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HAPPINESS AND ECONOMIC PRODUCTION THROUGH 'SOCIAL SHARING' IN THE INTERNET AGE: SOME RESULTS FROM SETI@HOME*

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HAPPINESS AND ECONOMIC PRODUCTION THROUGH 'SOCIAL SHARING' IN THE INTERNET AGE: SOME RESULTS FROM SETI@HOME*

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ABSTRACT

Voluntary Internet-based distributed computing ('social sharing' for short) is emerging as a distinct mode of resource allocation and economic production, alongside price-based and hierarchy- (i.e. firm-) based modes. This paper presents a cross-country analysis of the factors determining participation in the classic example of a social sharing project, the Search for Extraterrestrial Intelligence (SETI@home). The key hypothesis tested is that the average level of happiness in a country is a major positive and statistically significant motivational factor for participating in SETI@home, even after controlling for cross-country differences in ICT access and GDP per capita. It is also hypothesised that trust, i.e. social capital, is a less important motivational factor than happiness. Both hypotheses are confirmed, but only for the group of developed and advanced countries.

* I thank Ruut Veenhoven and Paul Perry for supplying some of the data used in this paper.

JEL Classification: I31, D2, D64, Z13

Key Words: Happiness, SETI@home, Internet, social sharing, resource allocation, mode of production, distributed computing, social capital.

1. INTRODUCTION

SETI@home is the prime example of a voluntary and non-commercial Internet-based distributed computing project, or public resource computing. It uses the idle capacity of millions of computers to search for signs of extraterrestrial intelligence in radio signals from space. Data units are distributed from the project's server via the Internet to participating computers that have downloaded the software to process the units. Once processed, they are returned and another data unit is downloaded for processing.[1]

Benkler (2002, 2004) has argued that projects like SETI@home herald the advent of a common but so far neglected third mode of resource allocation and economic production in the digital age, i.e. Internet-based 'social sharing and exchange' ('social sharing' for short), whose salience in the economy is sensitive to technological conditions, although it is not strictly determined by them.[2] The other two modes are price-based and hierarchy- (i.e. firm-) based resource allocation. Benkler does not argue that social sharing will supplant the other modes, or that it will always be the more efficient way of producing digital goods and services. Rather, it is a distinct third mode of production that has some systematic advantages in identifying and allocating spare resources of human capital, creativity, and materials.[3]

Benkler (2002) has called for more qualitative and quantitative research into social sharing activities. This paper and Engelbrecht (2005) contribute to the emergent research agenda. In the earlier paper I showed that SETI@home participation and results per capita across 172 countries are not idiosyncratic. Rather, they can be largely explained by the cross-country variation in Information and Communications Technology (ICT) access as measured by the International Telecommunication

[1] For a history of the SETI@home project and of the science behind it see Anderson et al. (2002) and the SETI@home website at http://setiathome2.ssl.berkeley.edu/.

[2] Other examples of social sharing include open source software, Wikipedia, Slashdot, the Open Directory Project, and Google. However, its roots go back to the pre-Internet era, with car pooling being a prominent earlier example (Benkler, 2004).

[3] Benkler (2002) focuses mostly on the sharing of creativity, i.e. the efforts of creative labour. Benkler (2004) extends his earlier analysis to the domain of sharing rival material resources in the production of rival and nonrival goods and services. I use the term 'social sharing' to encompass, in principal, sharing of all kinds of resources, although SETI@home is clearly a case of sharing physical, rivalrous and (mostly) privately owned goods (i.e. computing power and bandwidth).

Union's Digital Access Index (DAI), GDP per capita (gdp), and regional dummy variables (Engelbrecht, 2005). That paper included the largest number of countries possible, which enabled me to also comment on the global SETI@home digital divide. However, the large number of countries included in the analysis severely limited the availability of explanatory variables.

The current paper explores the role of additional explanatory variables related to the motivation of participating in SETI@home. In particular, it is hypothesized that happiness or subjective well-being as measured by survey responses is a major motivational factor determining participation in social sharing, even after controlling for differences in general economic conditions and ICT access. There is a large happiness literature that contains many studies that discuss correlations between self reported happiness and other variables and/or try to analyse the determinants of happiness in a regression framework. This paper is one of the few so far that uses happiness as a major explanatory variable in a regression analysis.

The paper also addresses the issue of the relative importance of trust versus happiness as a motivational factor for social sharing. Trust is usually seen as a major component of social capital, and has been shown to have positive impacts on economic activity (Knack and Keefer, 1997). However, Benkler (2004) has argued that social capital is not a prerequisite for participation in SETI@home. I assess this hypothesis by, alternatively, using happiness and trust as explanatory variables in the regressions.

The major findings of this study are that there is indeed statistically significant evidence for a causal link between the level of happiness in a country and social sharing in terms of SETI@home, but only for the group of richer countries. Reassuringly, the strongest results are obtained for the a-priori preferred happiness variable, and results for trust are, as hypothesized, much weaker.

Section 2 develops the main hypothesis tested with respect to motivational factors determining participation in SETI@home. Variable selection and data sources are discussed in Section 3. Section 4 introduces the model, and empirical results are presented in Section 5. This is followed by a summary and concluding comments (Section 6).

2. SETI@HOME: AN EXAMPLE OF 'SOCIAL SHARING' AS A NEW MODE OF ECONOMIC PRODUCTION

SETI@home was launched in May 1999 and for much of its existence has been the most powerful special purpose supercomputer in the world. By December 2004 it had more than 5 million participants ('users'). Some information on the profile of SETI@home users and their professed reasons for participating in the project can be gained from a continuous on-line poll available on the official SETI@home website.

Data downloaded on March 30th, 2005, indicate that approximately 140,000 people had participated in the poll. Unsurprisingly, the vast majority of respondents (i.e. almost 94%) thought there was life outside earth. Of the remaining respondents, agnostics outnumbered non-believers by more than 3 to 1. 78% thought that earth should send a signal for aliens to hear. However, only 35% of respondents thought that aliens are likely to be friendly towards us, with 59% answering 'not sure'. Most respondents were in the 20-39 age range (about 61%), and most were male (almost 93%). When asked for the main reason why they were participating in SETI@home, 58.5% said they did it 'for the good of humanity', followed by about 17% responding 'to keep my computer busy'. Only about 3% admitted to participating in order 'to become famous', and even fewer said they participated in order to get their name listed on the SETI@home website.

Although one has to be careful not to read too much into them, these responses provide a broad picture of what motivates SETI@home users to participate in the project. These motivations are reflected in the design of the client interface and the SETI@home website in general, which try to provide the type of feedback to participants that binds them to the project by providing meaning to their contribution (Benkler, 2004). One of these mechanisms is the provision of user and results data by country, on which the empirical analysis reported in this paper is based.

SETI@home provides a screensaver which acts as a form of virtual marketing (Anderson et al., 2002). The website shows leader boards of work units processed not just for countries, but also for individuals and categories like email domains, teams, computer types, operating systems, and web links that might be of interest to

participants, thereby exploiting their competitive urges and interests and binding them to the project. Top users get recognised on the website and can download a certificate of appreciation. In short, the project caters for heterogeneous participants with diverse motivations.[4]

Benkler (2002, 2004) discusses in some detail the diverse motivations of contributors to public resource computing projects like SETI@home. Human beings like to be creative and participate in creative acts, some like to be altruistic, some like to participate in projects to enhance their reputation etc. SETI@home also fulfils the desire on part of many amateur scientists to be involved in a science project. It has a relative advantage over science projects requiring collaboration based on more formal organisational and institutional structures ('e-science') which make it a lot more difficult to overcome transaction costs (David, 2004).

