The causal effect of income on life satisfaction and the implications for valuing non-market goods

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HIGHLIGHTS

- Addresses the issue of the causal effect of income on life satisfaction.
- Applies the life satisfaction non-market valuation approach to health.
- Checks the exogeneity of an alternative to the instrumental variable approach.
- Suggests existing willingness-to-pay estimates may be substantially overstated.
- Advocates further research into measurement errors in restricted windfall income.

ARTICLE INFO

ABSTRACT

Employing the life satisfaction approach to value physical health, this paper illustrates the use of a subset of windfall income (restricted windfall income) as a substitute for the more conventional household income monetary measure. Results provide no evidence against the exogeneity of restricted windfall income and indicate that the causal effect of income on life satisfaction is substantially higher (and willingness-to-pay estimates substantially lower) when restricted windfall income is used. Further research should be devoted to looking into the presence and size of measurement errors in restricted windfall income. If this bias is large, then the quest for valid and strong instruments will continue.

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1. Introduction

The life satisfaction approach to valuing non-market goods and services is increasingly being applied to value environmental quality (cf. Ambrey and Fleming, 2014; Ambrey et al., 2014; Luechinger, 2010) and poor health (cf. Dolan and Kahneman, 2008; Ferrer-i-Carbonell and van Praag, 2002; Powdthavee and van Praag, 2011). Unfortunately, reverse causality between income and life satisfaction biases the estimated income coefficient on which valuations rely. This bias is of an unknown degree and in an unknown direction, and may severely distort implicit willingness-to-pay estimates.

Existing studies have sought to address this issue by including an instrumental variable for income within the life satisfaction function. Instruments employed include household expenditure (cf. Kingdon and Knight, 2007), father and spouse's education (cf. Knight et al., 2009), social class (cf. Brown, 2013; Ferreira and Moro, 2010) and industry of employment (cf. Pischke, 2011). This has generally led to higher income coefficients and significantly reduced implicit willingness-to-pay estimates, although there are cases where the reverse is true (cf. Ferreira and Moro, 2010). The validity of the instrumental variables employed in these studies, however, has been questioned (cf. Pischke, 2011; Pischke and Schwandt, 2012; Stutzer and Frey, 2012).

Motivated by Frijters et al. (2011) and our own difficulties in finding a suitable instrumental variable for income, we offer an alternative to the instrumental variable approach; the use of a subset of windfall income—*restricted windfall income* as a substitute for the more conventional household income monetary

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measure.[1] We apply this alternative to the valuation of physical health. Throughout this application we implicitly assume that physical health is an exogenous determinant of life satisfaction. Our approach is closely related to work by Gardner and Oswald (2007) who find medium-sized lottery wins to be followed by an eventual significant improvement in mental wellbeing.

Results indicate that the effect of income on life satisfaction is substantially higher (and willingness-to-pay estimates substantially lower) when restricted windfall income is used as a substitute for household income. Importantly, the results also indicate that restricted windfall income is not statistically significantly associated with factors such as household income and a range of unobserved individual-specific time invariant characteristics.

This paper proceeds as follows. Section 2 discusses data and method. Results are presented in Section 3. Section 4 concludes.

2. Data and method

The life satisfaction approach entails the inclusion of a non-market good as an explanatory variable within a micro-econometric life satisfaction function along with other covariates, of which one must be monetary. The estimated coefficient for the non-market good yields first, a direct valuation in terms of life satisfaction, and second, when compared to the estimated coefficient for the monetary variable, the implicit willingness-to-pay for the non-market good in monetary terms (Frey et al., 2010). In the majority of applications to date, the monetary variable employed has been household income or some variant thereof.

To compare this conventional approach with the use of restricted windfall income, we employ data from the Household, Income and Labour Dynamics in Australia (HILDA) survey. Using unbalanced panel data from waves 2 (2002) to 11 (2011) we estimate a micro-econometric life satisfaction function which takes the form of an indirect utility function for individual i, in location k, at time t, as follows:

$$U_{i,k,t} = \omega + \beta y_{i,k,t} + \lambda' \mathbf{x}_{i,k,t} + \delta \alpha_{i,k,t} + u_i + \kappa_k + \tau_t + \varepsilon_{i,k,t}$$
$$i = 1 \ldots I, \ k = 1 \ldots K, \ t = 1 \ldots T \quad (1)$$

where $y_{i,k,t}$ is restricted windfall income[2,3] or the natural log of household income,[4] $\mathbf{x}_{i,k,t}$ is a vector of socio-economic and demographic characteristics including the remaining portion of windfall income, $\alpha_{i,k,t}$ is an individual's physical functioning score on a scale of 0–100, u_i is an individual-specific effect; κ_k are location effects; τ_t are time or year effects and $\varepsilon_{i,k,t}$ is the error term. In the micro-econometric function, the individual's true utility is unobservable; hence self-reported life satisfaction is used as a proxy. The estimation technique employed is the "blow up and cluster" estimator (cf. Baetschmann et al., 2013).

