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Working Paper

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cege Discussion Papers, No. 169

Provided in Cooperation with:
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Suggested Citation: Lohmann, Steffen (2013) : Information technologies and subjective well-being: Does the internet raise material aspirations?, cege Discussion Papers, No. 169, University of Göttingen, Center for European, Governance and Economic Development Research (cege), Göttingen

This Version is available at:
https://hdl.handle.net/10419/79222

Center for European, Governance and Economic Development Research
cege

Discussion Papers

Number 169 – August 2013

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GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

ISSN: 1439-2305

Information technologies and subjective well-being: Does the internet raise material aspirations?

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August 12, 2013

Abstract

This paper examines whether access to modern information technologies, in particular the internet, has an impact on invididual positionality – meaning the degree to which subjective well-being is affected by income relative to others rather than absolute income. We provide empirical evidence that positionality and internet access are intertwined. Exploiting variation over time in a panel of European households, we find stated material aspirations to be significantly positively related to computer access in areas with advanced internet infrastructure. Furthermore, we report cross-sectional evidence from the World Values Survey suggesting an indirect negative effect of internet access on subjective well-being since people who regularly use the internet as a source of information derive less satisfaction from income. Together, the empirical findings highlight the importance of information sets for how individuals evaluate own living conditions relative to others and suggests a vital role for informational globalisation to affect positionality.

Keywords: Subjective well-being, positionality, relative income, informational globalisation

JEL Classification: D03, I31

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I am grateful to Axel Dreher, Chris Elbers, Jan Willem Gunning, Joop Hartog, Merle Kreibaum, and participants of the Development Economics Seminar at the University of Goettingen for helpful suggestions and discussions. I also thank Jamie Parsons and Jennifer Philips for proof-reading. The EU-SILC dataset was kindly provided by EUROSTAT for the purpose of academic research. The findings, interpretations, and associated conclusions expressed in this paper are entirely those of the author and as such do not necessarily represent the view of EUROSTAT.

1 Introduction

In this paper, we examine whether access to modern information and telecommunication technologies (ICTs), in particular access to the internet, has an effect on invididual positionality – meaning the degree to which subjective well-being is affected by income relative to others rather than absolute income. We hypothesise that information sets are crucial for how people evaluate their own living conditions relative to others and therefore subjective well-being might be negatively affected by ICT-triggered rising material aspirations.[1] Our research builds on a growing economic literature documenting that subjective well-being and economic decision-making are affected by how individuals see themselves within their social environment. Of particular interest in existing theoretical and empirical work is the concept of relative income (see, e.g., Van Praag et al. 1979; Manski 2000; Luttmer 2005).[2] Clark et al. (2008) provides an executive survey of the relative income concept in the context of the Easterlin paradox. Recently, also experimental work has revealed evidence that the income rank matters for economic decisions independently from absolute income levels (Mujcic and Frijters 2013). In their study, experimental subjects are found to be rank-sensitive and to demand significant financial compensation above and beyond their actual income when falling short in terms of relative income vis-a-vis their peer group.

What has been less considered in existing empirical studies ist that relative income concerns require sufficient information about the lifestyles of others. In recent theoretical work, however, Van Praag (2011) synthesises that "the phenomenon of social transparency or lack of transparency plays a role in the evaluation of social subjective well-being". Our research hypothesis thus stems from the fact that relative concerns are crucially determined by the flow of information between individuals – which is increasingly facilitated by modern ICTs. A couple of studies have recently confirmed the empirical relevance of ICT-driven material aspirations. Hyll and Schneider (2013) provide evidence for television consumption to drive material aspirations using a natural experiment which exploits the fact that in former Eastern Germany only some areas could receive the TV signal from Western Germany due to geographical reasons. They find a positive relation between watching (West German) TV and material aspirations which are defined by individual assessments of the importance of material possessions. Bruni and Stanca (2006) find suggestive evidence that people who watch TV for more than two hours per day only experience half the increase in life satisfaction from a rise in income compared to low-frequency TV viewers. Finally, Frey et al. (2007) analyse data on life satisfaction and TV consumption in

[1] Throughout this paper, we sometimes use the terms 'subjective well-being' and 'life satisfaction' interchangeably. Although there may be philosophical and semantic differences, we take the stand of Van Praag (2011) and many other economists that both essentially cover a similar empirical concept.

[2] The relative income concept is commonly attributed to Duesenberry (1949) who was among the first to study the implications of relative income preferences for consumption behaviour.

Europe and provide evidence that TV viewers are on average less satisfied with their financial situation even after controlling for actual income. Clark and Senik (2010a) is, to our knowledge, the only study which looks beyond TV and assesses the role of the internet technology. They find that respondents without internet access tend to attach less importance to income comparisons. Similar results hold for the consumption of television. People who watch TV also stated that the primary direction of income comparisons is towards people outside the spheres of family, friends, or working colleagues. Moreover, respondents who find it important to compare their own income report lower happiness levels on average. However, the results are suggestive as obtained from a simple cross-sectional analysis.

The empirical analysis in this paper delivers a systematic test of the relation between internet access and material aspirations.[3] Naturally, in a non-experimental setting, endogeneous determinants of ICT possession pose a constant threat to identifying its causal impact on material aspirations. Nevertheless, the findings in this paper emphasise a vital role for the internet in shaping material aspirations and we resolve some of the endogeneity concerns present in the previous literature. First, using panel data from the European Union Statistics on Income and Living Conditions (EU-SILC), we directly relate ICT possession to a measure of reference income. Our findings show that households in possession of a computer report needing significantly higher levels of income to make 'ends meet', after controlling for their actual level of income and a range of socio-economic characteristics. The estimated effect of 3-5 % is robust with respect to different specifications of household income and wealth. Furthermore, we find direct empirical support for the hypothesis of internet-based material aspirations, as the positive effect of computer possession prevails in regions which become more advanced in their internet infrastructure. Against the background of this positive relation between material aspirations and ICT access, we subsequently explore the implications of rising material aspirations for subjective well-being. Based on recent data on life satisfaction, ICT usage, and income from the World Values Survey (WVS), we find that individuals who regularly use the internet as a source of information are predicted to derive less satisfaction from their income, pointing to an increase in material aspirations driven by the use of the internet. We find suggestive evidence that the internet is distinct from other media, such as newspapers or television and that material aspiration effects matter when going up the income ladder.

Given the limited range of papers on ICT-driven material aspirations, our paper is innovative to

[3]While we do not aim to uncover actual reference groups of each and every individual, we identify empirical regularities between ICT access and material aspirations. A potential concern to our analysis is therefore that we treat reference groups as a 'black box'. Recent empirical evidence (Mayraz et al. 2009) on the relation between subjective well-being and income comparisons, however, suggests that individuals are rather unaware of the well-being impacts of income comparisons which would in turn dilute the potential bias from the endogeneous choice of reference groups.

the existing literature in four ways. First, our paper is the first to provide systematic evidence on the role of the internet. Second, we take a closer look at how material aspiration effects differ among income groups within countries. In doing so, we relax the rigid assumption of Bruni and Stanca (2006) that the interaction between income and ICT access needs to be the same across all income groups and can assess the relevance of material aspirations effects in different parts of the income distribution. Third, we use the response to the minimum-income question, namely how much income it needs for the household to 'make ends meet', as a direct measure of aspirations to analyse the impact of ICT possession. In this way, we do not need to rely on direct survey questions as Hyll and Schneider (2013) but get a comparable and continous measure of material aspirations from multiple European countries.[4] This approach resolves some of the problems arising in other studies due to the actual reference point of individuals being unobservable to the econometrician. Finally, we resolve some of the endogeneity concerns present in previous cross-sectional studies and take a step towards establishing a causal link between internet access and material aspirations through controlling for time-invariant unobserved heterogeneity in ICT possession in a panel analysis of European households.

Together, the empirical results from our paper corroborate the hypothesis that modern ICTs raise material aspirations via fostering relative concerns in the society and have an indirect negative impact on subjective well-being. Our paper adds to multiple strands of current economic literature. First, we provide new insights on the relation between globalisation and subjective well-being. While the literature has so far mostly focused on the aftermath of economic globalisation, we contribute to the burgeoning literature on the microeconomic implications of social globalisation on well-being. Second, the evidence on existing material aspirations directly adds to the discussion in the happiness literature on how income translates into well-being. If material aspirations are sufficiently strong, even a constant growth in income does not necessarily imply a rise in subjective well-being.[5] In line with Easterlin (1995), our findings underscore the notion of external and internal norms to evaluate well-being and suggest a vital role for information technologies. On this note, Clark and Senik (2010a, p. 590) hypothesize accordingly that "a society which becomes more comparison-conscious (due to [...], for example, [...] prevalence in the media of information about other people's lifestyles) will [...] be, on average, less happy." Furthermore, material aspirations matter if we want to understand how individuals make economic decisions within their social environment, e.g., the consumption of

[4]Specifically, Hyll and Schneider (2013) use responses from the following questions: "To what extent do you attach importance to acquiring valuable personal possessions (real estate, expensive cars, etc.)?", "To what extent do you attach importance to making use of all opportunities offered to earn money?", and "To what extent do you attach importance to living a comfortable and pleasant life without much effort?".