The voluntary nature of participation naturally links SETI@home to the literature on altruism, gifting and volunteering.[5] Economists usually regard seemingly altruistic behaviour as due to a mixture of different motivations, both altruistic and egotistic (see, for example, Fehr and Fischbacher, 2003, Bénabou and Tirole, 2005). Moreover, Becker (1976) has shown that egoists might have incentives to act *as if* they were altruists, even if they are not. Many economists also recognise that altruistic, ethical and moral behaviour can usually be incorporated into the standard model of the utility maximising agent, despite the fact that many neglect to do this.[6]

Suffice to say, the topic remains an active area of research. Fehr and Fischbacher (2002) argue that economists fail to understand even core issues of their discipline if they insist on egotistic preferences at the exclusion of social preferences like reciprocal fairness, inequity aversion and pure altruism. Bénabou and Tirole (2005) suggest that the existing theories trying to explain altruistic behaviour need to be extended to accommodate a number of anomalies. They develop a theory of 'prosocial behaviour' that combines heterogeneity in individuals' degrees of altruism

[4] The SETI@home website also reports the type of location of users. Data for December 2004 indicate that 75.4% of them were located at home, 19.4% at work, 4.1% at schools and 1.1% elsewhere.
[5] See McGee and Skågeby (2004) for a review of the multi-disciplinary literature on altruistic sharing behaviour.
[6] See Becker (1996) and, for more recent reviews, Altman (2005) and Katz and Rosenberg (2005).

and greed with a concern for social reputation and self-respect. Altman (2005) argues that a broader neoclassical framework is especially appropriate and feasible when the consequences of economic agents' choices are not answerable to market forces. In that case neoclassical theory stresses the opportunity costs of non-egotistic behaviour. Moreover, Altman sees an inverse relationship between the quantity of virtuous acts undertaken and the level of opportunity costs. In the case of SETI@home, the opportunity costs are likely to be low, facilitating high levels of participation.

I conclude that participation in SETI@home and in similar projects cannot be explained purely by assuming standard egotistic utility maximising behaviour, but that it does not contradict an extended version of the standard assumption of rational utility maximisation that includes considerations of happiness. It is postulated that, ceteris paribus, happier people are more altruistic and therefore more likely to participate in Internet-based social sharing projects.[7] The major hypothesis proposed and tested in this paper is that the level of happiness in a country is a positive and statistically significant determinant of SETI@home participation measured in terms of output (i.e. data units processed) per capita, even after the degree of digital access and the standard of living have been controlled for.

3. VARIABLE SELECTION AND DATA SOURCES

Empirical studies of Internet/ICT diffusion and use report many (sometimes contradictory) findings with regard to positive and statistically significant explanatory variables. Kiiski and Pohjola (2002), for example, investigate the determinants of Internet diffusion across a sample of OECD countries during 1995-2000. They find that gdp and Internet access costs are the best explanatory variables for the growth of computer hosts per capita. Competition in telecommunication markets does not seem to have an independent influence. Education only becomes statistically significant in a larger sample of both industrial and developing countries.

[7] This does not exclude exceptions to the rule. For example, happiness is an unlikely motivating factor for at least a minority of SETI@home users: Anderson et al. (2002) report that the project has to be protected from a small number of misbehaving and malicious participants.

Using a panel of 161 countries over the 1999-2001 period, Chinn and Fairlie (2004) confirm the importance of income differentials in explaining the gap in computer and Internet use found in many other studies, but they also report that it is not always the only major factor. For example, differences in telecommunication infrastructure can be a rival factor. Secondly, in their country sample telecommunication access prices (and other policy factors) are swamped by economic, demographic and institutional factors. Thirdly, they find that the quality of regulation is of great importance. Furthermore, education co-varies with Internet use, but the education effect is small (i.e. in many cases accounting for only half of the effect attributable to differences in regulatory quality).

In contrast to the above, Caselli and Coleman II (2001), in their study of computer diffusion that uses five-yearly data from 1970 to 1990 for a varying sample of up to 90 countries, find that human capital (i.e. high levels of educational attainment) is an important determinant of computer technology adoption, even after controlling for other variables including gdp. Similarly, Pohjola (2003), in a study of ICT adoption and diffusion of 49 developed and developing countries during the 1993-2000 period, finds that human capital, the relative price of computers, and the level of income, are the most important determinants of computer use.

Taking account of the above studies, and considering the limited number of observations available, I focus on three broad categories of variables to explain the cross-country variation and growth in SETI@home results per capita. The first tries to account for Internet availability and its various dimensions, like Internet infrastructure, the ability or absorptive capacity of Internet users, costs of Internet access, the general level of Internet use etc. The second accounts for the standard of living as conventionally measured, i.e. by gdp. The third category tries to capture the main motivational factors explaining participation in SETI@home. The definitions and sources of variables used in this study are summarized in Table 1. The actual data used are shown in Appendix Table A1, and summary statistics are provided in Appendix Table A2. The variables and data are discussed in more detail below.

SETI@home Variables (SETI, ΔSETI)

The data on SETI@home results per capita ('SETI') were obtained from the SETI@home website. They are those reported on December 10th, 2002 and December 13th, 2004. They take into account all processed data units submitted from the beginning of the project up to the reported dates. The minor difference in the day of the month for the two years is due to the fact that the data on the website are not updated on a daily basis.

As can be seen from Appendix Table A1, there are large differences in results per capita across countries. The top ranked countries are Finland in December 2002 (with a value of 1.86) and Iceland in December 2004 (with a value of 4.18). The lowest ranked country in both years is Nigeria (0.00004 in December 2002 and 0.00014 in December 2004). Most SETI@home participants are, of course, located in developed countries, i.e. there exists a deep global SETI@home digital divide between rich and poor countries. However, this divide has not widened from December 2002 to December 2004. Instead, the data indicate that it has been slowly narrowing (see Engelbrecht, 2005, for further details).

Because of the cumulative nature of the data, I not only run regressions with December 2002 results per capita as dependent variable, but also with the *change* in results per capita from December 2002 to December 2004 ('ΔSETI ') as dependent variable. It should be noted that 'SETI@home results per capita' is an actual outcomes-based measure of Internet use. Such Internet use variables are rare.

Table 1: Definition and Sources of Variables

	Variable description and sources
Dependent variables:	
SETI	SETI@home results per capita, as reported on December 10th, 2002 (obtained from the SETI@home website).
ΔSETI	Change in SETI@home results per capita (December 10th, 2002 to December 13th, 2004).
Independent variables:	
DAI	Digital Access Index for 2002 (ITU, 2003).
gdp	2002 GDP per capita in thousands of purchasing power parity adjusted US$ (UNDP, 2004, pp. 139-141).
Happy90s	Variable 'hlt_90s' from the World Database of Happiness (Veenhoven, 2005).
Subjective well-being (SWB)	A combination of self-reported happiness scores and life satisfaction scores from the 1999-2001 wave of the World Values Survey (Inglehart, 2005).
Trust	Percentage of people who said others can be trusted. From World Values Survey, 1999-2001 wave (Ingelhart et al., 2004, Table A165).