As shown by Ferreira and Moro (2010), we are able to estimate the implicit willingness-to-pay (denoted as WTP) for a one-unit improvement in health by taking the partial derivative of utility with respect to health and the partial derivative of utility with

Table 1
Base model results.

Variable name	Fixed effects ordered logit estimate (standard error)
Restricted windfall income	8.81E−06[**] (3.85E−06)
Remaining windfall income	5.28E−07[*] (2.77E−07)
Household income (ln)	0.062693[**] (0.001190)
Physical health	0.008370[***] (0.000601)
Summary statistics	
Number of observations	254 727
Pseudo R^2	0.025500
WTP estimate (household income)	$5100
WTP estimate (restricted windfall income)	$900

Baseline controls: age squared; English speaking ability; marital status; lone parent; number of children; highest level of educational attainment; self-employed, employment status, years at current address; life events (marriage, separation, birth or adoption of a child, serious personal injury, property crime victimisation, being fired, the death of a spouse or child, a worsening of one's financial situation, or a change of residence in the past 12 months); 1/Years interviewed; somebody else was present during the interview; Accessibility/Remoteness Index of Australia (ARIA) dummy variables; state and territory dummy variables; wave dummy variables.

Omitted cases: speaks English well; never married and not in a de facto relationship; not a lone parent; year 11 or below; not self-employed; employed working 35 h or more per week; no others present during the interview or do not know−telephone interview; not experienced life event in the past 12 months; in a major city; New South Wales; wave 2 (2002).

[*] Significant at the 10% level.
[**] Significant at the 5% level.
[***] Significant at the 1% level.

respect to the monetary variable, as follows:

$$\text{WTP} = \frac{\frac{\partial U_{i,k,t}}{\partial \alpha_{i,k,t}}}{\frac{\partial U_{i,k,t}}{\partial y_{i,k,t}}} \quad (2)$$

where $y_{i,k,t}$ is either household income or restricted windfall income. While the estimated coefficients from the fixed effects ordered logit model have no meaningful interpretation (as they refer to an underlying latent variable), the ratios between any two coefficients can be interpreted (Frey et al., 2010).

2.1. An investigation into the exogeneity of restricted windfall income

The alternative measure of income should be randomly assigned to individuals. That is, the measure of income should be exogenous. *A priori*, restricted windfall income may be related to important, yet unobserved, omitted variables (for instance, personal characteristics such as cognitive and non-cognitive skills and personality). A statistically significant association between restricted windfall income and time invariant personal characteristics would suggest that restricted windfall income is itself endogenous. Following Pischke and Schwandt (2012) we investigate this issue by estimating the following equation:

$$M_{i,k} = \omega + \beta y_{i,k,t} + \lambda' \mathbf{x}_{i,k,t} + \kappa_k + \tau_t + \varepsilon_{i,k,t} \quad (3)$$

where $M_{i,k}$ is a proxy variable for an unobserved time invariant individual characteristic and all other variables are as previously defined. Proxies employed include mother's/father's schooling, whether or not the individual's mother/father has obtained a university qualification, and the individual's height.[5]

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[1] Restricted windfall income is that part of windfall income which is confined to "other irregular sources of payments". It includes lottery winnings among other irregular sources of income. It does not include: the sum of inheritances, bequests, redundancy and severance payments, resident and non-resident parental transfers, payments from other non-household members, lump sum superannuation payments, and lump sum workers compensation.

[2] Restricted windfall income: mean $43, minimum $0, and maximum $396,000. All monetary values are in AUD. As at 2 January 2014, 1 AUD = 0.89 USD; 0.65 EUR; 0.54 GBP.

[3] We initially specified a natural log transformation for restricted windfall income. However, against *a priori* expectations, this functional form was not found to be statistically significant.

[4] Household income: mean $38,574, minimum $0, and maximum $1,002,693.

[5] Measures of height and parents' education are obtained from the HILDA New Person Questionnaire in waves 6 (2006)–11 (2011).