[5]On the macro-level, Deaton (2008) exemplarily finds that after controlling for national per capita income, the effect of economic growth on life satisfaction is negative.

status goods despite low levels of income (see, e.g., Banerjee and Duflo 2011). In the context of development economics, the presence of relative concerns moreover has repercussions on how we think about absolute versus relative poverty. People with high material aspirations have a higher propensity to self-report being poor. Finally, our results augment the literature on the determinants of reference groups for interpersonal (income) comparisons. Clark and Senik (2010b), for instance, conjecture that in the future ICT-driven material aspiration effects might be particularly relevant for less developed countries who are currently experiencing drastic advancements in information technology infrastructure and cross-national standard of living comparisons might gain in importance (see also James 1987).

The remainder of this paper is structured as follows: To illuminate the mechanism behind ICT-driven relative concerns in subjective well-being, we lay out a simple theoretical argument in section 2. We derive the testable implications that higher information flows in the society lead to an increase in material aspirations in indirectly to a lower satisfaction with actual income. Section 3 provides the results from an empirical model of reference incomes that is estimated with the data from the EU-SILC. Section 4 describes the WVS data, justifies the choice of control variables in light of identification problems in the simple cross-section, and presents results from an empirical model of subjective well-being with heterogeneous income effects depending on the usage of different information technologies. Section 5 finally concludes.

2 Rationale behind ICT-driven income concerns

Recent work on the economics of well-being shows that subjective well-being and economic decision-making are affected by how individuals see themselves within their social environment. Brosnan and De Waal (2003) report that such so-called relative concerns might have been formed in an evolutionary process. One core finding of their study is that, in an experimental setup, monkeys reject formerly acceptable food deals in exchange for one token after observing that other monkeys got a better deal. In conclusion, they conjecture that "during the evolution of cooperation it may have become critical for individuals to compare their own efforts and pay-offs with those of others" (Brosnan and De Waal 2003, p. 297).

Obviously, concerns about other people's incomes requires sufficient information about their living conditions. The income comparison process should therefore be crucially affected by the availability of information and environmental transparency (Diener and Fujita 1997). Ex ante, the literature points to two main theoretical channels. First, firms market their new products through modern information technologies, meaning that people with access to ICTs

are increasingly confronted with material temptations. Second, modern information technologies can create new reference points by providing "virtual" reference groups: Individuals that used to have relative concerns vis-à-vis their closest environment may now be inclined to compare their living conditions with individuals in other regions, countries, or even on different continents (Bruni and Stanca 2006; Layard 2003). In both cases, access to modern ICTs triggers new material aspirations – which in turn implies that people will be less satisfied with existing material possessions. This phenomenon is commonly referred to as "satisfaction treadmill". Empirical evidence confirms the crucial role of information. In a study on rural China, Knight et al. (2009) find strong evidence for the importance of information sets for the formation of reference groups. Most rural people have rather narrow scopes of comparison, often limited to the local village. Having lived outside of the community for more than a year in turn leads to a negative effect on subjective well-being, potentially via increasing material aspirations. The findings are in line with early evidence from Van Praag et al. (1979) who find that people in less urbanised regions attach more weight to their own income than to incomes of others. Exemplarily, Van Praag (2011) synthesises that "the phenomenon of social transparency or lack of transparency plays a role in the evaluation of social subjective well-being" (p. 113). According to Van Praag, the comparison process is determined by the degree of self-orientation. Put in line with the arguments presented in this paper: The more transparent a society, the more information people will have about others, and the more relevant status concerns will be. This relation provides the first assumption to be tested in the empirical analysis:

Hypothesis on the level of aspired reference income: *The aspired income level rises with the degree of social transparency.*

If access to ICT drive material aspirations, however, then it furthermore exerts a indirect impact on subjective well-being. To illustrate this point, we refer to a stylized composite subjective well-being (SWB) function in the spirit of Stutzer (2004) where individuals derive well-being from own income (Y) and from comparing their own income to their aspired income (Y^*). To accomodate the fact that available information matters for the formation of aspired incomes, we model it to endogeneously depend on social transparency (π):

$$SWB = \alpha + \beta Y + \gamma \frac{Y}{Y^*(\pi)}, \tag{1}$$

where $\beta > 0$ captures the well-being component from one's own income and γ from meeting income aspirations (or not). Assuming that people suffer deprivation when falling short of their aspired income (and, conversely, enjoy happiness when being above), we suggest that $\gamma > 0$.

Increasing social transparency thus has an additional effect on subjective well-being over and above own income concerns by changing the ratio of actual and aspired income. Against this framework, we formulate the following testable hypothesis about differential income effects in the well-being function:

Hypothesis on differential income effects: *If material aspirations increase in social transparency, the positive effect of income of subjective well-being will be lower with greater social transparency.*

The latter hypothesis follows directly from the comparative statics of (1) as $\frac{\partial SWB}{\partial Y} = \beta + \frac{\gamma}{Y^*(\pi)}$ and hence $\frac{\partial^2 SWB}{\partial Y \partial \pi} = -\frac{1}{Y^*(\pi)} \frac{\partial Y^*(\pi)}{\partial \pi} < 0$.

In what follows, we will first test the hypothesis that material aspirations rise with social transparency facilitated through ICT (which we find to hold) and subsequently study the well-being implications of ICT possession.

3 Empirical analysis of reference incomes

3.1 Empirical strategy

This part of the empirical analysis directly tests whether ICT access has an impact on the level of aspired reference income in a sample of industralised European countries. As the measure of reference income, we take the minimum income that a household states it needs to 'make ends meet, that is to pay its usual necessary expenses'. This serves as a natural reference point against which households evaluate their actual financial situation given that the level of life satisfaction is arguably determined by the gap between actual and subsistence income. We provide some evidence below that the response to the minimum-income question is not just a noisy measure of actual income, but that households indeed stated what they considered as some kind of subsistence level of income.

As we have multiple observations per household over time, we can include individual fixed effects in the regression and absorb all time-invariant determinants of material aspirations. This is essential to our analysis, as there are various reasons why some households should report to need higher incomes than others, possibly related to the possession of information technologies. Some of these influences might be on the country-level, e.g., some countries might generally be more or less modest in answering these questions. Other factors might be on the individual-level, such as cultural or religious values that we cannot observe. As is commonly done in literature using minimum-income questions (e.g., Van Praag et al. 1980; Pradhan and Ravallion 2000; Stutzer 2004), we transform the minimum-income response into logs. With subscript i denoting

households, c countries, and t denoting the time dimension, our basic estimation equation with individual fixed effects reads:

$$\text{Log(MinIncome)}_{it} = \alpha + \beta_1 \text{ ICT}_{it} + \beta_2 \text{ Log(Income)}_{it} + \mathbf{\Phi Z}_{it} + \boldsymbol{\delta}_t + \boldsymbol{\delta}_{ct} + \boldsymbol{\delta}_i + \epsilon_{it}, \quad (2)$$

where the variable ICT reflects whether a household has access to a specific ICT. $\boldsymbol{\delta}_i$ captures unobserved time-invariant effects on the household-level. The vector $\mathbf{Z}$ includes various time-variant demographic and socio-economic control variables on the household level, as described further below. $\boldsymbol{\delta}_t$ and $\boldsymbol{\delta}_{ct}$ represent year and country-year fixed effects, respectively. The latter are essential to capture all unobservable factors that are constant across countries within a given year, most importantly a country's general economic environment which is supposed to matter greatly for how households evaluate their financial situation. We expect β_1 to be positive and significant if ICTs drive up material aspirations.

As it seems likely that the household fixed effects are correlated with the values of the other regressors in (2), we treat them as fixed and use the within-estimator to identify the coefficients. That is, the estimate of β_1 reflects the variation in computer possession in one household over time. If $\beta_1 > 0$, then households who purchase a computer during the survey period report to need a higher minimum income after the purchase given all other covariates, particularly actual income. Similarly, households who abandon the use of a computer report a lower minimum income (although this case is very rare in our data). In the empirical analysis, we estimate several forms of (2). Consistency of the estimate depends on the assumption that there are no time-variant unobserved factors that determine both the possession of computers and the response to the minimum-income question. As we argue below, we employ the most important time-varying determinants of ICT access. We furthermore will estimate (2) with the ICT variable interacted with a measure of broadband internet infrastructure to make a step towards establishing a causal interpretation linked to internet access.