The Digital Access Index (DAI)

The International Telecommunication Union (ITU, 2003, p. 4) has argued that access to ICTs is a most fundamental requisite for an inclusive information society, and that new indicators are needed that go beyond those measuring ICT infrastructure (like number of main telephone lines or Internet hosts), which no longer seems to be the main obstacles to ICT access. Other factors, for example affordability and the level of education of a population, also need to be taken into account. To remedy the shortcomings of existing indices, the ITU, in its 2003 World Telecommunication Development Report, introduced the DAI, which is arguably the most appropriate Internet access index currently available.

The DAI is a composite index made up of eight sub-indices: Number of fixed telephone and mobile telephone subscribers, Internet access price, adult literary rate, school enrolment rate, number of broadband subscribers, international Internet bandwidth, and number of Internet users. They are aggregated into five sub-components (infrastructure, knowledge, affordability, quality of access, and Internet

usage) before finally being aggregated into one index.[8] The DAI's value ranges between 0 and 1. The country with the highest DAI in 2002 is Sweden (0.85). Nigeria has the lowest DAI (0.15).

Standard of Living (gdp)

I use 2002 gdp in purchasing power parity (PPP) adjusted US$ reported in UNDP (2004) as an explanatory variable in the regressions in order to control for the cross-country variation in material living standards. The values for gdp in the data sample vary widely, i.e. between US$ 61,190 for Luxembourg and US$ 860 for Nigeria (see Tables A1 and A2A).

Motivational Variables

Layard (2005, p. 24) argues that happiness is supremely important because it is the main motivational device of the human species: What makes us feel good is generally good for our survival, and what causes us pain is usually bad for us. Since the 1940s, happiness or life satisfaction surveys have been accumulating steadily, and they have been a goldmine of data mostly for social scientists other than economists (Easterlin, 2002, p. ix), this despite the fact that concern about happiness has a long history in economics, going back to the early days of the discipline (Bruni, 2004).

In recent years happiness research has become a prolific area of economics research, and there has been a lively discussion about what happiness means and how to explain it.[9] The consensus, at least in economics, seems to be that the average level of happiness in a country is linked to and can be explained by objective factors. For example, Frey and Stutzer (2002) argue that an individual's happiness is strongly determined by micro- and macroeconomic conditions. Layard (2005, p. 71) reports

[8] See ITU (2003, chapter 5) for a detailed discussion of definitional and methodological issues of the DAI. The index was constructed for 178 countries in 2002. The ITU also calculated the DAI for 1998, but only for the 40 mostly developed economies for which it had data comparable to those for 2002. The rise in the ranking of Korea and Taiwan is especially dramatic (respectively improving 20 and 13 places), as is the drop in ranking of several Anglophone nations. For example, New Zealand drops 9 places, despite increasing its DAI from 0.6 to 0.72 (ibid., p. 117/8).

[9] See, for example, Veenhoven (1996), Oswald (1997), Frey and Stutzer (2002), Easterlin (2001, 2003), Di Tella et al. (2003), Layard (2005). For a psychology-based survey of the concept and its complex and multifaceted nature, see Diener et al. (2004).

that six factors can explain 80% of the cross-country variation in happiness as reported in the World Values Survey (WVS). These are the divorce rate, the unemployment rate, the level of trust, membership in non-religious organisations, the quality of government, and the fraction of the population believing in God.

However, few studies have explored the possibility of reverse causality, i.e. that happiness might cause higher levels of income and other outcomes. Kenny (1999) and Graham et al. (2004) are exceptions. Kenny investigates the hypothesis that happiness causes economic growth for a sample of OECD countries over the last 40 years, using time series evidence from happiness polls, and finds weak support for it (and no support for the causal link running from economic growth to happiness). Graham et al. use panel data from Russia to assess whether happiness affects income, health, and other factors. They find that the level of 'residual happiness' left after controlling for the degree of happiness associated with its usual determinants has a positive impact on people's future earnings and health.

These findings indicate that the issue of simultaneous relationships in happiness equations is a serious one which needs to be addressed once appropriate panel data are available. Unfortunately, the relative newness of Internet-based social sharing and the inevitable lag in published happiness statistics mean that I do not (yet) have such a data set available. Therefore, in this paper I simply assume that causality runs from the level of happiness to SETI@home participation. Like many other economists (for example Easterlin, 2001, Graham et al., 2004), I treat happiness, utility, subjective well-being, life satisfaction and welfare as synonymous, although that does not absolve me from arguing for, and choosing, a particular happiness variable out of a number of possible ones.

1) Happy90s

The first happiness variable used in the regressions reported below is taken from the World Database of Happiness (WHS) (variable hlt_90s) (Veenhoven, 2005). It reports mean scores for the 1990s for each country. In many cases, this is only based on one survey for each country, but it can be based on up to 10 surveys or more (ibid.). The variable was selected because it is the overall happiness variable in the WHS with the

largest number of observations. Veenhoven (2005) reports that it is based on 3+4+5 step verbal scales which are transformed to the 0-10 range by Thurstone transformation. Such transformations are in a sense arbitrary but they have been reported as quite accurate.[10] The values range from 8.06 for Iceland to 5.06 for the Russian Federation (Appendix Table A1).

2) Subjective Well-Being (SWB)

An alternative and generally more up-to-date happiness variable is 'Subjective Well-Being' (SWB) based on the latest wave of the World Values Surveys (WVS) (Inglehart et al., 2004). SWB has been widely reported in the press and is currently being used in a number of studies (for example Inglehart, 2005). It is constructed from the combined scores derived from the following responses to two WVS questions: The percentage of people who answered "feeling very happy" to the question: "Taken all things together, would you say you are:", and the percentage of people who answered "satisfied" to the following question: "All things considered, how satisfied are you with your life as a whole these days?" (Inglehart et al., 2004, Tables A008 and A170).[11]

Inglehart (2005) reports that there is a positive link between SWB and economic development, with a correlation of r = 0.66 across the more than 80 societies included in the WVS. However, this relationship is non-linear, with SWB levelling off for rich countries. Starting with Easterlin (1974), this has been observed by numerous other happiness researchers.[12] Moreover, there are some interesting 'anomalies' in the data.

[10] See Veenhoven (1993) for further details on this method.
[11] Inglehart (2005, p.11) explains the construction of SWB as follows: "Happiness was rated on a four-point scale, on which high scores indicated low levels of happiness; life satisfaction was rated on a ten point scale on which high scores indicated high levels of satisfaction. To give both variables equal weight, the mean scores on the happiness scale were multiplied by 2.5 and subtracted from the life satisfaction scores."
[12] Some more recent examples include Kenny (1999) and Graham et al. (2004). Layard (2005, p. 3/4) refers to the happiness paradox of the developed world: On average inhabitants of developed countries are no happier than 50 years ago, despite a more than doubling of average incomes. Above a certain income threshold, additional income is not much associated with more happiness. The threshold varies from author to author, but it is usually similar to common distinctions between developed and developing countries. However, in recent years there has also been support for the dissenting view that there is a robust positive relationship between income levels and happiness in rich countries (see Di Tella et al., 2003; Hagerty and Veenhoven, 2003; and Oswald, 2005).

Most Latin American countries have higher levels of SWB than suggested by their level of economic development, whereas the opposite applies to ex-Soviet countries.[13]

The values for SWB derived from the 1999-2001 wave of the WVS range from -1.81 for the Ukraine to 4.32 for Mexico. It should be noted that for a few countries, Inglehart et al. (2004, p. 2) include 1995 survey wave data in their 1999-2001 survey data source book. In the data set used in this paper this applies to 12 out of 63 countries: Armenia, Australia, Azerbaijan, Brazil, Colombia, Dominican Republic, El Salvador, Georgia, New Zealand, Norway, Switzerland, and Uruguay.

