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The poor borrowers' perspective in a quasi-natural experiment

Leonardo Becchetti Stefano Castriota

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Leonardo Becchetti
Facoltà di Economia, Università di Roma Tor Vergata

Stefano Castriota

Informazioni :
Facoltà di Economia di Forlì - Corso di Laurea in Economia delle Imprese Cooperative e delle ONP
Tel. 0543-374620 – Fax 0543-374618 e-mail: nonprofit@spfo.unibo.it

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Leonardo Becchetti*
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Abstract

Research on the nexus between life satisfaction and income has looked at lottery winners or post-communism transition to document that exogenous changes in income generate effects of the same sign on happiness. In this paper we consider the unfortunate tsunami event as a *negative* lottery and examine the effects of the tsunami related income losses, net of the most ample possible set of concurring factors, on life satisfaction and self-esteem of a sample of Sri Lankan microfinance borrowers. Our empirical findings help to discriminate between various effects of material damages and monetary losses, both having strong significant impact on the dependent variables. Our contribution to the literature is in: i) identifying an exogenous shock which is temporary and does not suffer from voluntary participation bias (unfortunate "winners" of the negative lottery, exactly as control sample, did not decide to buy the lottery ticket); ii) testing the money-happiness nexus on a sample of individuals close to the poverty line.

Keywords: life satisfaction, quasi natural experiment, tsunami, natural catastrophe.
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Faculty of Economics, Universita' Tor Vergata, Via Columbia 2, 00133 Rome, Italy. Tel: +39 06 7259 5706. Email: becchetti@economia.uniroma2.it. We thank Rafael Di Tella, Rita Ferrer-i-Carbonell, Robert Cull, Craig McIntosh, Robert Lensink and Bruce Wydick The usual disclaimer applies. We also wish to thank the Italian NGO Etimos, the Italian Civil Protection, the University of Rome Tor Vergata, Agro Micro Finance and the Agromart Foundation. Special thanks to Francesca Lo Re and Alberto Contarini (Etimos), Mr. Kamalsiri (Agro Micro Finance) and Mr. Kannangara (Agromart Foundation) for kind support during the stay in Sri Lanka and to David Berno, Salvatore Morelli and Francesca Palermo for valuable research assistance.

1. Introduction

According to a well known Einstein's say, a typical boundary between philosophy and empirical sciences is that "things that matter cannot be measured". This problem led philosophers like Wittgenstein to affirm that nothing should be said about issues we cannot discuss on the basis of empirical observations. Economists did not stick to the severe Wittgenstein's judgement and conceived the fundamental building block of their theories, the utility function, on the basis of untested assumptions on individual preferences. The recent diffusion of a wide series of surveys collecting information on self-declared happiness[1] gives us for the first time the unique opportunity of evaluating the significance of different determinants of life satisfaction and testing what has been an undisputed assumption for many decades.[2]

Empirical studies on happiness had to overcome an objection related to the consistence of respondents' declarations with effectively perceived happiness levels. With this respect several arguments in support of the validity of this assumption have been developed.[3] A second crucial issue in this kind of studies (like in many others) is that of causality: while economists are more inclined to look at changes that life events can produce on our wellbeing, psychologists remind us that personalities have fixed traits which are inherited from birth or childhood and affect our future

[1] One of the most well known among these databases, The World Value Survey, contains information from domestic representative samples in more than 80 countries for different waves. The Eurobarometer does the same for EU countries. The limit of these two databases is that individuals interviewed in different waves are not the same so that it is not possible to analyse the effects of changes in happiness for the same individuals across time. Panel data analyses on happiness are instead possible with the British Household Survey Panel and the German Socioeconomic Panel. The drawback is that in this latter case the analysis refers to individuals living in only one country (United Kingdom and Germany respectively).

[2] Utility and happiness are not exactly the same concept. But something is useful by definition if it can be used for what enhances our wellbeing and life satisfaction. A straightforward link between utility and happiness may therefore be easily established and such link is conventionally assumed in most of the happiness literature.

[3] The most relevant arguments are that: (i) happiness studies have a long tradition in psychology and sociology thereby overcoming a cultural "Darwinian selection" in these disciplines (Alesina, Di Tella and MacCulloch, 2004); (ii) significant and positive links have been found between self-declared happiness levels and healthy physical reactions such as smiling attitudes (Pavot et al., 1991 and Eckman et al., 1990) and heart rate and blood pressure responses to stress (Shedler, Mayman and Manis, 1993); (iii) a significant nexus between positive feelings and physical measures of brain activity (higher alpha power in the left parefrontal cortex) has been identified in neuroscience studies while, at the same time, measures of hedonic well being, such as self-declared life satisfaction, have been shown to be related to the same activity (Clark et al., 2006); (iv) it has been shown that well-being levels are good predictors of future respondents' behaviour (i.e. individuals choose to discontinue activities associated with low levels of well-being (Frijters, 2000 and Shiv and Huber, 2000)); (v) respondents' self-declared happiness levels are strongly correlated with the evaluation of the same respondents provided by friends and family members (see Sandvik et al., 1993 and Diener and Lucas, 1999).

life events.[4] Researchers from both disciplines find reasonable arguments for their claims since biunivocal causality directions are plausible in almost all relationships between happiness and its determinants.

Frey and Stutzer (2006) wonder whether marriage increases life satisfaction or rather happier people get more easily married. Becchetti et al. (2007) argue that investing in relationships has positive effects on happiness and that, at the same time, happier people have a more intense social life. Clark et al. (2006) argue that we need caution when drawing policy advices from studies on happiness and unemployment. Part of the effect that we measure is in fact the expression of an inverse causality nexus in which individuals with lower life satisfaction, or prone to pessimism, have relatively higher difficulties in finding a job. This part of unhappiness related to the unemployment condition can hardly be tackled by active labour policies.

Like in many other domains, the causality problem arises also in the money-happiness relationship: does money make people happier or have happier people superior attitudes for developing their productive skills which lead them to greater material achievements in the society?

From a methodological point of view the problem has been faced in many ways. A first approximation has been to evaluate whether the nexus holds when we move from level to first difference estimates, since it is more difficult to say that short term changes in life satisfaction generate immediate changes in income or employment status than viceversa. However, even in this case, the reverse causality nexus cannot be excluded. Another approach to tackle the problem has been that of using panel fixed effects in order to disentangle the role of inherited individual traits in which our ego is structured in the first years of life. Another line of research performs a two-equation estimate in which the two causality directions are jointly estimated and disentangled[5]. The problem with this approach is that it requires sufficiently long time series and assumes the

[4] De Neve and Cooper (1999) find 137 personality traits correlated with well being, the most relevant being *extraversion*, *conscientiousness*, *neuroticism*, *agreeableness*, *emotional stability* and *openness to experiences*.

[5] Becchetti et al. (2007) run a GMM panel VAR to create multiequation systems in which happiness and a given determinant are, in turn, dependent variable and explanatory factor. In their paper the authors use this approach to solve the causality problem between happiness and sociability.

dependent variable to be continuous. Unfortunately, this is not the case for measures of life satisfaction which are inevitably discrete.

Given the problems with the methodologies mentioned above, one of the most reputed approaches which empirical studies use to solve the issue is lab or quasi-natural experiments. The advantages of lab experiments are the reproducibility and the capacity to insulate, *ceteris paribus*, the variation of one factor whose effects can be measured on the dependent variable. The main disadvantage is the lack of external consistency, or the risk of inconsistence of the artificial events produced in the laboratory with what happens in the reality of economic life. For this reason, even though there are no perfect approaches, economists look with great interest at "quasi-natural experiments" that is, at those real situations in which the occurrence of a particular historical event or shock can represent unequivocally an exogenous variation whose effects on target variables can be measured. Under these particular circumstances the exogeneity of the shock eliminates the suspicion of reverse causality so that the relationship between the exogenous variation and that of the target variable can be interpreted univocally.