3.2 Data

The EU-SILC is a household survey carried out in 29 European countries (27 EU member states plus Norway and Iceland) for the purpose of studying monetary and non-monetary aspects of living conditions and social inclusion throughout Europe.[6] The survey is conducted annually in 3,000 to 5,000 households within each country as a rotating panel. For our analysis, we use data

[6]The countries are: Austria (AUT), Belgium (BEL), Bulgaria (BUL), Cyprus (CYP), Czech Republic (CZE), Germany (GER), Denmark (DEN), Estonia (EST), Spain (ESP), Finland (FIN), France (FRA), Greece (GRE), Hungary (HUN), Ireland (IRE), Iceland (ICE), Italy (ITA), Lithuania (LTH), Luxembourg (LUX), Latvia (LAT), Malta (MAL), Norway (NOR), Poland (POL), Portugal (POR), Romania (ROM), Sweden (SWE), Slovak Republic (SVK), and the United Kingdom (UK).

from the waves of 2004 to 2009.

Our dependent variable to measure material aspirations is constructed from the subjective assessment of the household's financial situation. Households report the explicit minimum income they need 'to make ends meet' ("In your opinion, what is the very lowest net monthly income that your household would have to have in order to make ends meet, that is to pay its usual necessary expenses?").[7] One concern with using this question is that the response to the minimum-income question might just be a noisy measure of actual income, especially given that households were asked how much it needs to "make ends meet, that is to pay its usual necessary expenses." In figure A.1 in the appendix, we plot country means of the response to the minimum-income question against actual household income. We see that the estimated quadratic fit is significantly different from the 45-degree line, such that we do not have any reason to believe that the minimum-income question was misunderstood to reflect current expenses. The pattern resembles typical pictures from development economics where households are asked about subjective minimum incomes (e.g., Vos and Garner 1991; Pradhan and Ravallion 2000). Households in poorer countries locate themselves around their actual income levels while in richer countries households' actual incomes are well above subsistence. With higher incomes, the response to the minimum-income question rises, but at a diminishing rate.

The main explanatory variables of interest on the right-hand side of the well-being equation are measures of ICT possession. We define dummy variables taking the value 1 if the household possesses a computer, a television set, or a phone, respectively. The simplifying assumption that computer possession is an imperfect proxy for internet access does not seem too absurd, given that our data span the second half of the first decade of the 2000s. Also, we know from the WVS that almost 80 % of those respondents who stated to use personal computers "frequently" also said that they used the internet as a source of information. We furthermore analyse if the effect of computer possession depends on the availability of modern internet infrastructure below.

In the sample, we find that 56 % of the households in our sample stated that they possess a personal computer in the year of the survey. Television and (mobile) phones are much more diffused and coverage extends to almost the whole sample. Figure A.2 in the appendix depicts how computer possession changed within countries throughout our sample period. Almost all countries feature a notable increase in the diffusion of personal computers. Less developed and transition countries, like Estonia, saw computer ownership rates growing by about 20 percentage points between 2005 and 2009. Countries that already had high ownership rates at the beginning of the sample period, e.g., Luxembourg or Finland, still have a moderate increase of around 10 percentage points. For our identification strategy, we rely on within-household variation of

[7] All income variables in the dataset are denominated in Euro.

Table 1: EU-SILC (2004-2009): Descriptive Statistics

	Mean	Standard deviation	Min	Max
Minimum income needed	18324.30	12733.96	2	948478
Income	24823.40	21661.26	58	206344
Computer	0.56	0.50	0	1
TV	0.98	0.15	0	1
Phone	0.96	0.19	0	1
Age	52.61	15.86	13	83
Household size	1.86	1.10	1	15
Male	0.45	0.50	0	1
Married	0.58	0.49	0	1
Lower education (dummy)	0.19	0.39	0	1
Middle education (dummy)	0.61	0.49	0	1
Higher education (dummy)	0.21	0.40	0	1
Employee (dummy)	0.51	0.50	0	1
Self-employed (dummy)	0.06	0.25	0	1
Unemployed (dummy)	0.25	0.43	0	1
In-training (dummy)	0.03	0.18	0	1
Retired (dummy)	0.04	0.20	0	1
Rural (dummy)	0.36	0.48	0	1
Mid-urban (dummy)	0.23	0.42	0	1
High-urban (dummy)	0.41	0.49	0	1
Observations	791,551			

computer possession over time. In our data, we find that 13 % of all households have acquired a personal computer within the sample period.

As for control variables, we use actual disposable household income, being the sum of all gross personal income components among the household members after taxes and transfers, as main measure of the actual income position of a household. We allow for different measures when testing for robustness. On the household level, we furthermore control for the degree of urbanisation (rural, mid-urban, and high-urban areas), household size, and the presence of children. Additional controls are the respondent's age, gender, marital status, educational attainment, and economic status. Table A.1 in the appendix provides exact definitions of all variables and summary statistics are given in table 1. We see that the average respondent is between 52 and 53 years of age, and that the sample features slightly more female respondents. About 58 % are married. Middle education is the most prevalent educational attainment (61 %) and most respondents are employees (51 %).[8] Finally, most of the sample households live in high-urban areas (41 %), followed by rural and mid-urban areas.

3.3 Results

3.3.1 The effect of ICT possession on material aspirations

As a starting point, we simply compare the response to the minimum-income question by whether households are in possession of a computer. Figure 1 presents the mean response for all countries

[8]The information on the economic status is based on the individuals' own perception. This might be one reason for the differences in unemployment rates and official statistics.

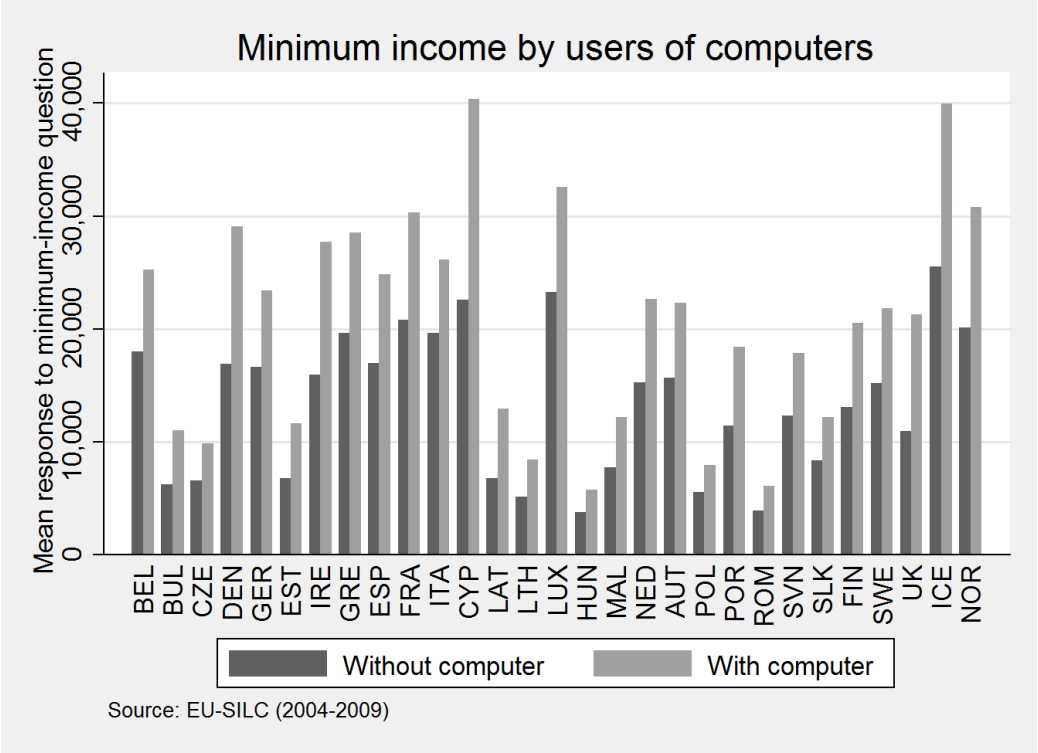

Figure 1: Difference to minimum-income question by computer possession

in our sample differentiated by the computer variable. We see that in all countries households in possession of a computer report on average that they need a higher income to make ends meet. In many countries, the difference is stark, going up to about 50 % in Latvia, for instance. The simple comparison of means is, of course, only descriptive. There are various reasons why households with computers report to need more money, most importantly that both variables are jointly determined by actual household income.

Our basic estimation equation to disentangle the determinants of the response to the minimum-income question is given by (2).[9] Table 2 reports the regression results when we pool all countries in our sample together. In column (1), logged household income is regressed solely on the computer dummy, plus individual fixed effects, year fixed effects, and country-year fixed effects. We find that for the respondents in our sample, the possession of a computer is associated with a significant increase of the minimum-income needed of about 7.2 % (=exp(0.0699)-1).

In column (2), we add the television and the phone dummies. The coefficient for computer possession drops slightly to 0.069, but stays highly significant. TV possession features a smaller, but also significant effect with 0.054. Phone possession is not associated with a significant increase in the response to the minimum-income question. In column (3), we add the log of actual household income. As can be seen, a 10 % increase in household income is associated

[9]We also estimate equation (2) with non-log-transformed income variables, but the log-log specification for income provides a better fit for the data.