Inglehart (2005) views SWB as a good proxy for the extent of *self-expression values,* which themselves proxy for post-material values associated with affluent societies. Poorer countries, in contrast, are characterised by what Inglehart calls *survival values*. Therefore, the WVS not only highlights the enormous cross-cultural variation in people's beliefs and values but also indicates that the value systems of rich countries differ dramatically and systematically from those of poor countries (ibid., p. 13).

I do not attempt to address the deeper methodological issues concerning SWB variables, or to perform an exhaustive sensitivity analysis. This is not possible with the small data sample available. Rather, my aim us to use the most well-known measure of SWB and test whether it has a positive and statistically significant direct impact on the cross-country variation in the dependent variables.

3) Trust

Benkler (2004) explicitly discusses the relationship between social sharing and the literature on social norms and social capital, i.e. trust. There are similarities in that both emphasise social relations, but they differ in that social norms and social capital are usually thought of as enabling market exchange and production, whereas social sharing refers to a different mode of production. He argues (ibid., p. 333/4) that:

[13] Also see Diener and Oishi (2003) who discuss differences in SWB between some regions, as well as providing a general discussion of issues arising in the comparison of SWB across cultures.

> "…social sharing is a broader phenomenon, one that includes cooperate enterprises that can be pursued by weakly connected participants or even by total strangers and yet function as a sustainable and substantial modality of economic production. Indeed, in the context of the digitally networked environment, it is this type of sharing and cooperative production among strangers and weakly connected participants that holds the greatest economic promise."

Benkler seems to suggest that there is little correlation between SETI@home participation and the general level of trust in a country. On the other hand, Inglehart et al. (2004) report that societies that rank high on self-expression values, which are positively correlated with SWB, also rank high on interpersonal trust.

To shed light on this issue, I explore whether trust is a less important direct determinant of SETI@home participation by explicitly including a trust variable derived from the WVS as an alternative motivational variable in the regressions. The trust variable is the percentage of people who answered "most people can be trusted" to the question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" (Inglehart et al., 2004, Table A165). The values for trust range from a high of 0.67 for Denmark to a low of 0.03 for Brazil (see Appendix Table A1).

There is already some evidence reported in the literature supporting the view that trust is related only indirectly to the dependent variables via the happiness variables. For example, Bjørnskov (2003) tests the hypothesis that social capital, measured by the level of trust, is significantly correlated with happiness at a national level. Indeed, he assumes that it has an independent effect on it. His findings confirm this hypothesis for advanced countries, in particular Northern European countries, but not for low-income countries. In short, in the case of developed countries happiness and trust variables should probably not be used as either alternative explanatory variables, or side-by-side, in the same equation. Rather, trust should be an explanatory variable in a separate happiness regression.

4. THE MODEL

The proposed model assumes that the per capita number of SETI@home data units processed is determined by the degree of digital access, the standard of living and a variable that proxies for the main motivational factor for this type of voluntary, not-for-profit, activity. The estimated equations are of the following general form:

$$\left\{ \begin{matrix} SETI_i \\ \Delta SETI_i \end{matrix} \right\} = \alpha_0 + \alpha_1 DAI_i + \alpha_2 gdp_i + \alpha_3 \left\{ \begin{matrix} Happy90s_i \\ SWB_i \\ Trust_i \end{matrix} \right\} + \varepsilon_i \qquad (1)$$

where i indexes countries and ε is a white noise error term. Applying the extended Box-Cox transformation, each variable in the above equation is transformed in the same way according to $x = \left(x^{\lambda} - 1\right) \big/ \lambda$, where x is a variable and λ is the transformation parameter. If λ = 1, equation (1) is a linear, if λ = 0, the equation is logarithmic. Other values of λ correspond to more complicated functional forms. I do not focus on particular functional forms, but on the general properties of the regressions as expressed in the reported test statistics and, for economic interpretation, the elasticities implied by the Box-Cox regression estimates. The only exception to transforming all variables in equation (1) by the same λ occurs when SWB is included in regressions using the full data set that includes all countries. In that case, some of the observations for SWB are negative (see Table A1). Therefore, the Box-Cox transformation breaks down and SWB is not transformed.[14]

A major limitation of the modelling approach adopted in this paper, which it shares with much of current happiness research, is that of neglecting possible reverse causation between the dependent and explanatory variables. For example, there is evidence that volunteer and charity work is often a source of happiness (Frey and Stutzer, 2002), and one might speculate that this also applies to participation in social sharing projects. However, this issue cannot be addressed with the SETI@home and happiness data currently available.

[14] However, regression estimates obtained for the data set from which the eleven negative observations for SWB are deleted and all variables are transformed with the same λ produce very similar estimates to those obtained when SWB is the only untransformed variable in the regression.

It is also possible that there are interaction effects between the various explanatory variables, especially between gdp and others. However, adding interacted variables to equation (1) did not improve the regression estimates, probably due to the small sample size and associated multicollinearity problems. Moreover, it should be noted that the motivational variables are lagged compared to the other explanatory variables, which should reduce the causality problems for the variables of most interest. However, in future research it would be desirable to explicitly explore the causal relationships between the explanatory variables in equation (1) in a simultaneous equation framework.

Engelbrecht (2005) has shown that DAI, gdp and a regional dummy variable for the group of development and advanced countries as defined by ITU (2003, p. xi) are positive and statistically significant determinants of SETI@home participation in the maximum size data sample containing 172 countries. The largest data set used in this study includes 63 countries and inclusion of the country group dummy variable did not improve the estimates. Therefore, the dummy variable is not included in equation (1). However, the discussion of variables in the previous section has indicated that many of the relationships between them *are* likely to differ between the groups of rich and poor countries. I therefore estimate the model not only for the whole data sample, but also separately for the group of developed and advanced countries and 'the rest'. Regressions for 'the rest' (36 countries) do not improve on the estimates reported for the full data set and are therefore not reported.

The 26 countries making up the developed and advanced country group are highlighted in Appendix Table A1 and their summary statistics are reported in Appendix Table A2B. For these countries, gdp in 2002 ranges from a low of US$ 16,950 for the Republic of Korea to a high of US$ 61,190 for Luxembourg. In December 2004, the group of developed and advanced countries accounted for 20.3% of the population of the 63 country sample, but 89.7% of all SETI@home users and 91.6% of all processed data units. The focus on this small group of countries makes it even more important to keep the model as simple as possible in order to preserve degrees of freedom.

5. EMPIRICAL RESULTS

5.1. CORRELATIONS

It is useful to begin the empirical analysis by looking at correlations between the variables. Table 2A reports correlations in the 62 country data set.[15] They are all statistically significant at the 1% level. DAI and gdp have higher correlations with the dependent variables than do the three motivational variables. As far as correlations between different explanatory variables are concerned, they are highest between the alternative happiness variables Happy90s and SWB, followed by that between gdp and DAI. They are lowest between the two happiness variables and Trust. The correlations between the happiness variables and gdp are quite high, at 0.53 and 0.62, with the higher correlation being obtained for the more up-to-date happiness variable SWB. These correlations are similar to those found by others. For example, Schyns (1998, p. 15) reports a correlation of 0.64 between gdp and mean happiness.

The correlations reported in Table 2A are sizable but they do not seem to suggest any severe multicollinearity problems. However, a plot of SETI against SWB indicates that the relationship between them is not straightforward (see Appendix Figure 1). In particular, a sizable number of observations lie along the horizontal axis. A look at the data in Appendix Table A1 suggests this might be due to the 'Latin American effect' mentioned earlier.

