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The Half-Life of Happiness: Hedonic Adaptation in the Subjective Well-Being of Poor Slum Dwellers to a Large Improvement in Housing

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ABSTRACT

Subjective well-being may not improve in step with increases in material well-being due to hedonic adaptation, a psychological process that attenuates the long-term emotional impact of a favorable or unfavorable change in circumstances, such that people's happiness eventually returns to a stable reference level. We use a multi-country field experiment to examine the impact of the provision of improved housing to extremely poor populations on subjective measures of well-being to test whether poor populations exhibit hedonic adaptation when their basic housing needs are met. After sixteen months, we find that subjective perceptions of well-being improve substantially for recipients of better housing but that after, on average, eight additional months, 60% of that gain disappears.

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1.**Introduction**

Some 2,300 years ago, Aristotle posited that the pursuit of happiness "…is a first principle; for it is for the sake of this that we do all that we do." In other words, happiness is what we value, and everything else, including health and material well-being, is valued only to the extent that it makes us happy. This raises the fundamental question as to whether the colossal improvement in material conditions that has occurred since the time of Aristotle has made human beings substantially happier. If happiness monotonically increases with development, then the enhancement of material well-being should have made human beings many orders of magnitude happier today than they were at the time of Aristotle.

One reason why subjective well-being may not improve in step with increases in material well-being is put forward by the *hedonic adaptation* hypothesis, which states that there is a psychological process that attenuates the long-term emotional impact of a favorable or unfavorable change in circumstances, such that people's happiness eventually returns to a stable reference level (Frederick and Loewenstein, 1999). According to this hypothesis, then, variations in happiness and unhappiness are no more than short-lived reactions to changes in people's circumstances. In other words, while people initially have strong reactions to events that change their material level of well-being, they eventually return to a baseline level of life satisfaction that is determined by their inborn temperament (Diener et al., 2006). In psychology, this idea is known as the *set point theory* and was labeled the *hedonic treadmill* in the seminal work of Brickman and Campbell (1971).[1]

Veenhoven (1991) and Frederick and Loewenstein (1999) further hypothesize that people do not adapt to shocks to the level of satisfaction of basic necessities that are related to survival and reproduction. This suggests that hedonic adaptation is manifested the most in people who have achieved a certain level of basic material well-being rather than being a persistent phenomenon that is evenly distributed across all socioeconomic groups. This idea is analogous to the notion of diminishing marginal utility, where the marginal increase in happiness derived from material gain is higher at lower levels of material wealth. The analog in hedonic adaptation is that adaptation is more limited at lower levels of material wealth. In essence, then, the idea is that the poor do not display hedonic adaptation,

[1] In a widely cited paper, Brickman et al. (1978) present evidence that lottery winners and accident victims report life satisfaction levels that are almost comparable to those of people who did not win a lottery nor were accident victims one year after the event, suggesting that at least partial hedonic adaptation to both positive and negative shocks may take place. However, this evidence should be viewed with caution as it is based on a small and selected sample of lottery winners and accident victims that was then compared with a small, geographically matched and self-selected sample of individuals.

or at least, do not adapt completely, to shocks to the satisfaction of their basic needs. Along these same lines, Di Tella and MacCulloch (2008) argue that there is a need to test whether income buys long-term happiness in a low-income context in which the majority of the population has not yet attained a minimum standard of living – something that, to our knowledge, has not yet been done.

In this paper we use data from field experiments in three developing countries to test the hypothesis that material well-being buys long-term happiness among extremely poor slum dwellers. Specifically, we present the first piece of evidence on hedonic adaptation among the poor to an improvement in the satisfaction of one of their basic needs: shelter. The 1948 United Nation Universal Declaration of Human Rights identified housing, along with food and clothing, as a basic requirement for achieving an adequate standard of living.[2] Despite this, almost one billion people, primarily in the developing world, live in urban slums and lack proper housing (United Nations, 2003).[3] Most slum dwellers live in houses with dirt floors and with roofs and walls that are constructed out of discarded cardboard, tin or plastic. These houses do not provide proper protection from inclement weather, are not secure, and are not pleasant to live in. Many have insufficient access to services such as clean water, sanitation and electricity (UN-Habitat, 2003, and Marx et al., 2013).

