu_i^u]. \quad (15)$$

From (15) it can be seen that last period's felicity out of consumption is a sufficient statistic for *expected* felicity growth from consumption. 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 we can improve the estimation by first conditioning out lagged felicity from felicity growth.⁷ The procedure then is: First, estimate $\hat{\tau}$ from: $E[(\Delta u_{it}^* - \tau u_{it-1}^*) u_{it-2}^*] = 0$. Second, estimate α_x, α_ψ from:

$$\begin{aligned} E[(\Delta u_{it}^* - \hat{\tau} u_{it-1}^* - \alpha_x \Delta y_{it}^*) (y_{it+1}^* - y_{it-2}^*)] &= 0 \\ E[(\Delta u_{it}^* - \hat{\tau} u_{it-1}^* - \alpha_\psi \Delta y_{it}^*) \Delta y_{it+1}^*] &= 0. \end{aligned} \quad (16)$$

1.5 Employment

So far, we 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 respectively persistent shocks if

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

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

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

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

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

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 upwards 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 transitory ones, $\alpha_x > \alpha_\psi$, which e.g. holds under market incompleteness.

However, if hours worked exhibit serial autocorrelation such that

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

we can identify γ from the moment conditions:⁹

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

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 as further assumption

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

One can understand these conditions as a particular version of the “No Foresight” condition. The number of hours worked two periods before does neither change 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 of 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 depend 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 employ-

⁹Technically, 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.

¹⁰The duration of unemployment benefits in Germany depends on the length of the prior employment spell and increases to a maximum of 12 months (for below 50-year olds) 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.

ment,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

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

1.6 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 from 0 to 10. We assume that this happiness variable is generated from an ordered probit model, where happiness h_{it} is determined by

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

The latent u_{it}^{**} is determined as in (4) and all error terms $\mu_i^y, \mu_i^u, \epsilon_{it}, \psi_{it}, \xi_{it}$ 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 as 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 for each household-year an estimate $\widetilde{f}(z_{it})$, we can infer an interval $U_{it} = (\widetilde{c}_{h_{it}} - \widetilde{f}(z_{it}), \widetilde{c}_{h_{it+1}} - \widetilde{f}(z_{it}))$ 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

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

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

¹³Frijters 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 as 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.

residual latent utility

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

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

Replacing u_{it}^* by $\overline{u_{it}^*}$ in the estimation equations derived in Section 1.1 renders the previously derived estimators feasible. It introduces measurement error, but only to 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 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.

1.7 Felicity vs. Utility

So far, we 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 $U_{it} = E_t \sum_{s=0}^S \beta^s u(c_{it+s}, h_{it+s})$. 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

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

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 $S \rightarrow \infty$ 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 B, 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 refers 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 differential

¹⁴For 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 transitory shocks and persistent ones have approximately the same variance.

impact on self-reported well-being even in the absence of any (self)insurance, so that the estimation bias would be an even more severe problem then.

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 and 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 horizon they affect the household, this wealth interaction should be insignificant.

2 Data

We use data on subjective well-being from the German annual socio-economic panel (SOEP). The SOEP is a representative longitudinal study of private 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 C.

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 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

¹⁵The 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) | 7.145 | 1.740 | 0 | 10 |
| Income (in logs) | 10.431 | 0.534 | 2.594 | 13.770 |
| Age (in years) | 40.564 | 8.358 | 25 | 55 |
| Schooling (semesters) | 24.150 | 5.192 | 14 | 36 |
| Household size | 3.032 | 1.249 | 1 | 6 |
| Satisfaction with health (0-10) | 6.953 | 2.113 | 0 | 10 |
| No. of children | 0.892 | 1.015 | 0 | 4 |
| Fraction of respondents who are ... | | | | |
| Disabled | 6% | Employed | 78% | |
| Males | 52% | Living with a spouse | 83% | |

effect of log-hours worked variations for those persons who supply positive hours.