In the developed and advanced country data set only SWB is positively correlated with gdp at the 1% level (see Table 2B). The correlations between gdp and Trust and gdp and DAI are greatly reduced and much smaller than those between gdp and Happy90s or SWB. The correlations between gdp and the dependent variables are also reduced in size compared to the larger data set and they are no longer statistically significant at the 1% level. With one exception, the motivational variables Happy90, SWB and Trust now have higher positive correlations with SETI and ΔSETI than do DAI and gdp, with the highest correlations being observed for the preferred happiness

[15] For one of the 63 countries listed in Appendix Table A1, i.e. Malta, there was no observation for SWB, the variable of most interest.

Table 2: Correlations

A) Correlation coefficients – 62 observations data set

SETI	1.000						
ΔSETI	0.938	1.000					
DAI	0.728	0.718	1.000				
gdp	0.751	0.712	0.839	1.000			
Happy90s	0.482	0.382	0.388	0.526	1.000		
SWB	0.560	0.476	0.545	0.619	0.869	1.000	
Trust	0.702	0.572	0.482	0.514	0.363	0.355	1.000
	SETI	ΔSETI	DAI	gdp	Happy90s	SWB	Trust

All $p < 0.01$

B) Correlation coefficients – 26 observations data set (developed and advanced countries)

SETI	1.000						
ΔSETI	0.960*	1.000					
DAI	0.681*	0.603*	1.000				
gdp	0.404	0.447	0.226	1.000			
Happy90s	0.566*	0.530*	0.462*	0.473	1.000		
SWB	0.755*	0.712*	0.439	0.548*	0.823*	1.000	
Trust	0.721*	0.592*	0.650*	0.169	0.419	0.507*	1.000
	SETI	ΔSETI	DAI	gdp	Happy90s	SWB	Trust

* = $p < 0.01$

C) Correlation coefficients – 36 observations data set (other countries, i.e. 'the rest')

SETI	1.000						
ΔSETI	0.938*	1.000					
DAI	0.674*	0.618*	1.000				
gdp	0.772*	0.671*	0.912*	1.000			
Happy90s	-0.202	-0.181	-0.198	-0.133	1.000		
SWB	0.016	-0.015	0.113	0.197	0.812*	1.000	
Trust	-0.001	0.007	-0.173	-0.139	-0.154	-0.220	1.000
	SETI	ΔSETI	DAI	gdp	Happy90s	SWB	Trust

* = $p < 0.01$

variable SWB. The plot of SETI against SWB now suggests that the relationship between them is clearly positive (see Appendix Figure 2). There is no evidence of a levelling off of SETI at higher levels of SWB.

Finally, the correlations matrix for the data set of the poorer 36 countries (Table 2C) suggests that the correlations obtained for the 62 country sample are mostly dominated by those for developed and advanced countries (an exception being the correlation between gdp and DAI). For the poorer country group, gdp and DAI are highly correlated with the dependent variables, whereas all correlations involving the motivational variables are mostly negative, small, and statistically insignificant!

5.2 REGRESSION RESULTS

The regression results for the large data set including all countries are reported in Table 3. In all cases λ is close to zero, indicating that the estimated equations are logarithmic. The elasticities at the mean are, therefore, very similar to the reported coefficient estimates. The elasticities for the statistically significant coefficient estimates indicate that DAI is the most elastic of the explanatory variables. On average, if DAI is increased by 1%, SETI increases by almost 3% and ΔSETI by 3.5% to 4%. However, although the explanatory power of all the regressions is high as indicated by the adjusted R^2 values, the motivational variables perform badly, either being statistically insignificant or, like the two happiness variables in the ΔSETI regressions (3.4) and (3.5), being statistically significant but negative, which is counter-intuitive.[16]

The DW test is used to test for serial correlation of the residuals (the error term in equation 1) and general misspecification of the model. The null hypothesis is accepted at the 1% level of significance for all regressions except (3.6), for which the DW statistic is inconclusive. The JB test is a test for normality of the residuals and also for general model misspecification. The JB values obtained for the regressions reported in Table 3 indicate that the null hypothesis is accepted at the 1% level of significance in all cases.

[16] In univariate regressions, Happy90s, SWB and Trust are all statistically significant and positive, but the DW values are very low.

Table 3: Regression Results: Explaining cross-country variations in 2002 SETI@home results per capita, and changes in SETI@home results per capita over the 2002-04 period, large data set

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
Dep. variable:	SETI	SETI	SETI	ΔSETI	ΔSETI	ΔSETI
Indep. variables:						
DAI	2.716[a] (2.950)	2.877[a] (3.164)	2.760[a] (3.350)	3.405[a] (3.474)	3.706[a] (3.796)	3.804[a] (4.097)
gdp	1.339[a] (3.636)	1.299[a] (3.470)	0.948[a] (3.232)	1.409[a] (3.194)	1.484[a] (3.189)	0.922[b] (2.407)
Happy90s	-1.456 (-1.356)			-2.678[b] (-2.136)		
SWB		-0.093 (-1.105)			-0.212[b] (-2.290)	
Trust			0.183 (0.804)			0.010 (0.042)
Intercept	-1.349 (-0.695)	-3.830[a] (-2.766)	-2.902[b] (-2.171)	1.552 (0.712)	-3.100[c] (-1.966)	-2.062 (-1.305)
No. ob obs.	63	62	63	63	62	63
Adj. R^2	0.862	0.860	0.853	0.865	0.868	0.848
DW	2.109	2.085	2.135	2.407	2.352	2.495
JB (2DF)	2.813	2.944	3.005	4.887	8.749	2.674
λ	0.020	0.020	0.05	-0.02	-0.030	0.00
Elasticities at mean:						
DAI	2.737	2.900	2.815	3.403	3.702	3.804
gdp	1.441	1.399	1.141	1.318	1.343	0.922
Happy90s	-			-2.548		
SWB		-			-0.376	
Trust			-			-

[a] Denotes $p < 0.01$. [b] Denotes $0.01 < p < 0.05$. [c] Denotes $0.05 < p < 0.10$

The data are for developed and advanced countries, plus other countries ('the rest'). All regressions were estimated using the extended Box-Cox model. λ indicates the exponent in the model that was used to transform all dependent variables and explanatory variables (except in regression 3.2 and 3.5, where SWB is not transformed because some the observations are negative). t-ratios are given in brackets. DW is the Durbin-Watson d test statistic. JB is the Jarque-Bera test statistic. Its critical value at the 1% level of significance is $\chi^2_{(2)} = 9.21$.

In response to the disappointing results obtained for the motivational variables I perform separate regressions on the two country sub-samples. When only observations for countries other than developed and advanced ones are used, the estimates are similar to those reported in Table 3, except that in regressions (3.1) and (3.2) the estimates for Happy90s and SWB also become negative and statistically significant! I interpret this to suggest that the motivational variables have no role to

play in explaining SETI and ΔSETI in the sample of 'the rest'. In the following I therefore concentrate on the developed and advanced countries. Estimates for those countries suggest a dramatically different picture.