We use data on subjective perceptions of well-being generated by a large-scale, multi-country randomized field experiment that provided basic housing units to extremely poor populations living in slums in three Latin American countries: El Salvador, Mexico and Uruguay. We test the hedonic adaptation hypothesis using experimentally generated variations in the supply of houses combined with quasi-experimental variations in the length of exposure to the treatment. To the best of our knowledge, this is the first paper to examine hedonic adaptation by the poor to an improvement in the satisfaction of basic needs and the first to use experimentally generated variation for this purpose.

We find that subjective perceptions of well-being are substantially greater sixteen months after receipt of improved housing, but that, eight months later, about 60% of that gain disappears. Indeed, we find that the degree of hedonic adaptation is consistent across different satisfaction indicators, from satisfaction with quality of life to satisfaction with quality of housing characteristics. Our results suggest that an at least partial degree of hedonic adaptation is a common human behavior that is

[2] United Nations, Universal Declaration of Human Rights, Article 25 (1948).

[3] In line with previous work, we define a slum as an overcrowded settlement that affords poor-quality housing and inadequate access to safe water and sanitation and which suffers from insecurity of tenure (UN-Habitat, 2003).

present even among extremely poor populations that experience a major improvement in the level of satisfaction of their basic necessities.

The rest of this paper is organized as follows. In Section 2, we discuss the related literature and the contribution made by this paper. In Section 3, we describe the intervention and the experimental design. In Sections 4 and 5, we discuss the strategy of measurement of subjective well-being and introduce the identification strategy and econometric methods used in this study. In Section 6 we present our empirical results, while in Section 7 we discuss alternative interpretations and implement robustness checks. Finally, Section 8 concludes.

2. Related Literature

A number of previous studies have used observational data to test whether happiness levels in non-poor settings vary with changes in living standards. Many of these papers examine adaptation to negative shocks such as unemployment (Clark and Oswald, 1994, and Winkelman and Winkelman, 1998), disability (Oswald and Powdthavee, 2008), hemodialysis (Riis et al., 2005), major illness (Ferrer-i-Carbonell and Van Praag, 2002, and Groot et al., 2004), divorce (Clark et al., 2008) and falling below the poverty line (Clark, D'Ambrosio and Ghislandi (forthcoming)).[4] Others have studied adaptation to positive shocks, including Yap, Anusic and Lucas (2012 and 2015) and Grover and Helliwell (2015), who show that marriage has large and long-lasting effects on life satisfaction in the United Kingdom, Switzerland and other developed countries. Nakazato, Schimmack and Oishi (2010) find that moving to a better home in Germany had lasting effects on housing satisfaction that were measurable five years later, but no effects at all on life satisfaction. Gardner and Oswald (2007) and Apouey and Clark (2015) document continuing mental health and life satisfaction gains from lottery winners in the United Kingdom. Di Tella, Haisken-De New and MacCulloch (2010) used observational data to study happiness adaptation to both positive and negative changes in income and status in Germany and found that, within the space of four years, individuals completely adapt to changes in income. With a few exceptions, this research generally shows that people at least partially revert to their reference level of happiness over time. Nonetheless, all of these studies are based on samples that either do not

[4] They use observational panel data for the period from 1992 to 2011 in Germany to estimate the effect of falling below the poverty line on the level of satisfaction with quality of life. They find that life satisfaction falls with poverty and that there is little evidence of adaptation within a poverty spell. Their results may, however, suffer from potential selection problems associated with time-varying non-observable variables, such as productivity or effort, that may well be correlated with both the probability of entering poverty and achieving perceived life satisfaction over time (for causal evidence concerning the positive effects of happiness on productivity, see Oswald, Proto and Sgroi (2015)).

include people living in extreme poverty or do not separate out the effects on poor households from the effects on non-poor households.