Table 2: EU-SILC: Determinants of subjective minimum-income

	(1)	(2)	(3)	(4)	(5)
Computer	0.0699***	0.0694***	0.0558***	0.0410***	0.0005
	(0.0171)	(0.0169)	(0.0130)	(0.0077)	(0.0087)
Broadband coverage					-0.0002
					(0.0007)
Computer × Broadband					0.0005**
					(0.0002)
TV		0.0535***	0.0446***	0.0422***	0.0281***
		(0.0104)	(0.0091)	(0.0091)	(0.0070)
Phone		0.0075	-0.0009	-0.0144	0.0190
		(0.0348)	(0.0326)	(0.0306)	(0.0199)
Log(Income)			0.1345***	0.1162***	0.0890***
			(0.0216)	(0.0170)	(0.0202)
Age				0.0202***	0.0354***
				(0.0040)	(0.0079)
Age-squared				-0.0003***	-0.0002***
				(0.0000)	(0.0000)
Household size				0.0068***	0.0033***
				(0.0007)	(0.0009)
Male				0.0776***	
				(0.0169)	
Married				0.1114***	0.1005***
				(0.0138)	(0.0184)
Mid-education				0.0256	-0.0037
				(0.0205)	(0.0030)
High-education				0.0529	0.0047
				(0.0314)	(0.0146)
Employee				0.0393***	0.0184**
				(0.0053)	(0.0066)
Self-employed				0.0044	0.0049
				(0.0042)	(0.0050)
Unemployed				-0.0024	-0.0138*
				(0.0084)	(0.0064)
In-training				-0.0028	0.0094
				(0.0050)	(0.0102)
Retired				0.0108	-0.0012
				(0.0084)	(0.0063)
Mid-urban				0.0108	0.0046
				(0.0146)	(0.0347)
High-urban				0.0509	-0.0478
				(0.0322)	(0.0291)
Year-FE	YES	YES	YES	YES	YES
Country-Year-FE	YES	YES	YES	YES	YES
Observations	881,668	881,564	881,564	791,551	218,006

Dependent variable: Logged minimum income to make ends meet. Fixed-effects within panel regression.
Standard errors clustered on country level in parentheses. ***/**/*: significant at 1 %/5 %/10 %
Source: EU-SILC (2004-2009) and EUROSTAT (2012)

with an increase in the minimum income of 1.4 %. As the computer and TV variables are positively related to household income, their estimates drop, but stay significantly different from zero. In column (4), we finally include demographic and socio-economic characteristics as control variables. The control variables have the expected signs. Higher household income leads to higher material aspirations, with an estimated elasticity of about 0.12. Material aspirations rise with age, but at a declining rate. An increase in household size leads to a higher minimum income needed, as does being married. Male respondents are found to have higher aspirations. Being employed (as compared to being economically inactive) significantly raises the response to the minimum-income question.

Turning to the interpretation of the ICT variables, we see that the possession of a computer as

well as a TV leads to an increase in the response to the minimum-income question of roughly 4.2 to 4.3 %. Compared to column (1), the coefficient of computer ownership dropped notably which points to omitted individual characteristics having biased the estimate in the univariate analysis.[10]

Although we have presented some evidence that computer possession and internet usage are highly correlated, we next perform a test whether computer possession actually reflects ICT-based social interaction via the internet. To this end, we estimate a model that tests for heterogenous effects by regions with different broadband internet infrastructure. Recalling that the argument of ICT-driven material aspirations due to increased social transparency rests in the usage of highly interactive technologies such as the internet, we would expect stronger effects in regions with better internet infrastructure, e.g., for that internet usage is more excessive or that more people in the social environment are online as well. Regional statistics on broadband usage of internet are obtained from EUROSTAT (2012) for eleven countries in our sample for the period of 2006 to 2009. In column (5), we estimate equation (2) adding an interaction between computer possession and the regional share of household with access to broadband internet with the reduced sample.[11] Although our statistical analysis loses some power due to a much lower number of observations, we find the estimated effect of computer possession to be non-linear. It gains statistical significance when interacted with the measure of the penetration of broadband internet technology. With the mean value of the broadband coverage variable around 40 % and a maximum share of around 80 % of all households, the combined effect is of a similar magnitude as in the original specification in column (4). This constitutes the second central finding of our paper: Households with computer acccess in areas with advanced internet infrastructure report to need significantly more income 'to make ends meet'. We thus have some confidence that the empirical proxy of computer possession in the full sample is in fact capturing the extent of ICT-based social interaction via the internet.

3.3.2 Robustness checks

Table 3 provides results from a number of alternative specifications for the model of reference incomes. We are mainly concerned with how robust the estimated effect of computer possession turns out against different specifications of income. In other words, how sure can we be that computer possession does not simply pick up functional misspecification of income?

We primarily see that the main results for computer and TV do not change significantly when

[10] We note that the sample size differs across the columns as the panel is unbalanced. We have checked that the results do not change significantly if we restrict our sample in column (1) to the same 791,551 observations that we have when including all covariates.

[11] As our sample size decreases significantly, we do not have intertemporal variation for the respondent's gender anymore and thus drop this variable from the analysis.

Table 3: EU-SILC: Robustness checks

	(1)		(2)		(3)		(4)	
Computer	0.0425***	(0.0081)	0.0403***	(0.0076)	0.0362***	(0.0067)	0.0409***	(0.0077)
TV	0.0432***	(0.0090)	0.0423***	(0.0091)	0.0293***	(0.0063)	0.0422***	(0.0091)
Phone	-0.0108	(0.0312)	-0.0136	(0.0309)	-0.0221	(0.0332)	-0.0144	(0.0307)
Income	0.0000 ***	(0.0000)						
Income-squared	-0.0000 ***	(0.0000)						
Wage decile			0.0286***	(0.0028)				
Log(income)					0.1118***	(0.0160)	0.1160***	(0.0169)
Observations	791,551		791,551		791,174		791,551	
Year-FE	YES		YES		YES		YES	
Country-Year-FE	YES		YES		YES		YES	
Occupation-FE	NO		NO		NO		YES	
Controls as in table 2	YES		YES		YES		YES	
Other assets	NO		NO		YES		NO	

Dependent variable: Logged minimum income to make ends meet. Fixed-effects within panel regression.
Standard errors clustered on country level in parentheses. ***/**/*: significant at 1 %/5 %/10 %
Source: EU-SILC (2004-2009)

we include income and squared income as control variables (column 1). Also, we get similar results when we take a relative measure of income, i.e., compute country and year-specific wage deciles for each household, as with the WVS dataset (column 2). We also consider the possibility that our income measure does not fully reflect the material wealth of the households in the sample. We utilise the EU-SILCs data on possession of cars and washing machines by creating dummy variables for each asset to provide a more complete indication of material wealth. The results are given in column 3. The coefficients of computer and TV ownership drop slightly, but stay highly significant. As a final robustness check, we include ten occupational dummy variables capturing the different sectors of the labour market in which the households operate (column 4).[12] Throughout all specifications, the estimated effect for computer possession remains significant at around 3-4 %. We eventually also check that our results for computer and television ownership hold when considering different types of habitat and obtain estimates for subsamples of different degrees of urbanisation.[13]

4 Empirical analysis of well-being implications

4.1 Empirical strategy

Our previous results show that there is a robust positive relation between ICT access and material aspirations. As outlined in section 2, this potentially has repercussions on subjective well-being through fostering relative deprivation (for the relatively poor) or relative happiness (for the relatively rich). Using data from the WVS, we perform a simple cross-sectional analysis to test whether individuals who use different ICTs, particularly the internet, are systematically

[12]The occupational classification follows the one-digit ISCO codes. With the exception of skilled agricultural and fishery workers, all occupational dummy variables enter significantly and positively with non-employment as baseline.

[13]Regression results available upon request.

different in how their income translates into life satisfaction. Here, the identification of the effect of ICTs on subjective well-being comes from comparing self-reported well-being of individuals who are similar in terms of income and other basic socio-economic and demographic variables, but differ only in their usage of information technologies. Subjective well-being will be proxied by self-reported life satisfaction scores. Individuals are asked how they evaluate their life satisfaction on a limited numerical scale, where 1 stands for the lowest degree of satisfaction and 10 for the highest.[14]

In line with the arguments outlined above, we model subjective well-being to depend on own income and the availability of information about the living conditions of others. The crucial element of our estimation equation is the interaction effect between information sources and income, which reflects how well-being effects of income differ between users and non-users of information technologies. It is reasonable to allow for varying coefficients of the interaction term and to estimate interaction effects for different income groups separately. In this way, the effect of income on well-being need not be linear and we can test whether differential income effects matter when going up or down the income ladder. Given that we perform a cross-sectional analysis, this essentially serves to identify in which group (the relatively rich, the relatively poor, or both) such indirect well-being effects matter. If we separate income into deciles, our estimation equation for the WVS reads:

$$\text{SWB}_i = \alpha + \sum_{k=1}^{10} \beta_k I(Y_i = k) + \sum_{j \in S} \gamma_j \text{info}_{ij} + \sum_{k=1}^{10} \sum_{j \in S} \delta_{kj} \left(\text{info}_{ij} \cdot I(Y_i = k)\right) + \mathbf{\Phi Z}_i + \epsilon_i, \quad (3)$$

where subjective well-being (SWB) is regressed on dummies for ten income deciles ($I(Y_i = k)$), a dummy for each source of information from the set S used (info), an interaction term of income and the different sources of information for all income groups, and a set of control variables ($\mathbf{Z}$). If $\beta_k > 0$ and $\delta_{kj} < 0$, the positive effect of additional income on well-being is reduced by the negative effect of ICT-driven material aspirations.