Examples of valuable studies identifying exogenous shocks in the empirical happiness literature are those of Gardner and Oswald (2006) looking at lottery wins and Frijters et al. (2004a, 2004b and 2006) considering aggregate changes in real income after transition or reunification in Russia and Germany respectively. The novel contribution of this paper is the unique opportunity of investigating the impact of money on psychological variables by looking at the effects of tsunami on self-declared life satisfaction and self-esteem of a sample of 305 microfinance borrowers in Sri Lanka. If the money-happiness relationship has been investigated in quasi-natural experiments in case of positive shocks (lottery wins) or negative shocks in transition countries, this is the first case, to our knowledge, in which this occurs for negative shocks in a specific group of low income individuals close to the poverty line.

Furthermore, an additional advantage of our shock with respect to the previously considered ones is that is temporary and does not suffer from voluntary participation bias (unfortunate "winners" of the negative lottery, exactly as control sample, did not decide to buy the lottery ticket)

Even though the literature on self-esteem is much less extended, the debate between economists and psychologists on the causality nexus between self esteem and life events has taken a very similar direction with respect to that of life satisfaction. According to Tafarodi and Swann (2001) self-esteem is "the intrinsic perception of one's self in relation with other people" and is strictly related to self-confidence, representing the perceived ability of accomplishing one's own goals in life, since "…those who are liked enjoy a clear advantage in achieving their goals". In analogy to what occurs in the happiness literature, economists emphasize that self-esteem can be significantly affected by life events (Checchi and Pravettoni, 2003), while psychologist tend to believe that it is mainly determined by the ego structuring during childhood,. To our knowledge, the only two papers documenting this last point are those of Checchi and Pravettoni (2003) and Plotnick, Klawitter and Edwards (2001). For this reason the analysis of the effect of the tsunami shock on self-esteem is an important original contribution to this literature as it could provide for the first time unequivocal evidence from a quasi-natural experiment of a causality nexus from a life event to individual self esteem.

The paper is divided into five sections (including introduction and conclusions). The second section describes the survey design. The third and the fourth present and comment descriptive and econometric findings respectively. The fifth concludes.

2. The survey

During the month of April 2007 one of the authors of the paper, Stefano Castriota, and two additional Italian researchers went to Sri Lanka to interview a sample of randomly selected MFI borrowers in the Southern coast in order to perform an impact evaluation of the tsunami and to

study the recovery process. Interviews were performed face to face through the help of professional translators with economic background. The 305 selected people are clients of a Sri Lankan MFI, Agro Micro Finance (AMF), which received financial support from international organizations and Italian institutions after the natural catastrophe of December 2004. AMF was funded in 2000 by the Agromart Foundation which started performing microfinance activities in 1994. After six years, the Agromart Foundation decided to delegate this task to AMF in order to better focus on its original activity, the provision of technical assistance and education to rural populations. AMF kindly supported us in the selection process and provided us with the list of clients. Interviews were carried on during the monthly society meetings, at the borrowers' homes or in extra-meetings organized for this purpose by AMF.

We randomly selected a sample of 200 damaged (the treatment group) and 105 non-damaged (the control group) borrowers in the provinces of Galle, Matara and Hambantota. The treatment group is larger because in some relevant issues we are interested to subsamples of the treatment group which differ for damage typologies. From the methodological point of view it is important to reduce at minimum the possibility of interview biases: as it is possible to infer from the questionnaire attached below, the nexus between happiness and income is not the main focus of the survey whose aim is to evaluate the impact of tsunami and recovery on respondents' wellbeing. Therefore, the risk of respondents manipulation on the specific money-happiness issue is presumably low.

The survey contains questions on socio-demographic, economic and psychological variables. A section is devoted to microcredit, savings and other loans and another to the damages from the tsunami. A bit less than half of the sample has both economic activity and house close to the sea (maximum 1 kilometer), the average age is 48.5 ranging from 23 to 73, 85 percent are female, 82 percent are married and education level is low for advanced economies (35 percent has no formal, 48 percent primary and 16 percent secondary or tertiary education). Most of people are working in agriculture (21 percent), manufacturing (39 percent) and trade (49 percent) while a minority in

fishery (2 percent) and other activities (9 percent)[6]. The average number of house members is 4.6 with 2.3 children.[7] All economic variables expressed in US $ or Sri Lankan Rupees have been normalized to April 2007 terms.

Since the tsunami damages are the discriminating factor for inclusion in the two subsamples, and to reduce at minimum the omitted variable bias problem in our estimates which follow, we ask details on them. In our questionnaire respondents report separately for six types of damages: (i) to family members (injured or dead), (ii) to the house, (iii) to office buildings, (iv) to working tools, (v) to raw materials and (vi) to the market of the respondent's activity. 19 percent of the sample declares damages to the residence house, 25 percent to buildings or assets, 28 percent to working tools, one third to raw materials of its productive activity and 49 percent to the economic activity through a fall in the market demand.[8] Only 4 percent of borrowers report injuries to family members. Multiple damages are frequent and 26 percent of respondents declare at least 3 types of them while one third of interviewed individuals declare no damage. After the tsunami damaged people got assistance from international and national institutions: 32 percent relied on governmental subsidies (especially a four-month check of 5,000 Rps. to buy food), 27 percent on donations and grants from international organizations and NGOs and 3 percent on other forms of charity.

3. Descriptive findings

The tsunami was an unexpected event and we could not record our observations also before it. Therefore we follow the approach used in the development literature of reconstructing time series by creating retrospective panel data with a "memorable event" approach in which we ask respondents to provide information around important moments of their recent life (see McIntosh et al., 2007). More specifically, during the interviews carried on in April 2007 we asked respondents

[6] The total exceeds 100% since some people had more than one business activity.
[7] It must be considered that average wedding age is low, so the number of children currently living at home can be lower than the total number of sons and daughters because some of them are married and live in another house.
[8] As it is well known this problem is exacerbated when foreign aid occurs under the form of providing free goods to the local population, thereby generating negative effects on demand of producers operating close to the emergency area.

to provide information about four different periods: (P1) the six month interval before the first MFI loan ever obtained; (P2) the period going from the first MFI loan to the tsunami date (26 December, 2004), (P3) the interval between the tsunami event and the first MFI refinancing and (P4) the period from the MFI refinancing to the survey date (April 2007). The problem in this analysis lies in the heterogeneity of the four considered time windows since only two points in time (the tsunami and the survey date) are common to every borrower and only the first time interval (six months before first AMF financing) is fixed in length, even though not coincident for all respondents.

Information on the length of the second and third interval is therefore fundamental to our analysis (see Table 1). With this respect, the average length of the second interval is one year and a half (and no longer than two years and a half for 75 percent of sample respondents). The length of the third interval is 6 months for the first quarter of the sample, 10 months for half of it and 15 months for the last quarter. This implies that heterogeneity in the last two time windows is not strong. However, we obviously control for it in our regression analyses.[9] Consider that time heterogeneity, at least in the second and third period, is not a weakness of our data but a methodological requirement of the study (a reasonable upper boundary of the tsunami effect period is the loan refinancing date which is different for any borrower). In the rest of the paper we will try to reduce the heterogeneity of the time windows by explicitly introducing such variable in the estimates and by performing robustness checks of the results on a subample of borrowers with less than two years of seniority in the relationship with AMF before the tsunami date.