In low-income contexts, there have been a number of well-known studies on the effect of major improvements in housing and of cash transfer programs on happiness, but none of these studies has investigated the phenomenon of adaptation. Cattaneo et al. (2009) find that replacing dirt floors with cement floors both increases happiness and reduces symptoms of depression in Mexican slums. Ozer et al. (2011) find that beneficiaries of Mexico's *Oportunidades* program have significantly lower rates of depression. Ludwig et al. (2012) find that a one standard deviation decline in neighborhood poverty substantially increased the subjective well-being of the beneficiaries of the Moving to Opportunity (MTO) experiment. Devoto et al. (2012) find that greater access to clean municipal water supplies significantly increases happiness. Galiani et al. (2016) find that giving poor Mexicans non-contributory pensions reduces their symptoms of depression. Taken together, this body of work suggests that reducing poverty is associated with positive effects in terms of happiness. However, the literature does not include experiments based on the kind of data that would make it possible to test whether these effects change as a result of hedonic adaptation over time.

There is also a related body of literature on the general relationship between income and subjective well-being. In contrast to the papers cited above, which examine the impact of large shocks in material well-being on people's subjective well-being, this literature estimates the smooth association of income and subjective well-being. This part of the literature reports conflicting results from the longitudinal and cross-sectional evidence that has been gathered. Easterlin (1974, 2005 and 2006) provides evidence that increased income has not been associated with improvements in subjective well-being over time in the United States, and his analyses have been replicated in various other countries and for different periods of time.[5] Paradoxically, while there generally appears to be little evidence of a positive association between income and subjective well-being based on longitudinal time-series data,[6] there is substantial evidence of a positive and statistically significant association between income and happiness in the cross-sectional data on countries and on income groups within countries.[7]

[5] See, for example, Blanchflower and Oswald (2004), Diener and Ohishi (2000), Di Tella, MacChulloch and Oswald (2003) and Clark, Fleche and Senik (2014).
[6] An exception is Stevenson and Wolfers (2008), who find a positive time-series correlation between per capita GDP and average subjective well-being, but only for a few specific countries.
[7] See, for example, Blanchflower and Oswald (2004); Clark, Frijters and Shields (2008a); Deaton (2008); Diener and Biswas-Diener (2002); Diener and Seligman (2004); Diener et al. (2010); Di Tella and MacCulloch (2006); Frey and Stutzer (2002); Inglehart and Klingemann (2000); Senik (2005); Stevenson and Wolfers (2008); and Veenhoven (1991).

A common explanation of the Easterlin Paradox is based on the diminishing marginal utility of income (Frey and Stutzer, 2002; Layard, 2005; and Di Tella and MacCulloch, 2008). According to this line of reasoning, there is a satiation point before which happiness increases with income and after which additional income buys little, if any, extra happiness. This view is consistent with the hedonic adaptation models of Veenhoven (1991) and Frederick and Loewenstein (1999), who hypothesize that poor people do not adapt to shocks to the satisfaction of basic necessities that are related to survival and reproduction. This model is also consistent with both a positive longitudinal association between income and happiness in low-income countries and a weak or null association in high-income countries. Then, in the cross-country analyses, developed countries that have already reached a certain minimum level of GDP would mainly compose the "flat of the curve", while poorer countries would be positioned on the incline. In contrast, Clark, Frijters and Shields (2008b) put forward an alternative explanation in which individuals evaluate their life satisfaction by comparing their level of wealth with the wealth level of some reference individual or group in society. Under this hypothesis, increases in income will produce increases in happiness only if the distance between the individual and the reference group is shortened. Under this hypothesis, income growth has not increased subjective well-being within countries because the relative income differences across countries have not changed.