Regressions trying to explain the cross-country variation in SETI are reported first (see Table 4). For the group of developed and advanced countries, gdp is in most cases not statistically significant (the exception being regression (4.6)), whereas DAI remains mostly statistically significant at an acceptable level. In regressions that include SWB, adding gdp even reduces the explanatory power as shown by a slightly lower adjusted R^2 (compare regressions (4.3) and (4.4)). Parameter estimates for the motivational variables all have positive signs and they are mostly statistically significant, with SWB having the highest level of significance.[17] The lower levels of statistical significance for Trust seem to support the view that it is not as directly important for explaining SETI as is SWB, although the two variables are positively correlated.

Clear differences also emerge with respect to the overall explanatory power of the regressions. Those including the preferred motivational variable SWB, i.e. regressions (4.3) and (4.4), have appreciably higher explanatory powers than those including Happy90s or Trust. Moreover, they are the only regressions for which the null hypothesis of the DW test is accepted. By contrast, for regressions (4.1), (4.2) and (4.6), the DW statistic falls into the inconclusive range, and for regression (4.5), misspecification cannot be rejected. The JB values seem to suggest that all reported regressions have normally distributed residuals. However, the JB test is known not to perform well for small data samples.

[17] Again, in univariate regressions Happy90s, SWB and Trust are all positive and statistically significant at the 1% level, but only for SWB does the DW statistic clearly reject misspecification. I also ran regressions using the scores for the sub-component variables of SWB as reported in the WVS, i.e. 'happiness' and 'life satisfaction', instead of SWB. The estimates for these variables are also positive and statistically significant, but they are somewhat smaller in value (for happiness) and somewhat larger in value (for life satisfaction) than those for SWB reported in Table 4.

Table 4: Regression Results: Explaining cross-country variations in 2002 SETI@home results per capita, developed and advanced countries

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
Indep. Variables:						
DAI	5.102[b] (2.776)	4.905[b] (2.678)	3.320[b] (2.444)	3.323[b] (2.392)	3.801[c] (1.914)	3.095 (1.625)
gdp		0.080 (1.392)		-0.007 (-0.061)		0.058[b] (2.184)
Happy90s	0.981[b] (2.312)	0.792 (1.483)				
SWB			1.124[a] (6.338)	1.132[a] (5.017)		
Trust					1.558[b] (2.644)	1.406[b] (2.636)
Intercept	-2.867 (-1.459)	-2.796 (-1.347)	-0.971[c] (-1.869)	-0.937 (-1.227)	1.793[a] (4.457)	0.733 (1.213)
Adj. R^2	0.470	0.484	0.734	0.722	0.527	0.580
DW	1.230	1.338	2.102	2.100	0.821	1.058
JB (2DF)	2.594	0.898	0.062	0.065	1.701	0.534
λ	0.630	0.580	0.130	0.370	0.790	0.720
Elasticities at mean:						
DAI	4.889	4.716	3.234	3.240	3.603	-
gdp		-		-		0.744
Happy90s	3.955	-				
SWB			1.835	1.849		
Trust					0.861	0.819

[a] Denotes $p < 0.01$. [b] Denotes $0.01 < p < 0.05$. [c] Denotes $0.05 < p < 0.10$.

The dependent variable is SETI. All regressions are based on 26 observations per variable. All regressions were estimated using the extended Box-Cox model. λ indicates the exponent in the model that was used to transform all dependent variables and explanatory variables. t-ratios are given in brackets. DW is the Durbin-Watson d test statistic. JB is the Jarque-Bera test statistic. Its critical value at the 1% level of significance is $\chi^2_{(2)} = 9.21$.

The elasticities for the statistically significant coefficient estimates indicate, like in case of the larger data set, that DAI has the highest elasticity at the mean, but SWB is also highly elastic. I regard the very high elasticity estimates for Happy90s with scepticism, given that the overall explanatory power of regressions including this variable is much lower than for regressions that include SWB, and given the low DW statistics. It is also intriguing that when Trust is used, gdp, and not DAI, is statistically significant (regression (4.6)). Moreover, the impact of Trust on SETI is inelastic. These features again seem to emphasize the differences between happiness and trust as determinants of social sharing.

To summarize, the estimates reported in Table 4 provide evidence that for the group of developed and advanced countries happiness is a major determinant, besides the degree of digital access as measured by DAI, of cross-country variations in SETI@home results per capita, whereas gdp is not.

Estimates for the ΔSETI regressions are reported in Table 5. Most of the comments made above for regressions shown in Table 4 also apply here, for example with regard to the relative explanatory power of various regressions, the relative values of the parameter estimates for the different variables and their elasticities at the mean, and the DW and JB test statistics. However, all reported adjusted R^2 are somewhat lower.

In the regression with the highest explanatory power, i.e. (5.3), SWB is the only statistically significant variable. The estimate for DAI just fails to be statistically significant at the 10% level (p=0.104), with an elasticity estimate of 2.443. In contrast to regressions (4.3) and (4.4.), DAI is no longer statistically significant in regressions (5.3) and (5.4). The estimates reported in Table 5 emphasize even more than those reported in Table 4 the importance of SWB as an explanatory variable when the model is applied to developed and advanced country data.

6. SUMMARY AND CONCLUDING COMMENTS

In most happiness studies employing regression analysis happiness is the dependent variable, i.e. the focus is on the determinants of happiness instead of what effects happiness itself might have on other variables. In contrast, this paper reports an attempt to analyse the role of happiness as a direct determinant of participation in an Internet-based social sharing project, SETI@home.

It was found that for the group of developed and advanced countries, higher levels of happiness lead to higher levels of, and growth in, SETI@home results per capita, over and above the influence of technical and other aspects determining Internet access. Moreover, the standard of living does not seem to play a direct role. Reassuringly, for the group of developed and advanced countries equations including SWB, the a-priori

Table 5: Regression Results: Explaining cross-country variations in changes in SETI@home results per capita over the 2002-04 period, developed and advanced countries

	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
Independent variables:						
DAI	4.712[b] (2.172)	4.507[b] (2.138)	2.830 (1.695)	2.853 (1.676)	3.978 (1.542)	2.955 (1.232)
gdp		0.079 (1.564)		0.035 (0.403)		0.089[b] (2.291)
Happy90s	0.925[c] (2.066)	0.628 (1.202)				
SWB			0.938[a] (4.861)	0.866[a] (3.629)		
Trust					1.316[c] (1.780)	1.156[c] (1.770)
Intercept	-2.740 (-1.235)	-2.376 (-1.060)	-0.672 (-1.082)	-0.858 (-1.045)	1.915[a] (3.649)	0.434 (0.551)
Adj. R^2	0.370	0.405	0.606	0.590	0.355	0.448
DW	1.146	1.228	1.785	1.785	0.860	1.121
JB (2DF)	1.048	0.267	0.308	0.223	0.386	0.075
λ	0.680	0.650	0.470	0.480	0.740	0.680
Elasticities at mean:						
DAI	3.812	3.677	-	-	-	-
gdp		-		-		0.842
Happy90s	3.526	-				
SWB			1.558	1.455		
Trust					0.630	0.588

[a] Denotes $p < 0.01$. [b] Denotes $0.01 < p < 0.05$. [c] Denotes $0.05 < p < 0.10$.

The dependent variable is ΔSETI. All regressions are based on 26 observations per variable. They were estimated using the extended Box-Cox model. λ indicates the exponent in the model that was used to transform all dependent variables and explanatory variables. t-ratios are given in brackets. DW is the Durbin-Watson d test statistic. JB is the Jarque-Bera test statistic. Its critical value at the 1% level of significance is $\chi2(2) = 9.21$.

preferred happiness variable, have the highest explanatory power and the best statistical properties. Results for the motivational variable Trust are weaker than those for happiness and seem to confirm the lesser, or at least less direct, role of social capital for Internet-based social sharing hinted at by Benkler (2004). Very different results emerge for the group of poorer countries, and for the data set including both country groups. In that case, gdp is positive and statistically significant, in contrast to the motivational variables.