As our dependent variable (life satisfaction) is discrete and measured on an ordinal scale from 1 to 10, a great part of the analysis will use ordered probit estimation. As for the variables included in the interaction term, we need to take into account that in non-linear models, the calculation of the marginal interaction effect is not straightforward (Ai and Norton 2003). We finally assume observations to be independent across countries, but account for the possibility of correlated error terms within countries by clustering standard errors on the country level in

[14] We thus build on the presumption that reported satisfaction scores convey some information about utility, an assumption commonly made in both the theoretical and empirical happiness literature on the grounds that life satisfaction statements and economic decision-making are highly correlated (e.g., Van Praag 2011; Clark et al. 2008; Frey and Stutzer 2002; Kahneman et al. 2004; Ferrer-i-Carbonell 2012; Clark and Oswald 1996; Van Praag 2011; Benjamin et al. 2012).

all specifications.

As we perform a simple cross-sectional analysis, our analysis is challenged by a number of endogeneity concerns which might prevent the identification of the causal effect of ICTs on the satisfaction-effect of income. First and foremost, ICTs are not randomly assigned across the population. Rather, households make an active decision of whether or not to buy computers, television sets, and other media. One important limitation of the WVS dataset is, of course, that we can only control for individual heterogeneity based on observables, so that some justification for the choice of control variables is in order. According to the existing literature on the micro-level determinants of internet use, e.g., Chaudhuri et al. (2005), socio-demographics, income and education are among the major predictors. Additionally, we consider a number of softer attitudinal characteristics, such as different social networks, as affecting the propensity to buy access to ICTs. On the macro side, the diffusion of ICTs is highly dependent on the general economic performance of a country. For this reason, and to capture economic, societal and cultural differences in reported life satisfaction that are common within countries, we also include country dummies in all the regressions. This also accounts for the effect that measures of subjective well-being are hardly comparable across different countries (Diener and Oishi 2004).

4.2 Data

The WVS (2009) provides individual-level data on subjective well-being as well as values and beliefs towards economic, political, religious, social, and ethical topics. For our analysis of the effects of ICTs on well-being, we use data from the fifth wave that was conducted from 2005 to 2007. It covers six continents and 57 countries and for the first time, the questionnaire includes questions on the usage of different technologies used to acquire information.

Our measure of subjective well-being is taken as the response to the question "All things considered, how satisfied are you with your life as a whole these days?" which respondents answered on a scale from 1 (completely dissatisfied) to 10 (completely satisfied). Our main explanatory variables of interest include a measure of income and a measure of ICT usage. As the income measure, we use self-reported deciles in the national income distribution. So while we do not have a perfectly comparable and objective income measure across countries, we still have a comparable indicator of income within a country. As for a measure of usage of information technologies, respondents were asked the following question: "People use different sources to learn what is going on in their country and the world. For each of the following sources, please indicate whether you used it last week or did not use it last week to obtain information: daily newspaper, news broadcasts on radio or TV, printed magazines, in-depth reports on radio or

TV, books, internet and e-mail, talk with friends or colleagues." We define dummy variables that take the value of 1 if the respondent used the sources of information last week, and a value of 0 if not.[15] Around 30 % of the respondents in the sample stated that they had used internet or e-mail. Thus, in comparison, the internet is still the least often used source of information. 59 % of the people use the daily newspaper, 35 % use magazines, 31 % use books. 90 % of the respondents follow daily news broadcasts on radio or TV and 66 % follow in-depth reports on these media. Finally, 77 % of all individuals in the sample report that they stay informed through friends and work colleagues. Multiple answers were possible, such that responses are positively correlated.[16] As for those respondents using the internet, 79 % used newspapers, 94 % watched daily news and 75 % followed in depth-reports on TV, and roughly every second person also used books or magazines.

In table 4, we see that there is large variation in the typical sources of information used both across income groups within a country as well as across countries in different stages of development. Internet, in particular, is not universally available for all income groups in our sample, but is found to be most diffused in high-income countries and higher parts of individual countries' income distributions. The first row for each medium reports the share of people in the whole sample. As can be expected, people in higher income groups generally use multiple sources of information. The usage of internet and e-mail increase the most with increases in income. While only 12 % of all respondents in the lowest income decile said that they used internet at least once a week, of those in the highest income bracket 62 % report doing so. This pattern points to the fact that internet is, in many countries, still one of the more expensive sources of information. Other sources of information are used more extensively across all income brackets. When we group all countries in the sample into four categories according to the official World Bank (2012) classification (low-income, lower middle-income, upper middle-income, and high-income), we can identify some interesting patterns when contrasting low-income and high-income countries. As for the usage of internet, the share of users almost quadruples from the lowest to higher income deciles in low-income countries (7.5 % to around 27.5 %). In high-income countries, we see that even 30 % of those people at the bottom of the income distribution use the internet regularly. TV consumption is even more wide-spread, with usage shares of 50 to 60 % even in the lowest income deciles. It thus seems likely that if the internet shapes relative concerns, it may do so primarily in wealthy countries. With costs of internet usage dropping significantly in the future,

[15] As for the usage of internet, it seems sensible to assume that those people who report using the internet as a source of information are also those people who use the internet very often. Similarly, those respondents who do not use the internet as source of information at least once a week, are arguably also less frequent users of the internet in general. Using the internet as a source of information thus provides an adequate proxy for the usage of internet in general.

[16] All pairwise correlation coefficients are significantly different from zero.

Table 4: Different sources of information by income groups

Income Decile	1	2	3	4	5	6	7	8	9	10
Internet / E-Mail	12.0	14.3	19.3	24.7	27.9	35.2	41.4	43.7	55.2	62.1
Low-income countries	7.5	5.3	8.3	14.2	16.8	19.4	21.2	28.3	36.9	27.5
Lower middle-income countries	3.3	6.1	8.6	10.9	15.3	19.4	24.8	25.8	24.9	21.4
Upper middle-income countries	6.1	9.6	13.1	18.7	22.7	29.8	31.3	35.7	40.9	48.6
High-income countries	31.6	30.3	37.4	44.2	46.4	55.1	64.6	66.5	76.8	77.8
Daily newspaper	34.3	41.2	48.9	54.7	57.0	64.8	68.3	70.7	75.2	77.9
Low-income countries	9.6	10.4	17.6	28.6	32.2	49.3	45.3	47.2	64.1	45.8
Lower middle-income countries	22.6	24.8	33.2	37.5	40.7	49.4	53.9	57.3	58.8	43.8
Upper middle-income countries	27.0	37.0	44.4	52.4	55.4	62.8	64.7	68.5	68.1	70.1
High-income countries	66.0	68.2	73.4	75.9	78.3	80.8	84.4	85.6	86.6	89.2
News broadcasts (radio/TV)	78.4	83.9	87.4	88.8	89.9	91.5	91.6	90.4	92.3	93.0
Low-income countries	57.6	57.8	67.7	77.4	76.7	79.5	76.2	75.7	76.2	80.8
Lower middle-income countries	68.1	73.5	80.7	84.6	87.7	91.6	91.6	89.1	82.6	71.2
Upper middle-income countries	79.3	87.2	89.0	89.1	90.3	90.5	90.6	90.4	92.5	91.2
High-income countries	93.7	94.2	95.2	94.5	94.9	95.1	95.3	94.0	96.9	97.7
In-depth reports (radio/TV)	55.1	58.3	61.6	63.4	65.9	68.4	68.2	71.0	71.9	76.1
Low-income countries	43.9	37.9	44.8	55.7	54.6	63.5	60.5	64.3	67.7	82.0
Lower middle-income countries	40.9	42.2	49.4	56.8	63.2	70.3	67.7	70.9	65.4	58.3
Upper middle-income countries	54.9	62.8	67.1	66.3	68.0	67.4	67.0	71.6	71.1	74.9
High-income countries	72.3	69.1	68.7	67.3	69.0	68.8	70.7	71.6	74.7	78.8
Printed magazines	19.9	21.3	25.5	29.9	33.7	38.5	44.0	45.7	49.6	54.7
Low-income countries	9.4	10.4	13.2	23.1	26.8	30.0	37.9	36.8	46.2	53.1
Lower middle-income countries	13.4	12.6	16.7	18.6	23.7	28.5	30.8	32.1	39.0	22.6
Upper middle-income countries	12.3	15.1	18.9	23.2	29.4	33.0	39.7	44.0	43.3	49.5
High-income countries	42.4	40.5	42.5	46.6	47.9	52.7	56.7	57.2	57.9	62.1
Books	20.4	21.5	23.9	27.3	30.6	35.6	39.8	40.5	43.7	46.6
Low-income countries	18.7	21.7	20.8	28.9	30.4	40.4	42.7	42.7	47.8	41.7
Lower middle-income countries	14.7	16.1	17.6	21.7	24.3	29.6	34.8	38.9	39.4	29.0
Upper middle-income countries	16.3	18.9	20.9	25.3	28.9	33.6	36.8	38.5	42.1	45.3
High-income countries	33.7	29.9	33.3	33.7	37.7	41.2	45.3	43.7	45.8	49.8
Friends or colleagues	65.7	67.6	72.2	74.6	76.7	79.7	82.3	83.5	84.8	84.4
Low-income countries	84.4	79.2	77.6	77.7	75.7	79.8	84.8	86.5	78.8	84.2
Lower middle-income countries	65.9	71.0	74.2	75.1	78.5	81.1	79.8	81.9	77.8	72.5
Upper middle-income countries	55.2	59.1	64.3	68.9	70.9	73.5	78.5	79.6	80.3	77.9
High-income countries	77.7	75.5	79.3	80.4	82.2	85.7	87.4	88.6	91.0	90.7