Some of the variables we consider for our analysis are built following the World Values Survey approach (full description of them is provided in Tables A1a and A1b in the Appendix). *Life*

[9] The estimation of common effects in a sample of nonsynchronous events is a typical feature of event studies in finance (for a standard treatment see Campbell, Lo and McKinlay, 1997). In those studies nonsynchronicity concerns the event date and abnormal returns are calculated on the basis of the definition of a normal return model estimated in the period preceding the event window. In our study nonsynchronicity concerns the rightward boundary of the event window (the first AMF refinancing after tsunami) when measuring tsunami effects and the leftward boundary of the event window (the same first AMF refinancing) when measuring refinancing effects. Hence we have both nonsynchronicity and irregularly spaced event windows (see Figure 1). Abnormality in our empirical work is measured with respect to both normal changes preceding the event window and the comparison of changes in the event period for the treatment and control sample. To solve the problem of irregularly spaced windows we add relevant window lengths in months as controls in our regressions.

satisfaction and *self-esteem* range from a minimum of 1 to a maximum of 10, *trust* is dummy variable equal to one if the respondent believes that most of people can be trusted, *standard of living* is a self-evaluation of the standard of living in terms of consumption goods from 0 (not sufficient) to 4 (very good), *prob. meal* is a dummy equal to one if the respondent to have had problems in providing daily meals. *Real income* is the real household income in terms of April 2007 Srilankan Rupees while *hours worked* is the average number of hours worked per week. *Saving* measures the possibility to save money and ranges from 0 (not at all) to 4 (very much). To capture the tsunami effects we adopt three different approaches. First, we include a dummy variable taking value of one if the individual reported any form of damage and zero otherwise (*damage*). Second, we build an indicator given by the sum of the six different types of damage suffered by respondents (*sumdam*). Third, we use 6 dummies picking up any of the different types of damage.[10]

Table 2 shows pairwise correlations among selected variables in the second and third period, which is the interval of interest for our research. We can see that life satisfaction and self-esteem are strongly correlated and that both are positively influenced by economic variables and negatively by the damages from the tsunami. Trust towards other people is weakly correlated with socio-economic variables while real income is obviously positively influenced by the number of hours worked and negatively by the damages from the tsunami. The other variables like standard of living, savings and declaration of problems in providing daily meals to family members follow the same path of the real income.

To be sure that the tsunami shock acted as a random negative lottery we verify whether before the natural catastrophe the main economic and psychological characteristics of damaged people were similar to those of non-damaged ones. In Table 3 we compare ex-ante (in the second period) characteristics of damaged and non damaged respondents. The hypothesis of equality in means is not rejected for all these variables at 95 percent or even 99 percent level. The only difference which

[10] *Dambuild*: damage to respondent's assets; *dammkt*: damage to the market of the respondent's activity; *damfamil*: injuries to members of the respondent's family; *damhouse*: damage to respondent's house; *damwtool*: damage to the repondent's working tools. The sixth type (damage to the raw materials) is not included in the regressions because its correlation with *damwtool* is equal to 0.73.

matters seem to be the share of people working in the agricultural sector which is obviously influenced by the location (those damaged live or have economic activities on the coast where trade and manufacturing are more developed than agriculture). Sample and treatment groups are therefore very similar before the tsunami event occurs in December 2004, while their situation becomes radically different in the third period.

From a descriptive point of view Figure 1 presents the cumulative distributions of changes in real household income in Sri Lankan Rps., life satisfaction and self-esteem from the second to the third period for treatment and control sample. The evidence presented clearly documents first order stochastic dominance of the distribution of the three variables of individuals damaged by the tsunami with respect to those unaffected, the difference being bigger for the lowest ventiles. To provide some examples of the differences of the cumulative distributions in some selected points, we register negative changes in life satisfaction for only 20 percent of non-damaged people against 65 percent of damaged ones. A drop of two points in the life satisfaction indicators involves only 10 percent of non-damaged against 40 percent of damaged. In spite of the shock, 40 percent of non-damaged people register positive changes in happiness against 15 percent of damaged ones. To interpret this finding notice that even among the damaged we register a share of respondents with positive changes in income after the tsunami shock (around 30 percent against around 50 percent in the control sample).[11] FIN QUI

Table 4 provides additional comparative evidence on the effect of our "negative lottery" by testing whether changes from the second to the third period in some selected indicators are significantly different from zero. We can observe that all the economic and psychological indicators worsen for damaged people, the loss being bigger when people declare a higher number of damages from the tsunami. On the contrary, this is not true for the control sample where no change is statistically

[11] To understand further this point consider as well that each respondent may be conceived, without lack of generality, as being subject to an additional random shock (drawn from a set of news unrelated to the tsunami event). The luckiest of them pick up from this set positive news which may compensate the negative effect of the tsunami on their income.

significant at 5 % level. Hence, without the exogenous shock, no significant changes in income and in the other wellbeing indicators are registered in the control sample.

To give an idea of the magnitude of the effects when we consider real income we find a 37 percent reduction in income for individuals with at least one damage and a 48 percent reduction for those with at least three damages. The same change in the control group is -5.6 percent but not significantly different from zero. These wide differences are hidden beyond a reduction in real income of around 25 percent when we consider the overall (damaged and non-damaged) sample. With regard to life satisfaction we register an insignificant fall of 0.08 points on a 1-10 scale for non damaged individuals, a reduction of 1.98 points for those with at least one damage and a drop of around 3.5 points for individuals with more than two damages. For these three groups changes are significantly different from each other. Similarly, self-esteem of non-damaged people does not register any significant change while that of people with at least one damage drops by 1.37 points and that of people with at least three damages by 2.56 points, again on a 1-10 scale.

In order to compare shocks on monetary and psychological indicators, in Table 5 we scale their changes from P2 to P3 on the standard deviation of the change in the previous period (from P1 to P2). The magnitude of the effects is impressive and significantly higher for psychological indicators, especially for those who report to have been more heavily damaged by the tsunami. Life satisfaction and happiness show the biggest losses, respectively 1.5 and 0.48 standard deviations in the full sample and 3.34 and 1.06 standard deviations in the subsample of people with at least three damages. Summarizing, the effects of the tsunami seem really severe not only from the statistical but also from the economic point of view, the consequences being stronger for psychological rather than for economic variables.

We may therefore conclude from descriptive findings that: (i) markedly abnormal changes in life satisfaction and self-esteem occurred after the tsunami for those reporting at least one damage; (ii) such abnormal changes depend on the number of different types of damage suffered since nothing happened for those reporting no damage; (iii) the change in income is also highly significant for the

treatment and not significant for the control sample, even if psychological indicators vary more than income.

These preliminary findings lead us to conclude that that the exogenous shock of the tsunami acts as a "negative lottery" which determines simultaneous changes in income, life satisfaction and self-esteem for damaged individuals.

In addition to these considerations we observe that the psychological variables seem to over-react with respect to economic ones, which implies that changes in happiness cannot be uniquely explained by changes in income but must also be explained by additional negative effects of the tsunami shock which are unrelated to income. It is evident that the dip in non-material wellbeing has been negatively affected not only by the income drop but also by the damages to family members and wealth and by other psychological processes. The latter may include the despair of assisting to the destruction of something which has not just an economic, but also an affective notional value, a sense of guilt or frustration for being among those hit, etc.

4. Econometric findings

In order to evaluate whether the exogenous change in income generated by the tsunami shock has affected life satisfaction and self-esteem of sample borrowers we estimate the following specification:

$$\Delta Wellbeing_i = \alpha_0 + \alpha_1 \Delta Income_i + \sum_k \alpha_{2k} Tsunami.Dam_i + \sum_j \alpha_{3j} Control_{ij} + \varepsilon_i$$

where the dependent variable is the change in the selected wellbeing indicator (life satisfaction or self-esteem) from the second to the third sample period. Since life satisfaction and self-esteem are discrete qualitative variables and take values from 1 to 10, the most suitable approach is an ordered probit estimate. However, given the extended range of our change in welbeing measures[12], in the literature the same dependent variable has sometimes been approximated to a continuous one so that

[12] Consider that first differenced life satisfaction and self-esteem variables have an extended -9, +9 range with respect to the 1-10 correspondent level variable.

both OLS and ordered logit models have been estimated (see Frey and Stutzer, 2006). We therefore estimate the specification under both approaches. All regressions are run by use of robust standard errors.