3.The Experiment

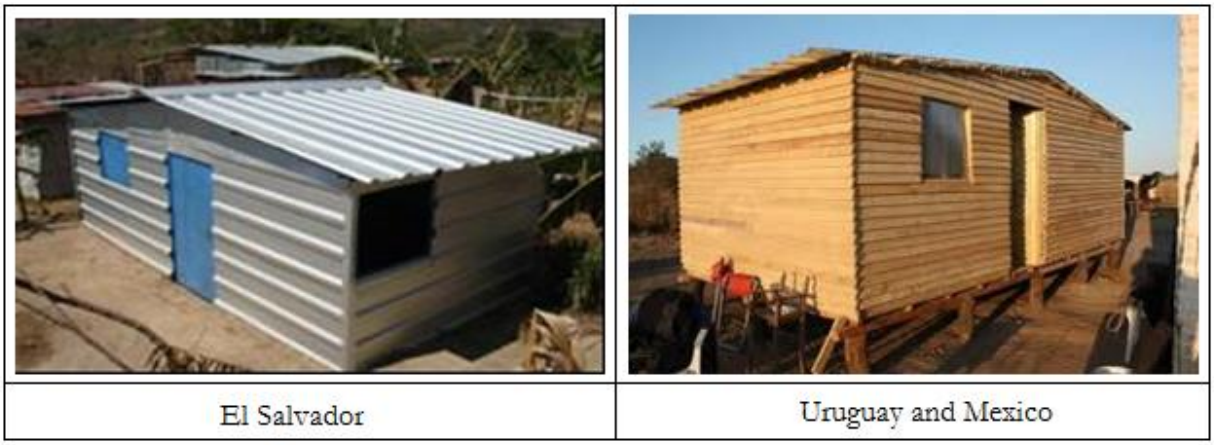
The houses were supplied by Un Techo Para Mi País ("A Roof for My Country" (TECHO)), a Latin American NGO whose mission is to provide basic, pre-fabricated houses to extremely poor populations with the express goal of improving their well-being. TECHO targets the poorest informal settlements and, within these settlements, the families who live in the most extremely substandard housing.[8] TECHO houses are a significant improvement over existing housing in terms of flooring, roofs and walls (Galiani et al., 2015). The targeted settlements are communities comprised of families that, for the most part, inhabit plots of land that they do not own and that are plagued by a host of problems, including insufficient access to basic utilities (water, electricity and sanitation), significant

[8] While the work primarily involves building homes, over 3,500 regular volunteers also commit at least one day a week to community organization and participation in social inclusion programs. This second phase of the intervention aims at developing skills through the implementation of these programs. Our study focuses on evaluating the impact of the first phase of the program: the construction of TECHO houses. We limit the evaluation sample frame to settlements that did not receive the services provided during the second phase of the intervention; accordingly, no intervention other than the construction of housing took place in the settlements studied during the period of analysis.

levels of soil and water contamination, and overcrowding. Typical houses are rudimentary units constructed from discarded materials, such as cardboard, tin and plastic, and have dirt floors.

TECHO houses are 18 square meters (6m by 3m) in size. The walls are made of pre-fabricated, insulated pinewood panels or aluminum, and the roofs are made of tin and are designed to keep occupants warm and to protect them from humidity, insects and rain. The floors are raised between 30 and 80 cm off the ground to reduce dampness and to protect the occupants from floods and infestations. Although these houses are a major improvement over the recipients' previous housing, the facilities are limited in that they do not include bathrooms or kitchens or amenities such as plumbing, drinking water hook-ups, or gas connections. The cost of a TECHO house is less than US$1,000 – with the bulk of the cost being the acquisition, storage and transportation of the materials, since there are essentially no labor costs; the beneficiary family pays 10% of the cost. In El Salvador, US$100 is approximately equivalent to 3.3 months' per capita baseline earnings, while in Mexico and Uruguay, it is roughly equivalent to 1.6 and 1.4 months of baseline earnings, respectively. Figure 1 shows examples of TECHO houses.

Figure 1. TECHO houses.



El Salvador | Uruguay and Mexico

TECHO budget constraints limit the number of housing units that can be built at any one time.[9] Under these constraints, TECHO opted to select beneficiaries by means of a lottery system that gives all eligible households within a pre-determined geographical neighborhood an equal opportunity to receive one of the units. TECHO first selected a set of eligible settlements and then conducted a

[9] This also constrained the size of the sample used in our study in each country.

census to identify eligible households within each settlement.[10] The eligible households were then surveyed (baseline survey) and randomly assigned to treatment and control groups within each settlement.[11, 12] In general, the number of treatments represents a small portion of all the households in the settlement. For example, in around 40% of the settlements, less than 10% of the households were treated, and the proportion of treated households exceeded 50% of the slum population in only 8% of the settlements. In order to obtain accurate information from the households and to avoid creating any desirability bias in the treatment group, the data collection work was separated from the implementation of the intervention by contracting a highly respected survey firm in each country. The enumerators told the interviewees that they were collecting data for a study on living conditions and did not make any reference to TECHO verbally or in writing. After randomization, treatment households were told about the program and its requirements by TECHO officials. Some of them accepted the program and some rejected it. Note that control households were not told that they would receive the benefits provided by the program in the future, so their behavior should not have been affected by the expectation of being treated in the next round, although they may have felt frustrated when they realized that they had lost the lottery (we will come back to this later in Section 6).