However, the currently available data greatly limit the extent to which the relationships between variables can be modelled. There are important potential interactions between the explanatory variables in the model, plus issues of reverse causation between dependent and explanatory variables, which need to be addressed in future research. Also, cross-country variation in the constituent variables is necessarily lost when one uses a composite index like DAI. Its sub-indices are better suited to highlight areas that might need policy attention. Therefore, the current research could be extended by relating SETI@home variables to the sub-indices of DAI.

Whether Internet-based social sharing as a mode of economic production will become more dominant in future is, in the end, an empirical question. SETI@home and similar projects seem to have the potential to greatly expand, given the continuously rising processing power of personal computers and the expansion and speed of the Internet. However, as pointed out by Benkler (2004), technological developments provide only a necessary condition for this. In addition, people have to have the motivation to participate and there has to be an institutional environment that is conducive to social sharing. Given the findings reported in this paper, one might expect the growth of Internet-based social sharing to continue with a rise in the average degree of happiness across a large number of countries.

As far as the institutional conditions supporting social sharing are concerned, Benkler (2002) argues they should be strengthened. For example, he regards stricter intellectual property rights as a step in the wrong direction because they raise the access cost to existing information resources as inputs. The stakes for economic progress are potentially very high (Benkler, 2004, p. 281):

> "If indeed we live in an economic system made up of price-based, hierarchy-based, and sharing-based modalities of production, if it is true that optimising our institutional system for price-based production undermines productivity in the sharing modality, and if it is true that our communications, computation, and information sectors are undergoing technological changes that improve the efficiency of social sharing, then

> we are making systematically mistaken policy choices not on the peripheries of our economies and societies, but at their very engines."

Therefore, a most important question to be addressed in future research is how to design the institutional framework and policies that support, or at least not hinder, social sharing.

Appendix

Table A1: The Data

	Number of SETI participants 10 Dec. 02	SETI results per capita, 13 Dec. 04	SETI results per capita, 10 Dec. 02	DAI 2002	gdp[1], 2002	Happy 90s	SWB	%Life Satisf.	Trust
Iceland*	2,091	4.180619	1.686808	0.82	29750	8.06	4.15	0.87	0.41
Finland*	37,218	4.053972	1.861733	0.79	26190	7.3	3.23	0.84	0.58
Denmark*	41,131	3.486458	1.73925	0.83	30940	7.9	4.24	0.86	0.67
Canada*	215,987	2.687024	1.198563	0.78	29480	7.34	3.76	0.81	0.39
Netherlands*	105,128	3.210817	1.484827	0.79	29100	7.92	3.86	0.9	0.6
United States*	1,713,882	2.700461	1.2752	0.78	35750	7.4	3.47	0.79	0.36
Sweden*	54,735	3.090765	1.558818	0.85	26050	7.73	3.36	0.8	0.66
UK*	292,935	1.956931	0.719136	0.77	26150	7.41	2.92	0.73	0.3
New Zealand*	19,477	2.120581	0.944087	0.72	21740	7.36	3.39	0.77	0.48
Luxembourg*	1,940	2.83319	1.139112	0.75	61190	7.71	3.52	0.82	0.26
Australia*	95,180	1.856876	0.785316	0.74	28260	7.88	3.46	0.77	0.4
Germany*	365,390	2.126561	0.806459	0.74	27100	6.57	2.55	0.79	0.35
Norway*	20,275	2.386267	1.043435	0.79	36600	7.32	3.25	0.79	0.65
Austria*	33,242	1.937539	0.876516	0.75	29220	7.54	3.69	0.83	0.34
Switzerland*	28,931	2.1823	1.015023	0.76	30010	7.84	4	0.85	0.41
Estonia	4,013	2.955051	0.777577	0.67	12260	5.93	0.24	0.44	0.23
Belgium*	29,026	1.045691	0.459747	0.74	27570	7.74	3.23	0.79	0.31
Ireland*	11,051	1.004199	0.484789	0.69	36360	7.75	4.16	0.85	0.35
Slovenia	5,419	1.561535	0.696092	0.72	18540	6.07	2.02	0.67	0.22
Portugal*	26,336	1.095231	0.372961	0.65	18280	6.69	1.99	0.62	0.1
Czech Republic	26,155	2.050173	0.544684	0.66	15780	6.8	1.94	0.67	0.24
France*	127,727	0.811721	0.308315	0.72	26920	7.5	2.61	0.66	0.22
Hungary	18,212	0.756501	0.242376	0.63	13400	6.22	0.41	0.37	0.22
Spain*	76,903	0.412941	0.136339	0.67	21460	7.12	2.13	0.65	0.36
Croatia	7,503	0.656842	0.225114	0.59	10240	6.43	1.55	0.54	0.18
Israel*	9,901	0.418168	0.218001	0.7	19530	6.16	2.08	0.65	0.23
Malta	649	0.598586	0.213378	0.67	17640	7.32	**n.a.**	0.86	0.21
Poland	52,314	1.291319	0.285147	0.59	10560	6.09	0.84	0.51	0.19
Singapore*	6,331	0.512917	0.232053	0.75	24040	7.77	3	0.71	0.17
Greece*	14,681	0.539566	0.187247	0.66	18720	6.65	1.45	0.61	0.24
Italy*	74,046	0.412572	0.142877	0.72	26430	6.54	2.06	0.7	0.33
Japan*	139,605	0.48	0.19613	0.75	26940	7.28	1.96	0.53	0.43
Slovakia	4,964	0.543816	0.196303	0.59	12840	5.84	0.4	0.47	0.16
Lithuania	2,889	0.62688	0.167285	0.56	10320	5.86	-0.07	0.33	0.25
Uruguay	3,174	0.128899	0.063637	0.54	7830	6.87	2.02	0.63	0.22
Latvia	1,814	0.541658	0.193372	0.54	9210	5.82	-0.7	0.33	0.17
Chile	11,534	0.089862	0.031949	0.58	9820	6.94	2.53	0.63	0.23
Argentina	24,881	0.089036	0.03665	0.53	10880	7.06	2.61	0.69	0.15
FYRM[2]	745	0.089735	0.025684	0.48	6470	6.11	-0.14	0.31	0.14
Rep. of Korea*	15,139	0.066589	0.028934	0.82	16950	6.62	1.12	0.47	0.27
Romania	6,303	0.189595	0.053345	0.48	6560	5.6	-1.3	0.38	0.1
Mexico	32,772	0.041557	0.0138	0.5	8970	6.72	4.32	0.8	0.21
Venezuela	7,507	0.07468	0.029229	0.47	5380	8.1	3.58	0.7	0.16
Brazil	52,619	0.030209	0.013395	0.5	7770	6.9	2.23	0.63	0.03