We expect the coefficient of the change in real household income to be positive and significant while that of the variable capturing the damages from tsunami to be negative. To isolate the income from the many other effects on happiness that may have been generated by the tsunami shock we consider the largest possible number of concurring factors. In addition to the different types of damage our controls included in the estimates are dummies for the three provinces (*Galle*, *Matara* and *Hambantota*) and dummies for the level of education[13], sex and age of the respondent, his/her field of activity[14], a dummy if the respondent has other outstanding loans (*other loan)*, and the concurring availability of remittances (*remittances*), government subsidies (*subsidies*) or grants (*grant*). Finally, in order to control for the heterogeneity in P2 and P3 time intervals, we introduce two variables measuring respectively the length in months of both periods (*length(P2)* and *length (P3)*).

Tables 6a-6b show what we expected in case of a truly exogenous event: only the change in real income and the variables capturing the damages from tsunami have an effect on psychological wellbeing. All the other variables are not statistically significant. We repeat the experiment by replacing the generic *damage* dummy with *sumdam* and with different dummies for each of the possible damages: life satisfaction and self-esteem are both directly affected by the drop in real household income and by the loss connected to raw materials and office buildings which are at the same time a form of wealth accumulated in the past and a necessary tool to earn money in the future. Results are very similar when using ordered logit or ordinary least squares estimators. On the whole, we may infer that monetary outcomes matter a lot since people who realized a wealth

[13] *Incompleted*=incomplete primary school, *Primary*=completed primary school, *Secplus*=secondary or more. Less than primary school completion is the benchmark (34 percent of the sample).
[14] *Manuf*=manufacturing, *fish*=fishery, *agric*=agriculture, *trad*=trade, tourism being the omitted benchmark.

loss, or a fall in current and/or future expected income, declared a strong dip in life satisfaction and self-esteem levels.

As a further robustness check we also re-estimate the model by restricting the analysis to the respondents whose lengths of the second and third period are both lower than 24 months (see Tables 7a-7b). In this way we reduce heterogeneity in time windows and ensure that average income levels before and after the tsunami date are computed over a period shorter than two years. The drawback is that we reduce considerably the number of available observations. Results on real income are very robust while those on the damages from tsunami a bit weakened. As a general comment, the insignificance of P2 and P3 lengths and the robustness of our results to the reduction of the heterogeneity in time windows seem to confirm that such heterogeneity does not impair the validity of our conclusions.

Table 8 shows the magnitude of the effect of coefficient estimated in Tables 6a and 6b. We multiply the coefficients and the standard deviations of the regressors at time 3 and divide this figure by the standard deviation of the dependent variable at time 2. In this way we evaluate the magnitude of the effects on happiness and self esteem of a one standard deviation shock on the explanatory variable in the tsunami period, compared to the normal change in life satisfaction and self-esteem in the "normal" pre-tsunami period. We can observe that the change in real household income and the damages from the tsunami have strong impact on both wellbeing indicators with a joint effect which is close to one and a half the standard deviation of the first difference of such indicators in the normal pre-tsunami period.

In order to provide an approximate evaluation of the share of variability explained by our target variables we look at the adjusted R-squares of OLS estimates from different specifications (see Table 9). By regressing first differenced dependent variables on only the constant and the change in real household income we find that the latter explains 14 percent of variation in life satisfaction and 12 percent of that in self-esteem. Regressions including only the constant and the sumdam variable lead to an R-squared equal, respectively, to 12 percent and 9 percent. Running regressions with

both the change in real income and one of the two variables capturing the damages from tsunami raises significantly the R-squared (38 percent for life satisfaction and 27 percent for self esteem).

This final check confirms that the effect of the shock is significant but that the change in income is only part of it. To such change we must add wealth and non material effects captured by the different damage dummies.

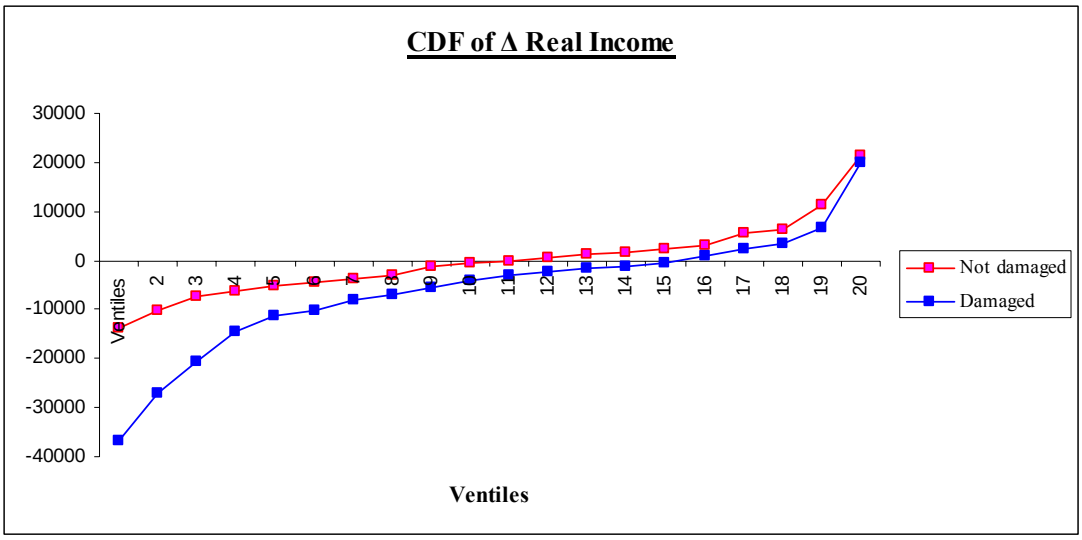
5. Conclusions

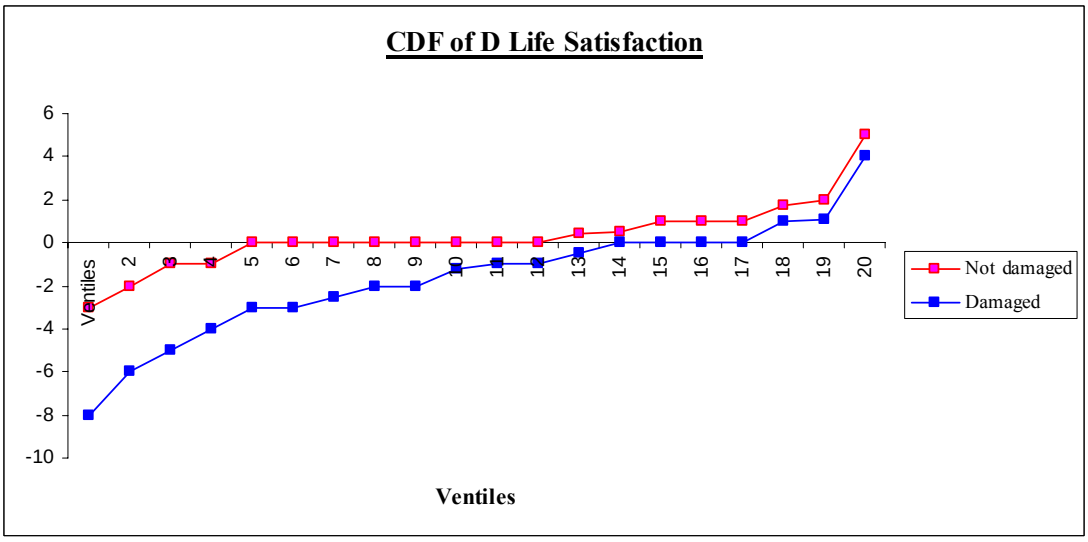
One of the most debated issues in the happiness literature is whether, and eventually how much, income matters to life satisfaction. The same effect of income on another fundamental variable, self-esteem, is largely unexplored. First differenced estimates in several empirical studies document that the relationship between changes in income and changes in life satisfaction is significant but weak. In presence of a serious problem of reverse causality the most reliable test to identify the exact effect of income on happiness is a quasi natural experiment in which a given historical event can undoubtedly be classified as generating an exogenous shock on income. The current literature has so far identified such events in lottery wins (positive changes in income) and political shocks in transition countries after the end of communism. No one has ever investigated so far the effect of a negative shock on income for a sample of individuals close to the poverty line.