Since TECHO did not have the capacity to work in all settlements at the same time, the program was rolled out in each country in two phases at the settlement level. Baseline surveys were conducted approximately one month before the start of the construction work in each settlement, which gave households time to acquire the funds to make the 10% contribution required by the program, while the follow-up surveys were conducted simultaneously for all settlements for both phases in each country (see Table 1). This process generated variations in the amount of time that beneficiaries had occupied the house at the time of the follow-up survey. Phase I settlements had 24 months of

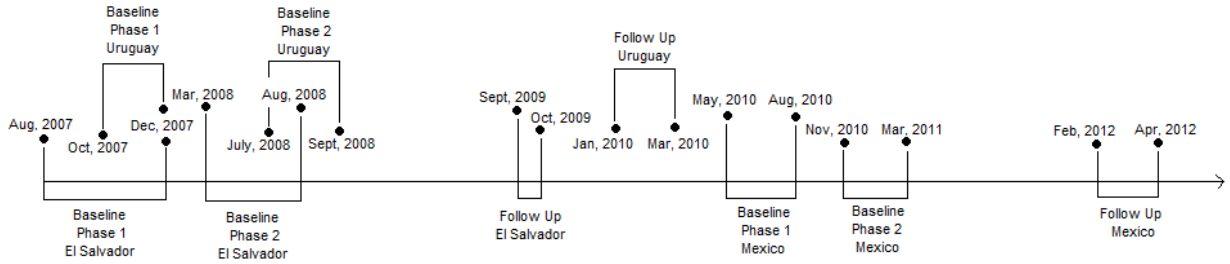
[10] Eligible settlements were those where: (i) at least 50% of the residents do not have title to the land that they occupy and/or (ii) the slum lacks access to at least one of the following three basic services: electricity, drinking water and sanitation. Settlements where TECHO had worked in the past were considered ineligible and were not part of the evaluation. In El Salvador, we first randomly selected states, then randomly selected municipalities within each selected state, and then TECHO did a census of eligible settlements within each selected municipality. In the case of Mexico, we first randomly selected municipalities within Estado de Mexico, and then TECHO did a census of slums within each selected municipality. Finally, in the case of Uruguay, since TECHO had already worked in most of the settlements in Montevideo and Canelones departments, the sampling was non-random and based on a census of settlements where the program had not been implemented in the past. See the Appendix, Figure A1, for a map of regions where the settlements included in the study are located in each country.

[11] In El Salvador and Uruguay, some settlements were randomly assigned a higher intensity-of-treatment level. However, since the number of clusters (settlements) was small, we do not exploit this feature to any significant extent in our analysis.

[12] Within each settlement, every household had the same probability of being chosen for inclusion in the intention-to-treat group, but this was not necessarily the case across settlements.

exposure, on average, while Phase II settlements had an average of 16 months of exposure, for a difference of 8 months, on average. Figure 2 shows the timeline of the surveys in each country.

Figure 2. Timeline



Our sample includes a total of 74 settlements, of which 29 were in Phase I and 45 were in Phase II. The total number of eligible households in these settlements was 2,373. Treatment was offered to 57% of the households, and over 85% of those households actually received a new house (see Galiani et al., 2015). The remaining 15% that were assigned to treatment could not afford the required 10% co-payment and hence did not receive a house. The compliance rate with the treatment is balanced across phases.

Attrition rates between baseline and follow-up amounted to 6% of the households in the assigned-to-treatment group and 7% of those in the control group, with most of the attriters being households whose members moved out of the slum and could not be reached in their new locations. This difference is not statistically significant at conventional levels (see Table 2). The difference between the attrition rates of the assigned-to-treatment and control groups within each phase was not statistically significant either. Finally, the attrition rates are also balanced across phases.