Source: World Values Survey, Wave 5 (2005-2007)

however, one could expect an increasing role of technology-driven relative concerns in lower and middle-income countries as well.

As for socio-demographic control variables, we employ standard regressors from well-being regressions (e.g., McBride 2001; Stutzer 2004; Dolan et al. 2008; Bjœrnskov et al. 2008; Di Tella et al. 2003) to proxy the age of the respondent, marital status, labor and educational status, subjective health, and the beforementioned attitudinal characteristics. As for their precise definition, we stay in line with Bruni and Stanca (2006) and refer to table A.2 in the appendix for details. Including all control variables, we are left with 53,325 observations from 49 countries.

Table 5 provides some basic descriptive statistics for the variables employed in the analysis. Average life satisfaction is close to 6.8 (although this has only limited meaning due to the ordinal scale). Moreover, the sample is almost equally split into male and female respondents. About 64 % of the respondents are married and the average person in our sample is slightly

Table 5: World Values Survey, Wave 5 (2005-2007) – Descriptive Statistics

	Mean	Standard deviation	Min	Max
Life satisfaction	6.79	2.23	1	10
Income decile	4.83	2.26	1	10
Age	41.78	16.13	18	98
Male (dummy)	0.49	0.50	0	1
Married (dummy)	0.64	0.48	0	1
Separated/Widowed/Divorced (dummy)	0.30	0.46	0	1
Unemployed (dummy)	0.10	0.30	0	1
Low education (dummy)	0.34	0.47	0	1
Middle education (dummy)	0.43	0.50	0	1
High education (dummy)	0.23	0.42	0	1
Subjective health status	3.88	0.85	1	5
Perception of honesty	8.74	2.16	1	10
Trusting (dummy)	0.26	0.44	0	1
Perception of freedom	7.11	2.22	1	10
Family important in life	3.91	0.33	1	4
Friends important in life	3.35	0.71	1	4
Leisure important in life	3.13	0.80	1	4
Politics important in life	2.39	0.96	1	4
Work important in life	3.51	0.73	1	4
Religion important in life	3.05	1.06	1	4
Info source: internet (dummy)	0.30	0.46	0	1
Info source: newspaper (dummy)	0.59	0.49	0	1
Info source: daily radio or tv reports (dummy)	0.90	0.30	0	1
Info source: in-depth radio or tv reports (dummy)	0.66	0.47	0	1
Info source: magazines (dummy)	0.35	0.48	0	1
Info source: books (dummy)	0.31	0.46	0	1
Info source: friends / colleagues (dummy)	0.77	0.42	0	1
Usage of a personal computer (dummy)	0.48	0.49	0	1
Observations	53,325			

above 40 years of age. 10 % are unemployed, the majority (more than 40 %) has a middle education degree, with 34 % and 23 % in low and high education, respectively. Only 26 % of the sample is generally trusting while perceptions of honesty and freedom are, on average, quite high. Throughout the whole sample, on average, family is named as important in life by most of the people, followed by working colleagues and friends.

4.3 Results

4.3.1 Does internet access change the satisfaction derived from income?

As a starting point, we only look at the internet as the ICT of interest. Table 6 provides regression results from both OLS and ordered probit estimation. The partial correlations of the control variables are in line with existing literature (e.g., McBride 2001; Stutzer 2004; Dolan et al. 2008; Bjœrnskov et al. 2008; Di Tella et al. 2003; Bruni and Stanca 2006) and confirm that our model of subjective well-being the model is well-specified.[17]

Turning to our research hypothesis that usage of ICTs lowers the satisfaction effect of income, we find income to be strongly positively correlated with life satisfaction in the least squares

[17] As they are not central to our analysis, we omit an executive discussion here.

Table 6: WVS: Determinants of life satisfaction – Least squares and ordered probit

	Least Squares		Ordered Probit		
	(1)		(2)		Marg. effects
Income	0.1908***	(0.0223)	0.0973***	(0.0112)	
Info source: Internet	0.4406***	(0.0753)	0.1986***	(0.0364)	
Income * Internet	-0.0819***	(0.0142)	-0.0376***	(0.0069)	
Age	-0.0366***	(0.0042)	-0.0214***	(0.0025)	[-0.0350]
Age-squared	0.0004***	(0.0000)	0.0003***	(0.0000)	[0.0004]
Male	-0.1105***	(0.0250)	-0.0621***	(0.0131)	[-0.1020]
Married	0.2102***	(0.0530)	0.1161***	(0.0296)	[0.1906]
Separated	-0.1024*	(0.0512)	-0.0671**	(0.0273)	[-.01102]
Unemployed	-0.2715***	(0.0515)	-0.1347***	(0.0276)	[0.2211]
Middle education	-0.0618*	(0.0334)	-0.0440**	(0.0193)	[-0.0721]
High education	-0.0601	(0.0409)	-0.0489**	(0.0237)	[-0.0802]
Subjective health	0.6088***	(0.0295)	0.3405***	(0.0154)	[0.5588]
Honesty	0.0217***	(0.0067)	0.0130***	(0.0036)	[0.0213]
Trust	0.1745***	(0.0337)	0.0918***	(0.0192)	[0.1506]
Freedom	0.2343***	(0.0109)	0.1333***	(0.0082)	[0.2188]
Family important	0.2138***	(0.0353)	0.1134***	(0.0190)	[0.1861]
Friends important	0.0565***	(0.0201)	0.0313***	(0.0114)	[0.0513]
Leisure important	0.0600***	(0.0187)	0.0367***	(0.0103)	[0.0602]
Politics important	0.0038	(0.0134)	-0.0004	(0.0079)	[-0.0007]
Work important	-0.0512**	(0.0209)	-0.0245**	(0.0113)	[-0.0402]
Religion important	0.1151***	(0.0160)	0.0699***	(0.0085)	[0.1147]
Observations	53,325		53,325		
Adjusted R^2	0.3214				

Dependent variable: Life Satisfaction (1-10)
Standard errors, clustered on country level, in parentheses. ***/**/*: significant at 1 %/5 %/10 %.
49 country dummies included as additional controls.
Source: World Values Survey, Wave 5 (2005-2007)

specification. We also see that the usage of internet as a source of information is associated with a highly significant increase in life satisfaction. This is consistent with the hypothesis that people derive satisfaction from using the internet, possibly because it serves as a source of information or because it allows them to engage in other happiness-giving activities. According to the hypothesis, the positive effect of income on life satisfaction should be lower for people with access to ICTs, so that the interaction effect should be negative and statistically significant. We find the interaction term between income and internet in the OLS specification to be significantly negative. The positive satisfaction effect of additional income in the form of climbing to a higher income decile is cut by more than 40 %.

We have to keep in mind that a negative interaction effect would also imply that going down one step on the income ladder is associated with a lower loss of satisfaction for those who use the internet. We thus relax the rigid estimation of table 6 in which the income and interaction effects are assumed to be homogeneous across all income groups, and turn to the more flexible estimation of equation (3). This is not only interesting for the abovementioned reasons per se, but also addresses concerns of potential functional form misspecification for the relation between income and life satisfaction, which might have driven the results in table 6. Due to the ordinal dimension of our dependent variable, we restrict ourselves to the result of the more adequate

Table 7: WVS: Marginal effects of income on life satisfaction by internet users

	Without internet		With internet		Difference	
1st decile			*(omitted)*			
2nd decile	0.01037**	(0.0047)	-.00150	(.0078)	-0.0119	(0.0096)
3rd decile	0.0158***	(.0057)	0.0103	(0.0094)	-0.0055	(0.0100)
4th decile	0.0289***	(0.0067)	0.0115	(0.0088)	-0.0174*	(0.0089)
5th decile	0.0539***	(0.0111)	0.0352***	(0.0090)	-0.0187*	(0.0109)
6th decile	0.0676***	(0.0108)	0.0427***	(0.0103)	-0.0248**	(0.0105)
7th decile	0.0922***	(0.0118)	0.0583***	(0.0125)	-0.0339***	(0.0093)
8th decile	0.1175***	(0.0144)	0.0680***	(0.0157)	-0.0495***	(0.0123)
9th decile	0.1079***	(0.0192)	0.0730***	(0.0152)	-0.0348**	(0.0157)
10th decile	0.1129***	(0.0227)	0.0680***	(0.0179)	-0.0449**	(0.0137)
Observations			53,325			

Ordered probit estimation of (3).
Standard errors in parentheses. ***/**/*: significant at 1 %/5 %/10 %.
Source: World Values Survey, Wave 5 (2005-2007)

ordered probit model in what follows.