We define employment on the basis of hours worked instead of using an official measure of labor force status because the latter relates (un)employment to whether persons received unemployment benefits or not. Since benefits expire (for most recipients in our sample) after 12 months there are many transitions out of unemployment that do not go into employment just as we observe many transitions into employment from persons neither working before nor receiving unemployment benefits. This is why we rather stick to a definition of employment based on hours worked. However, 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.¹⁶ Yet, some persons can obviously be classified as non-participants and should therefore be dropped from our analysis. Specifically, we drop all individuals that are in maternity leave, in education, or military service.

As a robustness check, we also provide results using data from the British Household

¹⁶However, when we only look at transitions from employment into registered unemployment, an increase in months in unemployment increases happiness. Results are available upon request.

Panel Survey (BHPS). As the BHPS only includes 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 D provides further details.

3 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 of both spouses in case a household is composed of more than one adult individual. 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 1. Also for employment e_{it} , we condition out the effect of observables z_{it} .

3.1 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 fixed household effects (Column ii).¹⁷ This finding is in line with what other researchers have found, cf. Ferrer-i Carbonell and Frijters (2004): there are households that are both permanently more happy and permanently earn more. As 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

¹⁷Table 7 in Appendix E 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.

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 (0.01) | 0.24 (0.02) | 0.23 (0.02) | | | | | |
| - transitory, ψ_{it} (α_ψ) | | | | 0.07 (0.05) | | | | |
| - persistent, x_{it} (α_x) | | | | | 0.45 (0.07) | 0.49 (0.09) | 0.45 (0.11) | 0.52 (0.08) |
| Employment, e_{it} (γ) | | | 0.06 (0.01) | | | -0.11 (0.15) | -0.11 (0.18) | -0.18 (0.14) |
| Persist. income × wealth | | | | | | | -0.17 (0.09) | |

Standard errors 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. IV regressions in Columns iv - viii refer to the method of moments estimators for transitory and persistent shocks discussed in Section 1, 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 regressions 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 regression are used as regressors.

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 1 suggest an upwards 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 1.5.

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 that is caused by employment loss. In other words, a non-employed household 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 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 as 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 for employment, this means that identification comes from comparing happiness growth of persons that are employed with those that 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 happiness growth of the two groups must be due to employment changes. 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 1.5. In the 2002 and 2007 surveys, households are 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,¹⁸ the imputation

¹⁸The direct effects are included in the regression but not reported in the Table. Also Headey and Wooden (2004) look at happiness effects of income and wealth for a sample of Australian households

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.¹⁹ We find that the pass-through of shocks α_x is the lower, the higher the imputed wealth is. 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 happiness growth that is predictable from past happiness as described in Section 1.4. The point estimate for the pass-through of persistent income shocks increases slightly, the effect of employment on happiness becomes a little more negative and is now marginally significant.

3.2 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 \bar{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 with $y_{it}^* - \rho y_{it-1}$ 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 indicator of being employed, or replace the employment measure by the number of log hours worked (Columns iv and v of Table 3). Our results remain qualitatively unchanged, the negative effect of hours worked is even marginally significant. Our results change somewhat if we replace employment by 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 that 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 an other (unreported) specification, we augment the regression from Column vi by an indicator of long-term unemployment and observe that this indicator picks up all the negative effect of unemployment.

Additionally, we repeat our estimations using household data from the UK. In

and find wealth to affect happiness more strongly than income does. They do not look at wealth-income interactions.

¹⁹To exclude the effects of household composition, we focus on stable marriages in this specification.

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, respectively. While the first-differenced OLS results suggest that income does not impact on 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 employment effect on happiness we find the same picture as before. While first-differenced OLS suggests a significant happiness increase from employment, the point estimate under IV estimation is negative.

In a third set of robustness checks, we split the sample by 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 theory point of view is that women not only exhibit a higher dis-utility from work (in line with data on female labor market participation), but also seem to be able to insure permanent income shocks comparatively less, 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 of women being less insured against permanent income shocks might call for a careful future analysis as this may relate to differences in insurance abilities within or outside the household (e.g. due to differences in household bargaining power) which should be reflected in consumption data. Of course it could also be that deep psychological factors (preferences) explain the differences in a way that women 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.