Under randomization, the outcomes of the assigned-to-treatment and control groups should be equal, on average, prior to treatment. Galiani et al. (2015) tested for the null hypothesis of no difference between the groups for a large set of variables measured at baseline which included socioeconomic characteristics, housing characteristics, assets, satisfaction with quality of housing and life, perception of security, education and health. The analysis indicates that there was a statistically significant difference between groups for only 4 out of 44 variables at conventional levels, which is about what

would be expected to occur by chance. The test results also show that the samples were balanced in each of the countries, as was the sample when pooled across all the countries.

4. Measurement

We measure subjective well-being with respect to housing quality and overall quality of life using self-reported Likert-scale measures. The measures are based on responses to the following question, each part of which highlights the specific attribute to be evaluated: "How satisfied are you with… (i) the quality of your floor; (ii) the quality of your walls; (iii) the quality of your roof; (iv) the protection of your house against water when it rains; and (v) the quality of your life. Would you say you are "Unsatisfied", "Neither Satisfied nor Unsatisfied", Satisfied", or "Very Satisfied"? These measures have been used extensively to measure general life satisfaction, to arrive at assessments of how people believe their lives are going and, increasingly, to assess the impact of social programs and public policy (Dolan, Layard and Metcalfe (2011).

The possibility of constructing a happiness metric is based on research that demonstrates that people have a common understanding of happiness and that numerical measures are effective in capturing those feelings. For example, van Praag (1991) reports that people are able to translate numerical happiness indicators into verbal labels, and Diener and Lucas (1999) show that people are able to predict the happiness levels of others.

Our metric allows 4 response points for relative happiness. Jacoby and Matell (1971) and Lehmann and James (1972) report that three-point scales do well when the focus is on group averages. Andrews and Withey (1976) find that three-point response scales capture 80%-90% of the variation captured by seven-point scales for the U.S. Finally, Alwin (1992) shows that there are diminishing returns after three-point scales to additional response options on happiness scales.

One issue that arises with respect to Likert-scale measures is how to best summarize the responses into a single indicator. A simple sum requires us to assume cardinality, i.e., that responses to the happiness question fall on a linear scale. One concern is that different individuals may have different utility reference points for each of the thresholds. As Ludwig et al. (2012) notes, however, in randomized experiments such as ours, even if respondents use different thresholds to map the response categories for happiness into utility, this is not a problem so long as the TECHO treatment

itself did not affect the happiness thresholds. In this case, the distribution of happiness thresholds would be the same across experimental groups by virtue of random assignment.

With these issues in mind we construct two different measures. The first, our primary measure, is a simple dummy variable that equals 1 if the respondent reports that s/he is satisfied or very satisfied, and 0 otherwise. This measure minimizes the potential problem with cardinality, but discards variation. As a robustness check, we follow Kling et al. (2007) and Ludwig et al. (2012) to construct a standardized measure using all the values from the satisfaction scale. Specifically, we use the full four-point indicator as a continuous measure and standardize it for each settlement using the mean and standard deviations for the control group of that settlement. The standardization procedure is based on the assumption that respondents have common views of how the thresholds map into utility within settlements but allows for them to vary by settlement. This second measure also has the virtue of enabling us to interpret the estimated effects in terms of standard deviations of subjective well-being and to compare the order of magnitude of the effects to those found in other studies.

5. Identification Strategy

We report estimates of intention-to-treat effects by time of exposure (phase) for:

$$Y_{ij} = \alpha + \gamma_1 Treat_{ij} + \gamma_2 Treat_{ij} \times PhaseI_j + \beta X_{ij} + \mu_j + \varepsilon_{ij} \qquad (1)$$

where Y_{ij} is the subjective well-being of household i living in settlement j; $Treat_{ij}$ is a dummy variable equal to 1 if family i in settlement j was offered a TECHO house and 0 otherwise; $PhaseI_j$ is a dummy variable equal to 1 if settlement j was treated in phase I and 0 otherwise; X_{ij} is a vector of household characteristics measured at baseline; μ_j is a settlement fixed effect; and ε_{ij} is the error term.[13]