To test our hypothesis of different income effects by usage of the internet and by different income groups, we calculate marginal effects of income on the probability of reporting the highest category of life satisfaction differentiating by users and non-users of internet. As table 7 shows, we find all estimated marginal effects for income to be positive and significant for the group of non-users. A rise in income is associated with a higher probability to report high life satisfaction up to the eighth income decile. For people who use the internet regularly, only from the fifth income decile onwards are there significantly positive income effects on life satisfaction.

More importantly, the last column of table 7 gives the contrast in marginal effects of income between internet users and non-users.[18] Figure 2 plots this difference in marginal effects. Given a confidence level of 95 %, we find the increase in life satisfaction associated with a rise on the income ladder to be significantly lower for internet users than for non-users from the sixth income decile on. The difference in marginal effects rises from slightly above 2 percentage points in the sixth income decile to almost 5 percentage points in higher income deciles. For the fifth income decile, for instance, the marginal effect of income is reduced by roughly 35 %. The highest relative difference occurs for the eighth income decile with a reduction of more than 42 %. The reduction is similar to what we find in the OLS analysis in table 6. For lower income groups, we do not find a statistically significant difference in the marginal effects of income.

These results are the first central point of this paper: Against the background that we are doing a cross-sectional analysis and identification comes from comparing incomes and ICT possession *across* individuals, this implies that indirect well-being effects from ICT-driven material aspirations matter when climbing up the income ladder. Having a higher income yields less life satisfaction for users of the internet due to higher material aspirations. Material aspiration

[18]The difference has to be interpreted as the percentage points that the marginal effect of income on the likelihood to report the highest category of life satisfaction is larger for internet users than for non-users.

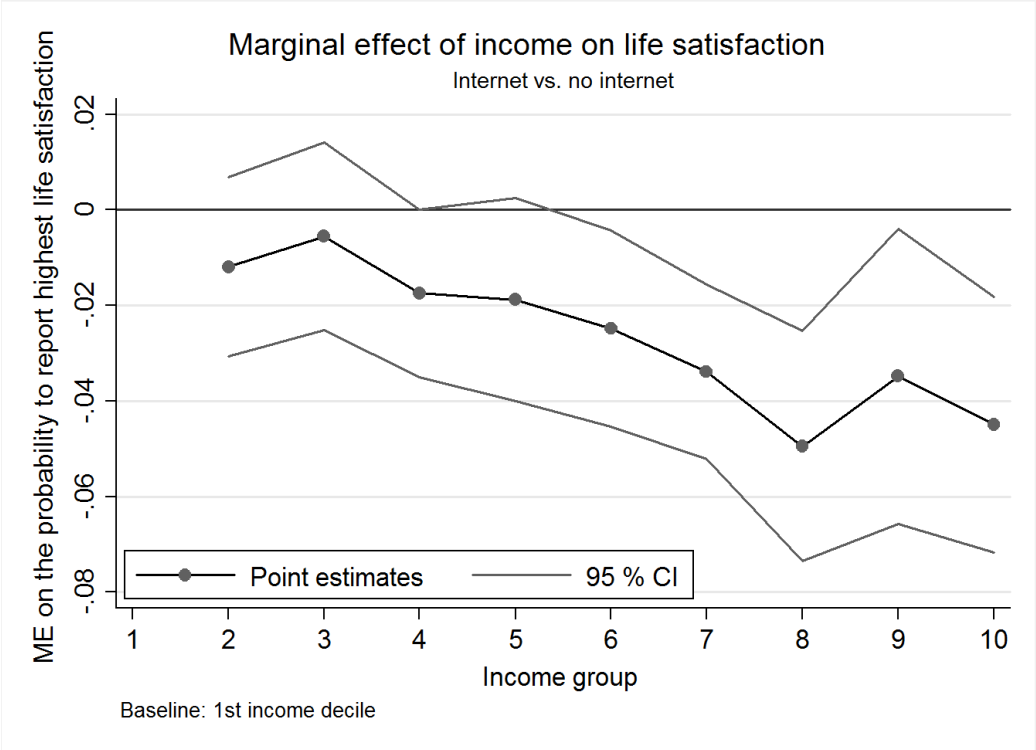

Figure 2: Difference in marginal effects of income on life satisfaction

effects do not matter when going down the income ladder, i.e., we do not find evidence for any differential income effects for lower income groups in our sample.

In the specifications above, we have only considered internet as the sole technology in our regression. Arguably, the internet is qualitatively different from other sources of information, for the scope of information that can be acquired is typically much wider and it allows for much more interpersonal interaction than, for example, radio or TV. Also, processing of information acquired via the internet might happen more consciously and actively than of information passively acquired through TV programmes. We therefore might expect material aspiration effects to be strongest for the internet as a source of information. When we plot the contrast in marginal effects of income between the users of the respective sources of information and the non-users for a model including various technologies, we find the differences in marginal effects individually not statistically significant for most sources of information.[19] Internet is the only technology for which income effects are systematically different for middle- to high-income groups.[20]

[19]Regression results available upon request.

[20]Of course, the usage of different sources of information is positively correlated in most cases. People who watch TV are also more likely to use the internet. Finding different patterns for different sources of information thus puts high demands on variation in our dataset.

4.3.2 Robustness

To finally assess the robustness of the main finding of heterogeneous income effects by ICT usage, we check whether the results hold for a different measure of computer and internet usage. In the WVS, respondents were asked how often they made private use of a personal computer. We separate the sample into two groups with different frequencies of usage: "frequent" or "occasional usage" and "no usage". The corresponding graph is given in figure A.3. Our results remain qualitatively unchanged. We see that income effects for PC users are significantly lower from the fifth income decile on. Taking the eighth decile for illustration, we find a reduction in the magnitude of again about one third.

Unfortunately, we cannot assess whether our results are robust to controlling for the type of habitat the households lives in (e.g., the degree if urbanisation) as this information is missing from the WVS dataset. The preceding results from the EU-SILC data, however, have not revealed any evidence that the unobserved degree of urbanisation might bias our results here.

5 Conclusion

There is now robust evidence from the emerging literature on the economics of happiness that individual subjective well-being is influenced by relative concerns towards the social environment. What has only attained limited attention in previous research is the role of information in shaping relative concerns. Van Praag (2011) argues that the extent to which inter-individual comparisons can be made crucially depends on the degree of self-orientation or, reciprocally, on the degree of social transparency. Against the background of significant advancements in the diffusion of modern information and telecommunication technologies, we posit that informational globalisation might have an impact on the strength that relative concerns have in affecting well-being. Specifically, we conjecture that access to the internet raises material aspirations, such that financial satisfaction for a given income is different for people with and without internet access.

Using two micro-datasets with information on life satisfaction, a level of reference income, and usage of modern media, we empirically test whether differential access to the internet (i) raises material aspirations and (ii) explains differences in the effects of income on reported life satisfaction. The direct analysis of material aspirations uses six waves from the European Union Statistics on Income and Living Conditions (2004-2009) to obtain a direct measure of the level of reference income that households might use as a benchmark in their comparison, namely the response to what households consider as subsistence income. Our results show that households in possession of a computer report to need higher incomes 'to make ends meet'

than those without. Considering all countries in the sample, the effect of computer possession is estimated around 4.2 % and is found to be contingent on areas with an advanced degree of internet infrastructure. Cross-sectional evidence from the fifth wave of the World Values Survey (2005-2007) suggests that individuals who regularly use the internet as a source of information derive less life satisfaction from a rise in income. This is consistent with the narrative of rising material aspirations. We find this effect to be restricted to upper parts of the income distribution, which indicates that material aspirations matter only when climbing up the income ladder. The usage of other media, such as newspapers or television, is in turn not associated with a significant difference in life satisfaction effects from income.

What insights do our results provide in terms of relevance for economic policy? We see the empirical evidence as one factor to explain supposedly paradoxical consumption decisions of households that live in a society where status matters. If material aspirations are precipitated by the diffusion of modern information technologies, this implies that in information-dominated societies, there might exist a tendency to shift towards status goods which are visible and reflect a certain social standing. Our findings also add to the debate of absolute versus relative measurements of well-being and poverty. Not only do material aspiration effects indicate the need for relative well-being measures, but people with high material aspirations will also self-report being poor even though their actual income might be relatively high.