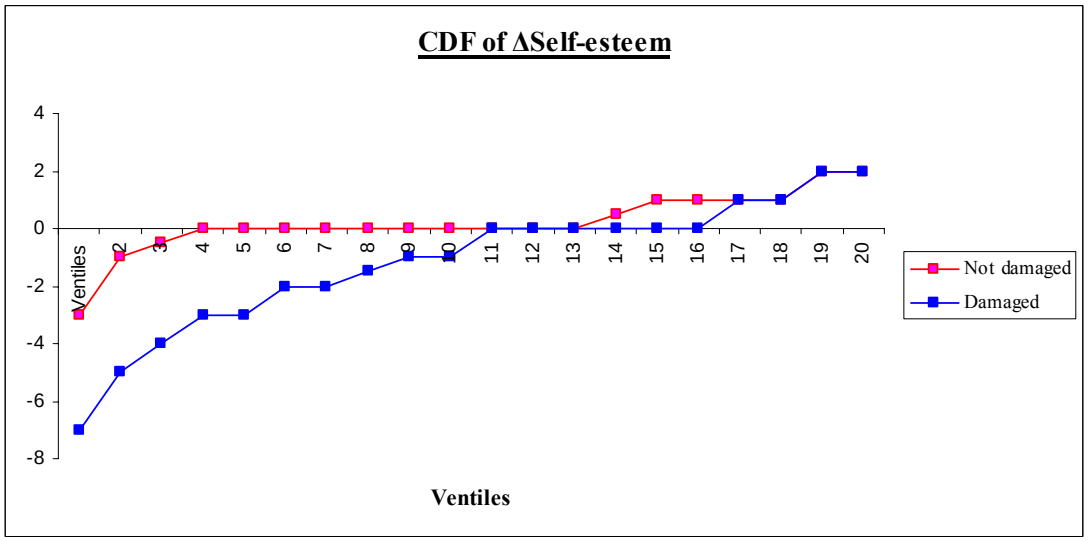
In our paper we identify the tsunami shock as a *negative* lottery event and rigorously define a treatment and a control sample of borrowers with homogeneous ex-ante characteristics. Both samples are made of borrowers of the same microfinance institutions, living in the same area, with no significant differences in MFI relationship seniority. In the paper we explain why we introduce heterogeneity in time spells relative to pre and post tsunami periods for our respondents and how we deal with it in a robustness check. Our results document that the effect of the shock is very serious since it generates significant concurring losses in income and fall in life satisfaction and self-esteem of damaged borrowers. The fact that nothing similar happens for the control group ensures us that

the shock has to be attributed to the selection for the “negative lottery”. We show that changes in income and the material damages from the tsunami significantly affect the change in life satisfaction and self-esteem even though they cannot explain all the variation of the two variables.

Figure 1: Cumulative distributions of changes in Real Income, Life Satisfaction and Self-Esteem from pre-tsunami (P2) to post tsunami/pre refinancing (P3) periods for treatment and control sample







Legend: P2 is the period going from the first MFI loan to the tsunami date (26 December, 2004) while P3 is the interval between the tsunami event and the first MFI refinancing.

Table 1: Cumulative distributions of the length of time windows in months

Cumulative %	Length of P2	Length of P3
1%	1	1
5%	2	2
10%	6	4
25%	11	6
50%	18.5	10
75%	31	15
90%	54	18
95%	66	26
99%	90	26

Legend: P2 is the period going from the first MFI loan to the tsunami date (26 December, 2004) while P3 is the interval between the tsunami event and the first MFI refinancing.

Table 2: Pairwise correlation matrix of selected socio-economic variables

	LifeS.	SelfE.	Trust	RealInc.	StandL.	ProbM.	Sav.	HoursW.	Damage	Sumdam
Life Satisf.	1									
Self-Esteem	0.70	1								
Trust	0.04	0.01	1							
Real Income	0.34	0.26	0.02	1						
Stand. Liv.	0.40	0.33	0.05	0.49	1					
Prob. Meal	-0.28	-0.20	-0.06	-0.25	-0.57	1				
Saving	0.26	0.15	0.02	0.34	0.38	-0.20	1			
Hours Worked	0.27	0.30	-0.01	0.20	0.27	-0.28	0.11	1		
Damage	-0.23	-0.22	0.00	-0.12	-0.19	0.16	-0.04	-0.11	1	
Sumdam	-0.25	-0.21	0.01	-0.10	-0.18	0.15	-0.07	-0.15	0.68	1

Variable details are reported in Table A1 in the Appendix.

Table 3: Mean and confidence intervals of selected indicators in the second time window

	Treatment Sample (damaged)			Control Sample (non-damaged)		
	Mean	**95 percent confidence intervals**		**Mean**	**95 percent confidence intervals**	
Real Income	18,117	15,028	21,206	15,948	14,189	17,706
Self-Esteem	7.87	7.62	8.12	8.16	7.82	8.50
Life Satisfaction	7.28	7.04	7.53	7.40	7.07	7.74
Happiness	2.77	2.68	2.86	2.80	2.66	2.94
Prob. Meal	0.09	0.05	0.12	0.07	0.02	0.12
Trust	0.49	0.42	0.57	0.50	0.40	0.60
Hours Worked	54.52	50.93	58.11	54.22	50.17	58.27
Stand. Liv.	2.46	2.34	2.57	2.45	2.29	2.61
Female	0.85	0.79	0.90	0.87	0.80	0.93
Age	48.53	47.09	49.98	48.39	46.34	50.43
Agriculture	0.16	0.10	0.21	0.36	0.27	0.46
Number of Children	2.46	2.25	2.67	2.22	1.94	2.49
Incompleted Education	0.39	0.32	0.46	0.28	0.19	0.36
Primary Educ.	0.46	0.39	0.53	0.50	0.41	0.60
Secondary and Tertiary Educ.	0.15	0.10	0.19	0.20	0.12	0.28
Length	26.17	23.35	29.00	22.06	18.85	25.27

Table 4: Changes in mean of selected indicators from P2 to P3

	Full sample	No damage	At least 1 damage	At least 3 damages
Δ Real Income	-5556.833	-1255.463	-8037.377	-10453.94
	(-7.04)	(-1.55)	(-7.24)	(-5.94)
Δ Equiv. Income PPP	-1.675444	-0.4536367	-2.381209	-3.039929
	(-7.07)	(-1.80)	(-7.16)	(-5.15)
Δ Standard of Living	-0.5377049	-0.0095238	-0.815	-1.089744
	(-8.03)	(-0.12)	(-9.32)	(-7.03)
Δ Self-Esteem	-0.8654485	0.0809524	-1.372449	-2.564935
	(-6.39)	(0.56)	(-7.50)	(-7.69)
Δ Life Satisfaction	-1.32392	-0.0857143	-1.987245	-3.447368
	(-8.94)	(-0.53)	(-10.23)	(-10.86)
Δ Happiness	-0.8519737	-0.0952381	-1.251256	-1.794872
	(-12.05)	(-1.25)	(-14.21)	(-14.14)
Δ Hours Worked	-9.203279	-1.933333	-13.02	-21.19231
	(-7.13)	(-1.48)	(-7.28)	(-6.30)
Δ Prob. Meal	0.1836066	0.0380952	0.26	0.3717949
	(7.49)	(1.42)	(7.78)	(6.41)

Robust t-statistics in brackets. Variable details are reported in Table A1 in the Appendix.