The settlement fixed effects capture the average unobservable differences across settlements (and hence countries). This is important, since randomization was conducted within each settlement. One point that is of particular importance is that settlement fixed effects also control for differences in the reference points for subjective well-being, which may vary geographically. Controlling for settlement

[13] As we explained in the last section, our subjective well-being measures can take the form of a binary outcome (limited dependent variable (LDV)) or a continuous outcome (z-scores). The problem posed by causal inference with LDVs is not fundamentally different from the problem of causal inference with continuous outcomes. If there are no covariates or the covariates are sparse and discrete, linear models are no less appropriate for LDVs than for other types of dependent variables. This is certainly the case in a randomized control trial where controls are included only in order to improve efficiency but their omission would not bias the estimates of the parameters of interest.

fixed effects, we assume that the error terms are independent and thus report only robust standard errors.[14]

The parameters of interest are γ_1, the treatment effect for Phase II (short-exposure) households; $\gamma_1 + \gamma_2$, the treatment effect for Phase I (long-exposure) households; and γ_2, the degree of hedonic adaptation – i.e., the difference in the treatment effect between Phase I (long exposure) and Phase II (short exposure). A negative γ_2 is consistent with at least partial hedonic adaptation. If γ_2 fully offsets γ_1, then we have full or complete hedonic adaptation, i.e., subjective well-being returns to its reference level.

Our identification strategy is two-fold. First, random assignment of treatment status guarantees treatment exogeneity, both overall and within phases, and thus provides the identification for both γ_1 and γ_2. Galiani et al. (2015) demonstrate that the overall sample was balanced over a large number of characteristics, and in Table 3 we further show that the samples are balanced within phases.

Second, a negative and significant γ_2 can be interpreted as evidence of hedonic adaptation only if the samples in both phases started from the same level of subjective well-being. This would be the case if the allocation of settlements to phases in each country were orthogonal to their characteristics. Indeed, even though the time of exposure to the treatment was not randomly assigned, we cannot reject the null hypothesis of no differences in baseline subjective well-being outcomes and covariates between Phase I and Phase II settlements (see Table 3). In particular, these results show that populations from Phases I and II were statistically comparable before treatment, thereby lending credibility to our interpretation of γ_2 as a measure of hedonic adaptation. Note that pre-treatment measures are also statistically balanced across intention-to-treat groups within each phase. Hence, potential time effects are controlled for by our experimental design.

[14] As long as the phasing design of the intervention is given at settlement level, then there is no within-settlement variation in phase. Thus, controlling for phase effects makes no sense, since phase and settlement fixed effects span the same subspace.

6. Results

We report the results of estimating equation (1) for two different specifications – one with and one without a set of control variables – and for both ways of constructing the dependent variables.[15,16] The dependent variable in all models is the indicator of satisfaction. We first estimate specifications 1 and 2 for limited dependent variables and then, as a robustness check, we replicate the exercise using z-score measures of satisfaction. The specific control variables included in the second specification are listed in the notes to Table 4. This table presents estimates of γ_1 and γ_2 on satisfaction with the housing unit (satisfaction with floor quality, satisfaction with wall quality, satisfaction with roof quality and satisfaction with the protection afforded by the house when it rains) as well as with an overall self-reported measure of quality of life. In each model, we also report the p-statistic for an F-test of the null hypothesis of full hedonic adaptation to the TECHO house ($\gamma_1 + \gamma_2 = 0$).

First of all, treatment substantially increased the subjective well-being of beneficiaries in Phase II (short exposure) as indicated by the estimated γ_1 (Table 4). They are happier with their houses and with their lives once they have received their TECHO houses.[17] This is systematic for all self-reported measures of satisfaction and is robust across models. Using the indicator-dependent variable, satisfaction with housing quality increased by between 54% and 97%, and gains in the households' overall subjective well-being amounted to increases of about 40%. This smaller effect on satisfaction with quality of life compared to the larger effects on satisfaction with housing quality is not surprising, as housing is only part of what determines quality of life.