Finally, there are limitations to our observational study. First, we are not able to specify an exact channel through which material aspirations enter the well-being function. We do have some indication that ICT access raise the level of reference income, but cannot identify whether this is driven by internal or external norms. ICTs might simply allow for stronger comparisons vis-à-vis a given reference group (potentially including the individual themselves), or change the entire scope of reference. As the EU-SILC dataset does not include a measure of subjective well-being, we cannot test for changing directions of income comparisons, e.g., vis-à-vis ad-hoc defined reference groups. The literature has identified several potential reference groups for the income comparison process: family, friends, neighbours, work colleagues, or the own past (see, e.g., Stutzer 2004). Such detailed analysis of how informational globalisation changes the nature of reference group formation provides interesting scope for further research.

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A Appendix

Table A.1: EU-SILC: Definition of variables

Computer / TV / Phone	1 if answer to "Do you have a computer / colour TV / telephone (including mobile phone)?" is "yes"
Income	Total disposable household income, after taxes and transfers
Age	Age of respondent
Household size	Number of people classified as part of the household
Male (dummy)	1 if repondent is male
Married (dummy)	1 if respondent is "married"
Low education (dummy)	1 for "pre-primary education" or "primary education"
Middle education (dummy)	1 for "lower secondary education", "upper secondary education" or "post-secondary non-tertiary education"
High education (dummy)	1 for "tertiary education"
Emploment status	self-defined current economic status
Low-urban (dummy)	1 if density below 100 inhabitants per square km
Mid-urban (dummy)	1 if density between 100 and 500 inhabitants per square km
High-urban (dummy)	1 if density exceeding 500 inhabitants per square km

Figure A.1: EU-SILC: Response to minimum-income question and actual household income

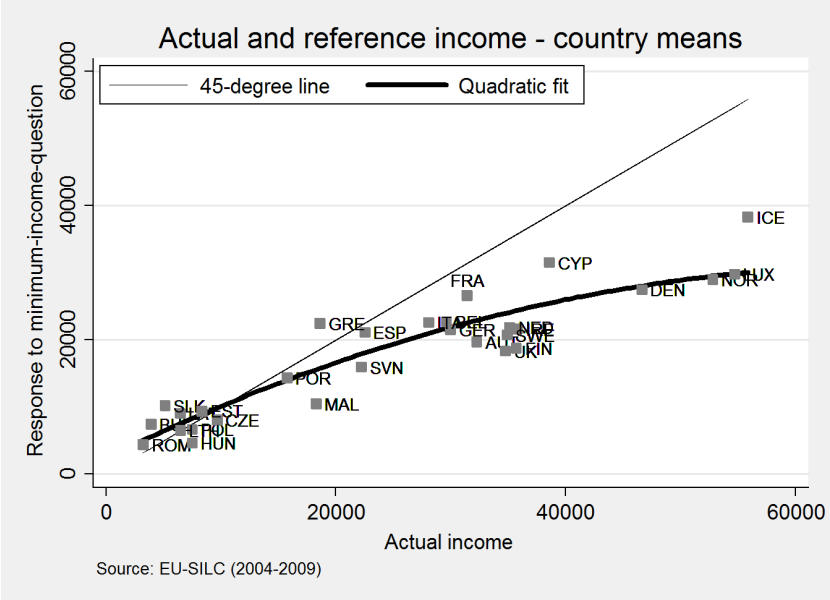

Figure A.2: EU-SILC: Computer possession over the sample period

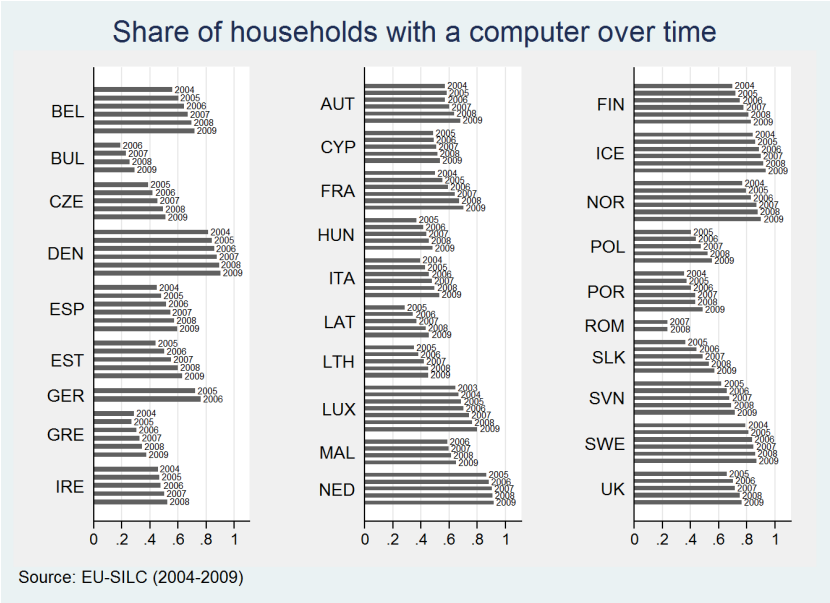

Figure A.3: WVS: Income effects and PC usage

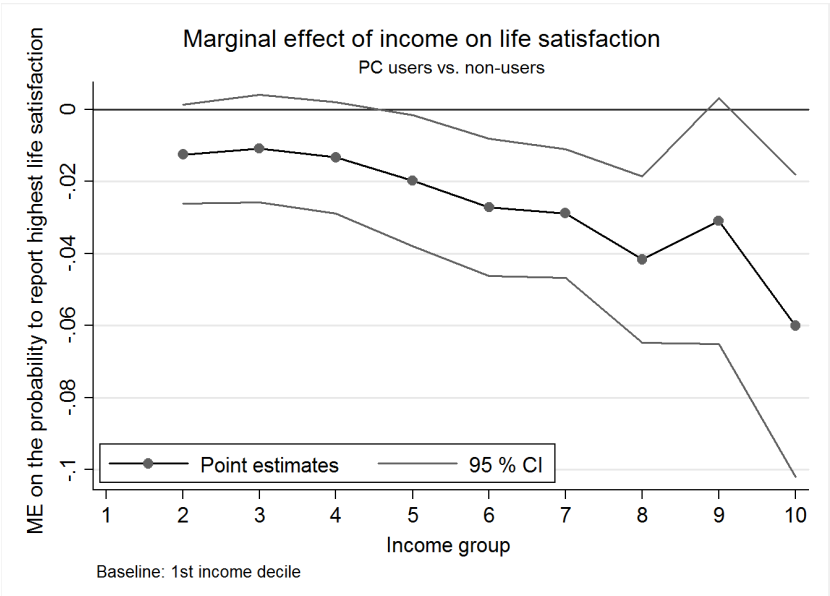

Table A.2: WVS: Definition of variables

Life satisfaction	Answer to "All things considered, how satisfied are you with your life as a whole these days?" (1: completely dissatisfied - 10: completely satisfied)
Income decile	Answer to: "On this card is a scale of incomes on which 1 indicates the lowest income decile and 10 the highest income decile in your country. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that come in!"
Age	Age of respondent
Male (dummy)	1 if repondent is male
Married (dummy)	1 if respondent is "married" or "living together as married"
Separated/Widowed/Divorced (dummy)	1 if respondent is "separated", "widowed", or "divorced"
Unemployed (dummy)	1 if respondent has "no paid employment" and is "unemployed"
Low education (dummy)	1 for "no formal education", "incomplete primary school", or "complete primary school"
Middle education (dummy)	1 for "incomplete secondary school: technical/vocational type", "complete secondary school: technical/vocational type", or "incomplete secondary: university-preparatory type"
High education (dummy)	1 for "complete secondary: university-preparatory type", "some university-level education, without degree", or "university-level education, with degree"
Subjective health status	Answer to "All in all, how would you describe your state of health these days?" (1: very poor, 2: poor, 3: fair, 4: good, 5: very good)
Perception of honesty	Answer to "Please tell me whether you think it can always be justified, never be justified, or something in between to cheat on taxes if you have a chance" (1: always justifiable - 10: never justifiable)
Trusting (dummy)	1 if answer to "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" is "Most people can be trusted."
Perception of freedom	Answer to "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. Please use this scale where 1 means "no choice at all" and 10 means "a great deal of choice" to indicate how much freedom of choice and control you feel you have over the way your life turns out."
Factors important in life	Answer to "For each of the following, indicate how important it is in your life: family, friends, leisure, politics, work religion" (1: not at all important, 2: not very important, 3: rather important, 4: very important)
Information sources (dummies)	Answer to: "People use different sources to learn what is going on in their country and the world. For each of the following sources, please indicate whether you used it last week or did not use it last week to obtain information: daily newspaper, news broadcasts on radio or TV, printed magazines, in depth reports on radio or TV, books, internet/e-mail, talk with friends or colleagues" (1 for having used)
Usage of a personal computer (dummy)	1 if answer to "How often, if ever, do you use a personal computer?" is "frequently"