Table 5: Magnitude of the tsunami effect on selected variables*

	Full sample	No damage	At least 1 damage	At least 3 damages
Δ Real income	-0.160	-0.020	-0.099	-0.575
Δ Equiv. Income PPP	-0.144	0.001	-0.076	-0.559
Δ Standard of living	-0.731	-0.013	-0.280	-1.612
Δ Self-esteem	-0.733	0.075	-0.044	-2.187
Δ Life satisfaction	-1.222	-0.095	-0.310	-3.052
Δ Happiness	-1.507	-0.188	-0.655	-3.349
Δ Hours worked	-0.489	-0.109	-0.190	-1.061
Δ Prob. meal	0.757	0.160	0.347	1.346

*The ratio between the standard deviation of the change of the variable from post first financing/pre tsunami (P2) to post-tsunami/pre refinancing (P3) and the standard deviation of the change of the variable from pre-financing (P1) to post first financing/pre-tsunami (P2) periods.
Variable details are reported in Table A1 in the Appendix.

Table 6a: The determinants of changes in Life Satisfaction after tsunami

Variable	Ordered probit			OLS		
Galle	-0.833218	-0.8625983	-0.9463007	-0.8028765	-0.7877087	-0.8191481
	(-2.28)	(-2.43)	(-2.5)	(-2.01)	(-2.23)	(-2.29)
Matara	-0.4141737	-0.5442891	-0.5188629	-0.2754263	-0.3756442	-0.2826899
	(-1.28)	(-1.73)	(-1.55)	(-0.80)	(-1.17)	(-0.86)
Agriculture	0.5207444	0.3473404	0.3700208	0.5319147	0.3087566	0.2992394
	(1.66)	(1.15)	(1.22)	(1.77)	(1.16)	(1.09)
Fishery	0.4560714	0.2604757	0.1496467	0.6260666	0.3666512	0.1988852
	(0.60)	(0.47)	(0.30)	(0.80)	(0.61)	(0.33)
Manufact.	-0.0145947	0.0503751	0.032337	-0.0772705	0.0120903	-0.0633652
	(-0.06)	(0.19)	(0.12)	(-0.26)	(0.04)	(-0.21)
Age	0.0092099	0.0078489	0.0039226	0.0135847	0.0126214	0.0080508
	(0.73)	(0.63)	(0.29)	(1.00)	(1.01)	(0.61)
Female	-0.0769615	-0.1476585	-0.1664785	0.0797021	-0.0062708	0.0066675
	(-0.24)	(-0.47)	(-0.52)	(0.25)	(-0.02)	(0.02)
Primary	0.1815764	0.0846596	0.1416947	0.165575	0.0006766	0.0501213
	(0.69)	(0.32)	(0.53)	(0.56)	(0.01)	(0.18)
Secplus	0.165784	0.0999071	0.1754949	0.1823447	0.0628105	0.079117
	(0.52)	(0.34)	(0.58)	(0.55)	(0.21)	(0.27)
Num.Child.	0.0300226	0.031835	0.0287761	0.0109364	0.0055683	0.0073072
	(0.37)	(0.41)	(0.35)	(0.12)	(0.07)	(0.09)
Δ Real Inc.	0.0000569	0.0000483	0.0000505	0.0000558	0.0000449	0.0000465
	(3.27)	(3.11)	(3.29)	(3.86)	(3.51)	(3.69)
Damage	-0.5351427			-0.3331496		
	(-1.68)			(-1.17)		
Sumdam		-0.6391632			-0.6334049	
		(-5.03)			(-5.33)	
Dam.Family			-1.233426			-2.096171
			(-1.36)			(-1.80)
Dam.House			-0.0841512			-0.520788
			(-0.15)			(-0.96)
Dam. Build.			-0.6391655			-0.6900087
			(-1.66)			(-1.73)
Dam.Tools			-1.686477			-1.279893
			(-3.19)			(-2.25)
Dam.Mkt.			-0.4989021			-0.35208
			(-1.61)			(-1.22)
Remittances	-0.2495981	-0.4310788	-0.2672197	0.0106472	-0.1403423	-0.1171605
	(-0.33)	(-0.62)	(-0.37)	(0.02)	(-0.24)	(-0.19)
Subsidies	-0.9766874	-0.4881622	-0.4828677	-1.3212	-0.6233697	-0.6736288
	(-3.03)	(-1.66)	(-1.62)	(-3.45)	(-1.9)	(-2.02)
Don.Grants	-1.206674	-0.5573278	-0.5412322	-1.315902	-0.542871	-0.538647
	(-3.16)	(-1.42)	(-1.35)	(-3.25)	(-1.32)	(-1.23)
Other Loans	0.0908093	0.2037622	0.2663143	0.1813634	0.2621105	0.2613055
	(0.34)	(0.74)	(0.98)	(0.70)	(1.03)	(1.02)
Length P3	-0.0076623	-0.0148059	-0.0127724	-0.0198276	-0.0249858	-0.0215374
	(-0.37)	(-0.74)	(-0.61)	(-0.84)	(-1.13)	(-0.95)
Length P2	0.0026777	-0.0001023	0.0032014	0.0047123	0.0014932	0.0034724
	(0.39)	(-0.02)	(0.45)	(0.59)	(0.20)	(0.46)
Constant				-0.4025316	0.2361957	0.2414497
				(-0.56)	(0.36)	(0.36)
N. of obs.	242	242	242	242	242	242
(Pseudo) R^2	0.0905	0.1144	0.1173	0.3656	0.4434	0.4535

Robust t-statistics in brackets.Variable details are reported in Table A1 in the Appendix.

Table 6b: The determinants of changes in Life Satisfaction after tsunami (window length ≤ months)

Variable	Ordered probit			OLS		
Galle	-0.7762379	-0.5859424	-0.9938041	-0.8712684	-0.746513	-0.912265
	(-1.50)	(-1.18)	(-1.80)	(-1.52)	(-1.46)	(-1.66)
Matara	-0.3783355	-0.338489	-0.6494893	-0.205251	-0.1950123	-0.3078314
	(-0.79)	(-0.69)	(-1.24)	(-0.43)	(-0.43)	(-0.67)
Agriculture	0.1473763	-0.0046049	-0.1423474	0.2224221	-0.0912199	-0.2747673
	(0.33)	(-0.01)	(-0.28)	(0.52)	(-0.23)	(-0.63)
Fishery	-0.5721847	-0.8292	-0.599651	-0.3201683	-0.515842	-0.6914291
	(-0.72)	(-1.34)	(-0.77)	(-0.35)	(-0.65)	(-0.88)
Manufact.	0.0927469	0.2476166	0.119464	0.1599305	0.3733315	0.1443545
	(0.22)	(0.61)	(0.29)	(0.31)	(0.77)	(0.32)
Age	0.0046634	0.0077804	0.0070997	0.0068264	0.0118746	0.0066973
	(0.26)	(0.43)	(0.37)	(0.38)	(0.73)	(0.39)
Female	-0.6277698	-0.7220619	-0.6078477	-0.2469206	-0.3241497	-0.2095361
	(-1.29)	(-1.40)	(-1.20)	(-0.58)	(-0.75)	(-0.48)
Primary	0.1114636	-0.125162	-0.0664458	0.0640935	-0.2426629	-0.4158759
	(0.29)	(-0.32)	(-0.16)	(0.14)	(-0.52)	(-0.94)
Secplus	-0.3780492	-0.6570077	-0.7135715	-0.375145	-0.6542983	-0.9407559
	(-0.84)	(-1.50)	(-1.59)	(-0.81)	(-1.56)	(-2.18)
Num.Child.	0.0525985	0.0687441	0.0303237	-0.0300928	-0.0095805	-0.0266207
	(0.47)	(0.64)	(0.26)	(-0.24)	(-0.09)	(-0.23)
Δ Real Inc.	0.0000832	0.0000804	0.0000819	0.0000827	0.0000751	0.0000748
	(4.69)	(4.46)	(4.43)	(4.73)	(4.44)	(4.54)
Damage	-0.3673405			-0.1162239		
	(-0.74)			(-0.25)		
Sumdam		-0.6266195				
		(-3.11)				
Dam.Family			-2.880414			-3.398312
			(-1.09)			(-1.41)
Dam.House			-0.4187325			-1.260186
			(-0.49)			(-1.58)
Dam. Build.			-0.1475666			-0.3817366
			(-0.25)			(-0.73)
Dam.Tools			-0.999019			-0.2956139
			(-0.92)			(-0.33)
Dam.Mkt.			-1.335029		-0.5956147	-1.040145
			(-2.51)		(-3.29)	(-2.09)
Remittances	-1.119081	-1.412236	-1.607072	-0.736732	-0.9181757	-1.206194
	(-1.25)	(-1.78)	(-1.61)	(-0.85)	(-1.34)	(-1.49)
Subsidies	-0.5589785	-0.0525231	-0.1132538	-0.8389508	-0.2042587	-0.2548368
	(-1.45)	(-0.15)	(-0.29)	(-1.64)	(-0.47)	(-0.62)
Don.Grants	-1.729535	-0.7682167	-0.859354	-1.729303	-0.796667	-0.7410705
	(-2.74)	(-1.10)	(-1.00)	(-2.82)	(-1.13)	(-1.03)
Other Loans	0.5451054	0.6188021	0.5837368	0.5481063	0.6125453	0.5035011
	(1.55)	(1.79)	(1.63)	(1.59)	(1.83)	(1.52)
Length P3	0.0029475	-0.0185792	-0.006384	-0.0535231	-0.0642599	-0.0503956
	(0.08)	(-0.50)	(-0.17)	(-1.15)	(-1.47)	(-1.17)
Length P2	0.020905	0.010986	0.0242759	0.0220891	0.0098034	0.0162575
	(0.79)	(0.40)	(0.90)	(0.81)	(0.37)	(0.66)
Constant				0.4882966	0.9909525	1.429956
				(0.51)	(1.03)	(1.39)
N. of obs.	130	130	130	130	130	130
(Pseudo) R^2	0.1174	0.14	0.1499	0.418	0.5179	0.5179