4 Discussion

How do our findings relate to the previous economic happiness literature? Most closely related is Dehejia et al. (2007) who show that households who 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) that show for Russia and East Germany, respectively the Czech Republic, Poland, and Hungary, relatively strong income effects on happiness. In particular, Caporale et al. (2009) explicitly compares 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 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. First, one should not read the results as “unemployment does not harm”.²⁰ First, the strong difference between IV and FD estimate points towards important long-run income effects of unemployment, see e.g. Arulampalam (2001) and in the happiness context Knabe and Rätzl (2011). Second, our regressions control for happiness effects of health and given that there is a literature discussing unemployment effects 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, while all may have different effects on happiness.

²⁰See also Knabe et al. (2010) who find that unemployed spent more time on activities they consider enjoyable.

5 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 income-happiness relation. More importantly, it predicts that shocks with different persistence have 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. Besides 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 household's well being.

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A Appendices

B CARA Utility and Insurance

In Section 1.7, 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 gets 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)

$$U_{it} = E_t \sum_{s=0}^S \beta^s u(c_{it+s}) \stackrel{\text{CEE}}{=} \sum_{s=0}^S \left(\frac{1}{1+\delta} \right)^s \left(\frac{1+\delta}{1+r} \right)^s u(c_{it}) = \frac{1+r - \left(\frac{1}{1+r} \right)^S}{r} u(c_{it}). \quad (24)$$

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 $S \rightarrow \infty$. 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.

C SOEP data

Table 5 summarizes the variables used in the baseline estimations and their keys in the SOEP data. Table 6 provides information on the number of observations as well as on the number of observations we loose due to sample selection.

D BHPS Data

The BHPS data we use provide annual information for the years 1991-2008. However, the question on life satisfaction is only available for the years 1996-2008 and missing in 2001. We keep only households living in England.²² In the BHPS, the life satisfaction 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).

²²The 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.

E 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 7 shows running a two-step estimation procedure instead of a single-step one does not significantly change results.

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 (10) | ii (11) | iii (20) | iv (20) | v (20) | vi (20) | vii (20) | viii FD | ix (20) |
| Moment Restriction(s) | | | | | | | | | |
| 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 (0.06) | 0.52 (0.22) | 0.47 (0.08) | 0.59 (0.10) | 0.42 (0.08) | 0.49 (0.09) | | 0.31 (0.10) |
| Employment, e_{it} (γ) | | | -0.22 (0.72) | -0.06 (0.12) | -0.18 (0.13) | | | 0.06 (0.02) | -0.15 (0.19) |
| Fraction of Yr. in Unempl. | | | | | | -0.23 (0.16) | 0.11 (0.30) | | |

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 by log hours worked. Note that this restricts the sample to persons who have worked at least one hour. In Columns vi and vii we replace employment by time spent in unemployment in the current year. In Column vii we restrict the sample to persons that have worked at least 520 hours in $t-2$. Columns viii and ix report results using BHPS data.

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 (all / t. / p.) | 0.25 (0.02) | 0.09 (0.07) | 0.40 (0.13) | 0.22 (0.02) | 0.05 (0.06) | 0.59 (0.13) | 0.28 (0.05) | 0.37 (0.15) | 0.28 (0.20) |
| Employment | 0.19 (0.03) | | -0.11 (0.34) | 0.02 (0.02) | | -0.16 (0.17) | | | |

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

Table 5: 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 ²¹ | | |

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

Table 6: 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 |
| Final number of observations for first-stage regressions | 131,989 |
| Final number of observations for which all instruments can be constructed | 82,803 |

Table 7: Similarity of Two-step and One-step Estimation

| | i OLS | ii O-probit |
|--------|----------------|----------------|
| Income | .316 (.009) | .325 (.008) |

Standard errors 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.