Bosnia and Herzegovina	800	0.062115	0.020792	0.46	5970	6.57	0.82	0.38	0.16
Colombia	8,597	0.019885	0.008954	0.45	6370	7.61	3.94	0.85	0.11
Turkey	14,058	0.111628	0.019453	0.48	6390	7.46	0.84	0.39	0.16
Dominican Rep.	1,599	0.01689	0.008782	0.42	6640	6.93	2.25	0.68	0.26
Russian Fed.	17,242	0.047899	0.013411	0.5	8230	5.06	-1.75	0.27	0.24
El Salvador	713	0.020321	0.008666	0.38	4890	8.07	3.67	0.71	0.15
Belarus	898	0.026414	0.010134	0.49	5520	5.22	-0.92	0.24	0.42
Peru	2,394	0.010439	0.003636	0.44	5010	6.48	1.32	0.5	0.11
Armenia	217	0.064015	0.047886	0.3	3120	5.61	-1.8	0.19	0.25
Georgia	328	0.010271	0.003693	0.37	2260	6.01	-1.11	0.25	0.19
Ukraine	2,395	0.025629	0.006364	0.43	4870	5.24	-1.81	0.25	0.27
Rep. of Moldova	213	0.017649	0.006787	0.37	1470	5.16	-1.63	0.19	0.15
Philippines	3,907	0.01234	0.005051	0.43	4170	7.24	2.32	0.53	0.08
Azerbaijan	247	0.00363	0.001495	0.24	3210	6.63	0.13	0.32	0.21
China	31,969	0.005819	0.001613	0.43	4580	6.86	1.2	0.53	0.55
Pakistan	1,145	0.001361	0.000337	0.24	1940	6.95	-0.3	0.1	0.31
India	14,864	0.00136	0.000504	0.32	2670	6.79	0.03	0.28	0.41
Bangladesh	260	0.000543	0.000126	0.18	1700	7.01	0.54	0.32	0.24
Nigeria	107	0.000141	0.000043	0.15	860	6.95	3.32	0.64	0.26

Notes: * Developed or advanced country (as defined by ITU, 2003, p. xi).
[1] GDP per capita in purchasing power parity adjusted US$.
[2] Former Yugoslav Republic of Macedonia.

Table A2: Summary Statistics of Variables

A) 62 Observations data set

NAME	MEAN	ST. DEV	MINIMUM	MAXIMUM
SETI	0.398	0.523	0.00004	1.862
ΔSETI	0.566	0.681	0.0001	2.494
DAI	0.585	0.178	0.150	0.850
gdp	15.926	12.189	0.860	61.190
Happy90s	6.844	0.800	5.060	8.100
SWB	1.809	1.769	-1.810	4.320
Trust	0.282	0.148	0.030	0.670

B) 26 Observations data set (developed and advanced countries)

NAME	MEAN	ST. DEV	MINIMUM	MAXIMUM
SETI	0.804	0.565	0.029	1.862
ΔSETI	1.027	0.665	0.038	2.494
DAI	0.751	0.052	0.650	0.850
gdp	28.105	8.519	16.950	61.190
Happy90s	7.350	0.517	6.160	8.060
SWB	3.025	0.872	1.120	4.240
Trust	0.380	0.151	0.100	0.670

Figure 1

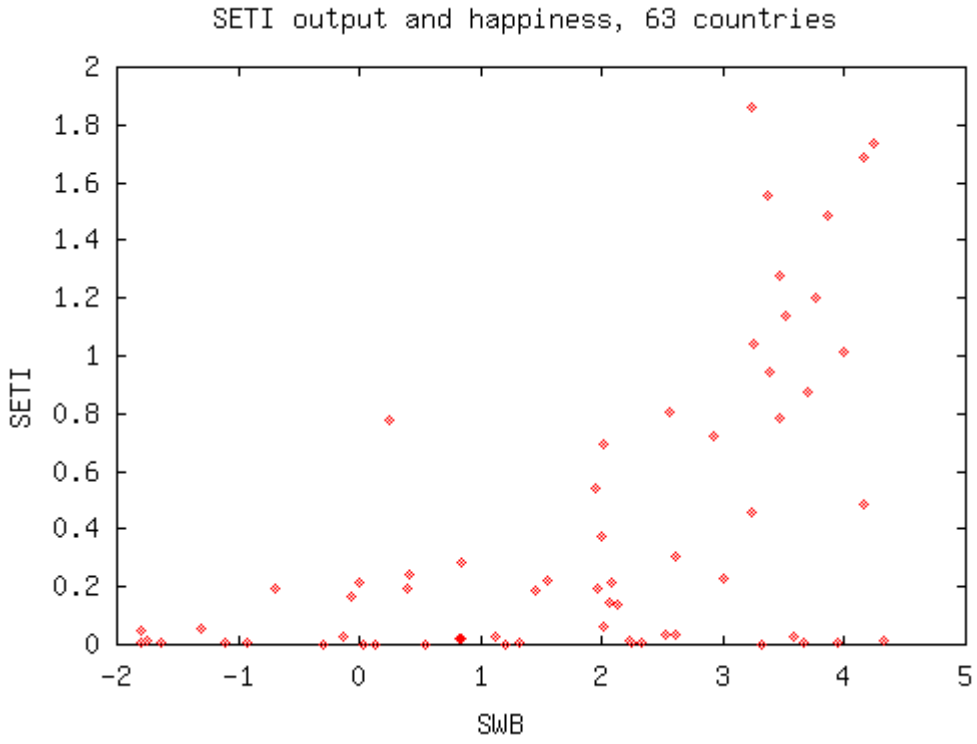
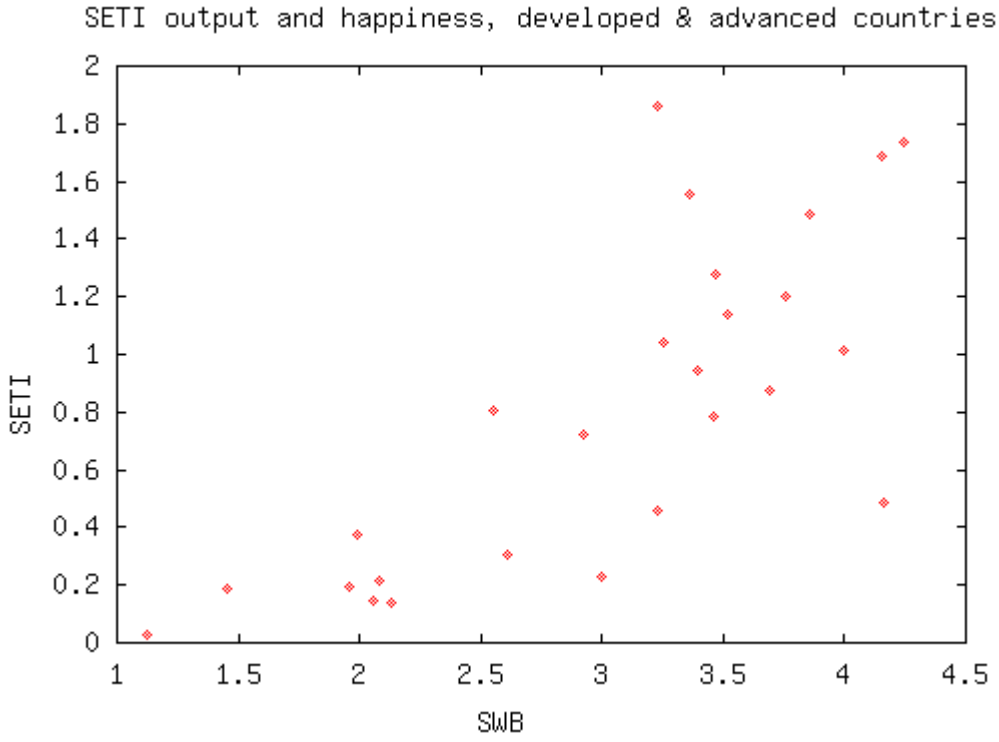


Figure 2



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