Robust t-statistics in brackets.Variable details are reported in Table A1 in the Appendix.

Table 7a: The determinants of changes in Self-Esteem after tsunami

Variable	Ordered probit			OLS		
Galle	-0.8333057	-0.8619071	-0.8061271	-0.7275691	-0.721024	-0.7044766
	(-2.26)	(-2.38)	(-2.13)	(-1.81)	(-1.92)	(-1.85)
Matara	-0.4081135	-0.517484	-0.4405456	-0.2927587	-0.3735104	-0.2754515
	(-1.19)	(-1.53)	(-1.23)	(-0.79)	(-1.05)	(-0.77)
Agriculture	0.16326	0.0258896	0.1504762	0.0651495	-0.105681	-0.0050755
	(0.58)	(0.09)	(0.54)	(0.23)	(-0.41)	(-0.02)
Fishery	-0.8330367	-1.041565	-1.273601	-0.6506965	-0.8568505	-1.147799
	(-1.10)	(-1.74)	(-2.44)	(-0.80)	(-1.37)	(-1.96)
Manufact.	-0.2963581	-0.22776	-0.1464392	-0.3669857	-0.2997176	-0.29303
	(-1.04)	(-0.80)	(-0.49)	(-1.26)	(-1.06)	(-0.97)
Age	0.0039632	0.0027131	0.0026072	0.0035579	0.0026487	0.0003104
	(0.30)	(0.21)	(0.18)	(0.28)	(0.22)	(0.02)
Female	-0.0391092	-0.1147572	-0.2019841	-0.1065374	-0.1725902	-0.2374444
	(-0.12)	(-0.36)	(-0.58)	(-0.34)	(-0.55)	(-0.73)
Primary	0.2544555	0.1809481	0.2074387	0.1597089	0.0360009	0.1089835
	(0.94)	(0.67)	(0.78)	(0.58)	(0.14)	(0.42)
Secplus	0.0101198	-0.0458938	0.0544698	0.091723	0.006792	0.101893
	(0.03)	(-0.14)	(0.16)	(0.27)	(0.02)	(0.29)
Num.Child.	0.0133266	0.0096191	0.0010073	0.0362408	0.0318712	0.0257462
	(0.17)	(0.12)	(0.01)	(0.42)	(0.40)	(0.31)
Δ Real Inc.	0.0000527	0.0000476	0.0000473	0.0000503	0.0000419	0.0000421
	(3.20)	(3.14)	(3.11)	(3.38)	(3.12)	(3.25)
Damage	-0.53121			-0.3117799		
	(-1.82)			(-1.18)		
Sumdam		-0.4912502			-0.5075686	
		(-4.11)			(-4.54)	
Dam.Family			-0.6554989			-1.514343
			(-0.62)			(-1.22)
Dam.House			0.3676314			0.3509811
			(0.71)			(0.68)
Dam. Build.			-1.035693			-1.052857
			(-2.88)			(-2.93)
Dam.Tools			-1.302985			-1.170511
			(-2.62)			(-2.23)
Dam.Mkt.			-0.2124309			-0.1418296
			(-0.67)			(-0.54)
Remittances	-0.0607753	-0.1416994	0.0164237	-0.0494724	-0.1688338	-0.0920664
	(-0.09)	(-0.21)	(0.02)	(-0.08)	(-0.30)	(-0.16)
Subsidies	-0.4493875	-0.1273346	-0.1153533	-0.7015875	-0.1537076	-0.2197475
	(-1.38)	(-0.43)	(-0.37)	(-2.05)	(-0.53)	(-0.72)
Don.Grants	-0.7588572	-0.2814585	-0.35411	-0.9317104	-0.323524	-0.399244
	(-2.00)	(-0.73)	(-0.99)	(-2.38)	(-0.85)	(-1.06)
Other Loans	-0.1506093	0.0015609	0.0767104	-0.0880065	-0.0187139	0.0094701
	(-0.60)	(0.01)	(0.27)	(-0.34)	(-0.07)	(0.04)
Length P3	0.0004428	-0.0042029	-0.0084489	-0.0127774	-0.0170338	-0.0168677
	(0.02)	(-0.20)	(-0.38)	(-0.58)	(-0.79)	(-0.75)
Length P2	0.0055212	0.0025283	0.0047686	0.0031279	0.0006421	0.003017
	(0.64)	(0.30)	(0.54)	(0.36)	(0.07)	(0.34)
Constant				0.6054649	1.093462	0.9683044
				(0.90)	(1.73)	(1.52)
N. of obs.	241	241	241	241	241	241
(Pseudo) R^2	0.0626	0.0778	0.0839	0.2464	0.3091	0.3291

Robust t-statistics in brackets.Variable details are reported in Table A1 in the Appendix.

Table 7b: The determinants of changes in Self-Esteem after tsunami (window length ≤ months)

Variable	Ordered probit			OLS		
Galle	-0.8551237	-0.7306814	-0.7564638	-0.5078792	-0.4359101	-0.4955805
	(-1.71)	(-1.58)	(-1.45)	(-1.04)	(-0.95)	(-1.09)
Matara	-0.0687717	-0.0478781	-0.0740875	0.2154569	0.215465	0.1845537
	(-0.15)	(-0.10)	(-0.13)	(0.47)	(0.47)	(0.41)
Agriculture	-0.0043084	-0.0716808	0.0049671	-0.0607433	-0.2160545	-0.1302073
	(-0.01)	(-0.17)	(0.01)	(-0.14)	(-0.52)	(-0.28)
Fishery	-1.955331	-2.212296	-2.316218	-1.557765	-1.697185	-1.935974
	(-1.93)	(-3.06)	(-2.62)	(-1.43)	(-2.07)	(-1.94)
Manufact.	-0.121852	-0.0883456	-0.1092957	-0.2437803	-0.1382341	-0.2414324
	(-0.30)	(-0.21)	(-0.24)	(-0.56)	(-0.32)	(-0.55)
Age	-0.0055421	-0.0052621	0.001002	-0.0147278	-0.0121128	-0.0111108
	(-0.29)	(-0.27)	(0.05)	(-0.89)	(-0.76)	(-0.71)
Female	-0.2836448	-0.3786957	-0.4409635	-0.3201759	-0.3666335	-0.3001999
	(-0.50)	(-0.63)	(-0.71)	(-0.63)	(-0.70)	(-0.59)
Primary	0.1671487	0.0953093	0.0491528	0.0126712	-0.1444821	-0.145684
	(0.40)	(0.22)	(0.11)	(0.03)	(-0.36)	(-0.39)
Secplus	-0.3222043	-0.4914436	-0.6097614	-0.3553196	-0.5004184	-0.6143131
	(-0.65)	(-0.95)	(-1.05)	(-0.78)	(-1.10)	(-1.21)
Num.Child.	-0.0193146	-0.0187582	-0.0585456	-0.0359348	-0.0246116	-0.0481316
	(-0.15)	(-0.15)	(-0.47)	(-0.28)	(-0.20)	(-0.41)
Δ Real Income	0.000075	0.000078	0.0000736	0.0000759	0.0000722	0.0000642
	(4.34)	(4.46)	(3.59)	(4.30)	(4.30)	(3.79)
Damage	-0.7955934			-0.1664709		
	(-1.55)			(-0.34)		
Sumdam		-0.4351991			-0.3463329	
		(-2.78)			(-2.57)	
Dam.Family			-1.69695			-2.433072
			(-0.33)			(-0.80)
Dam.House			0.2797354			0.3156182
			(0.39)			(0.43)
Dam. Build.			-0.903733			-0.9090674
			(-1.76)			(-2.07)
Dam.Tools			-0.6844445			-0.4475052
			(-0.73)			(-0.51)
Dam.Mkt.			-0.9192471			-0.5579904
			(-1.70)			(-1.41)
Remittances	-1.141014	-1.386953	-1.463548	-0.8989659	-1.013247	-1.143889
	(-1.67)	(-2.09)	(-1.92)	(-1.16)	(-1.45)	(-1.41)
Subsidies	0.2841803	0.4819292	0.4966744	0.0839407	0.4307295	0.2503625
	(0.62)	(1.16)	(1.09)	(0.20)	(1.13)	(0.61)
Don.Grants	-0.8369598	-0.3751137	-0.2792658	-1.19556	-0.6796819	-0.5593614
	(-1.34)	(-0.6)	(-0.46)	(-2.07)	(-1.21)	(-1.05)
Other Loans	0.177737	0.388436	0.2295202	0.1121626	0.163893	0.0014259
	(0.44)	(0.94)	(0.48)	(0.32)	(0.48)	(0.01)
Length P3	0.0040175	-0.0067223	-0.0067566	-0.0432665	-0.0491908	-0.0471225
	(0.12)	(-0.19)	(-0.18)	(-1.16)	(-1.32)	(-1.20)
Length P2	-0.0315888	-0.0326652	-0.0348096	-0.0115266	-0.0171861	-0.0109867
	(-1.07)	(-1.04)	(-1.04)	(-0.40)	(-0.61)	(-0.40)
Constant				1.92573	2.15768	2.146767
				(1.76)	(1.94)	(2.01)
N. of obs.	129	129	129	129	129	129

(Pseudo) R^2	0.0951	0.1051	0.1135	0.3169	0.3461	0.3763

Robust t-statistics in brackets. Variable details are reported in Table A1 in the Appendix.

Table 8a: Magnitude effects of selected regressors on changes in Life Satisfaction after tsunami

	Logit			**OLS**		
Δ Real Income	0.66	0.56		0.65	0.52	0.54
Damage	-0.24			-0.15		
Sumdam		-0.98			-0.98	
Dam.Family			-0.21			-0.36
Dam.House			-0.03			-0.19
Dam. Build.			-0.26			-0.28
Dam.Tools			-0.69			-0.53
Dam.Mkt.			-0.23			-0.16

Legend: The magnitude effect is calculated as the product between the coefficient of the β(X) and the standard deviation of X both at time 3, divided by the standard deviation of Y at time 2. The coeffients β(X) are from Table 6a.

Table 8b: Magnitude effects of selected regressors on changes in Self-Esteem after tsunami

	Logit			**OLS**		
Δ Real Income	0.57	0.51		0.54	0.45	0.45
Damage	-0.21			-0.13		
Sumdam		-0.70			-0.72	
Dam.Family			-0.10			-0.24
Dam.House			0.12			0.12
Dam. Build.			-0.38			-0.39
Dam.Tools			-0.49			-0.44
Dam.Mkt.			-0.09			-0.06

Legend: The magnitude effect is calculated as the product between the coefficient of the β(X) and the standard deviation of X both at time 3, divided by the standard deviation of Y at time 2. The coefficients β(X) are from Table 6b.

Table 9: Adjusted-R^2 from OLS regressions

Regressor	**Δ Life Satisfaction**				**Δ Self-Esteem**			
Δ Real Income	x		x	x	x		x	x
Damage			x				x	
Sumdam		x		x		x		x
R2	0.14	0.12	0.21	0.38	0.12	0.09	0.15	0.27

Note: The x indicates the regressors included in the estimation, in addition to the constant.

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APPENDIX

Table A1. Description of economic and socio-demographic variables

Galle	DV equal to 1 if the province is Galle
Matara	DV equal to 1 if the province is Matara
Hambantota	DV equal to 1 if the province is Hambantota
Female	DV equal to 1 if the gender is female
Age	Age of the respondent in years
HeadHous.	DV equal to 1 if head of the household
Incompled	DV equal to 1 if the education level is incomplete primary
Primary	DV equal to 1 if the education level is complete primary
SecPlus	DV equal to 1 if the education level is higher than primary
Agriculture	DV equal to 1 if the sector of activity is agriculture
Fishery	DV equal to 1 if the sector of activity is fishery
Manufacturing	DV equal to 1 if the sector of activity is manufacturing
Trade	DV equal to 1 if the sector of activity is trade
NumChildren	Number of children currently living in the house
RealIncome	Real income in April 2007 Sri Lankan Rps.
RealYeq	Real equivalent income in April 2007 Sri Lankan Rps.
PPPYeq	Real equivalent income in April 2007 PPP USD
StandLiv.	Standard of living in terms of consumption goods
ProbMeal	DV equal to 1 if the respondent had problems in providing daily meals
PrivMed.	DV equal to 1 if the respondent could afford private medical consultations
Savings	Amount of savings from 0 (not at all) to 4 (very much)
Van	DV equal to 1 if the respondent owns a van
Tract	DV equal to 1 if the respondent owns a tractor
Motorbike	DV equal to 1 if the respondent owns a motorbike
Bicycle	DV equal to 1 if the respondent owns a bicycle
HoursWorked	Number of hours worked per week
Happiness	Self-declared level of happiness from 0 (not at all) to 4 (very happy)
Life Satisf.	Self-declared level of life satisfaction from 1 (min) to 10 (Max)
Self-Esteem	Self-declared level of self-esteem from 1 (min) to 10 (Max)
Trust	DV equal to 1 if most people can be trusted
Health	Self-declared level of health from 1 (min) to 10 (Max)
Dam.Family	DV equal to 1 if the respondent reported damages to the family
Dam.House	DV equal to 1 if the respondent reported damages to the house
Dam.Build.	DV equal to 1 if the respondent reported damages to the office buildings
Dam.Tools	DV equal to 1 if the respondent reported damages to the working tools
Dam.RawMat.	DV equal to 1 if the respondent reported damages to the raw materials
Dam.Mkt.	DV equal to 1 if the respondent reported damages to the market of its own activity
Sum.Dam.	Number of types of damage from 0 to 6
Tsun.Forced	DV equal to 1 if the tsunami forced the respondent to use personal savings after the tsunami
Remittances	DV equal to 1 if the respondent received remittances from foreign countries
Subsidies	DV equal to 1 if the respondent received governmental subsidies
Don.Grant	DV equal to 1 if the respondent received donations and grants
Oth.Charity	DV equal to 1 if the respondent received other forms of charity
Relative Loan	Ratio between real amount loaned and average monthly income of the previous month