Adaptation: The initial gains in subjective well-being afforded by the treatment do not appear to be fully sustained over time, as indicated by the negative estimates of γ_2. The treatment effect on satisfaction with quality of life is 60% lower in households treated in Phase I than it is in those treated in Phase II.[18] However, we reject the null hypothesis of full adaptation in satisfaction with quality of

[15] Table A1 provides a detailed definition and sample size for each variable considered in this study.
[16] The statistical inference of our results is robust to clustering the standard errors at the settlement level since rejection decisions of the null hypothesis remain the same at conventional levels of statistical significance. This result lends credibility to our assumption that the settlement fixed effect captures the systematic unobserved differences across slums. These results are available upon request.
[17] In order to interpret these results more accurately, it is important to note that, for all the outcome variables considered in this study, there was no instance in which the average outcome for the control group decreased between the baseline and follow-up measures, which suggests that, if there was any frustration effect among lottery losers, it was not reflected in their reports of subjective well-being.
[18] Due to a problem with data collection in the follow-up survey in El Salvador, the non-response to this question was differentially greater for the control group. Thus, to be on the safe side, we randomly impute a value equal to 3 ("Satisfied

life. After eight months of additional exposure to the treatment, on average, TECHO beneficiaries partially adapted but were still happier compared to the reference level for no treatment. With respect to satisfaction with housing quality (floor, roof, walls and protection from rain), we find overall positive effects that decrease from short to long exposure by between 41% and 55%. Again, the results are consistent with partial but not full hedonic adaptation.[19, 20]

The results for satisfaction with quality of life and with various aspects of the quality of housing are displayed in Figure 3. For each variable, the first bar represents the mean level of satisfaction for the control group measured at follow-up. The next bar represents the mean level of satisfaction of the treatment group measured 16 months after construction, on average. It is computed as the mean of the control group plus the treatment effect for the Phase II group. Finally, the last bar represents the mean level of satisfaction of the treatment group 24 months after construction and is estimated as the mean of the control group plus the treatment effect for the Phase I group. The difference between the first bar and the second bar is the treatment effect on subjective well-being for the Phase II group, and the difference between the second and third bar is the extent of hedonic adaptation. While the third bar is lower than the second bar in all outcomes, it is still higher than the first bar, which is consistent with partial but not total adaptation.

Multiple Outcomes: Statistical Inference. In studies with multiple outcomes, a few statistically significant effects may emerge simply by chance. The larger the number of tests, the greater the likelihood of a type I error. We reduce the risk of false positives deriving from an examination of large numbers of individual outcomes by using Bonferroni Family-Wise Error Rates (FWER) to adjust the *p*-values of the individual tests as a function of the number of outcome variables. We compute Bonferroni FWER

with quality of life") to 84 missing values in the control group observations, which reduces the non-response rate for this variable from 43% to 7% (the same level as recorded for the intention-to-treat group). Without performing this imputation, γ_1 and γ_2 are 0.261 and -0.165, respectively, for Model 1 and are 0.262 and -0.165, respectively, for Model 2.

[19] Though one could always worry about a "priming" effect on subjective well-being questions, that is less of a concern here, since we find large differences in all measures of satisfaction with the house rather than only in satisfaction with quality of life, which could have been subject to priming. More importantly, this should not be an issue in testing the hedonic adaptation hypothesis, since both experimental groups were asked the same questions in the same order.

[20] As we mentioned earlier, linear models assume cardinality, i.e., that the difference in happiness between, for example, a ranking of 2 and one of 3 for any individual is the same as between a ranking of 3 and one of 4 for any other individual. Hence, as a robustness check, we relaxed this assumption and re-estimated equation (1) using an ordered probit model, with the results being qualitatively the same. The probability of a household being in the highest satisfaction category always increases with treatment in the second phase (γ_1 positive), and the difference across phases is positive for phase 2 (γ_2 negative); likewise, the probability of a household being in the lowest satisfaction category always decreases with treatment in the second phase (γ_1 negative), and the difference across phases is negative for phase 2 (γ_2 positive). See the Appendix, Tables A2 and A3.

corrections at the 10% level of statistical significance by dividing the desired size of the test by the number of satisfaction variables (5 in total). Hence, the Bonferroni corrected for a multiple-outcomes *p*-value is 0.02 for a significance level of 0.10. As can be observed in Table 4, all the results remain significant under this stringent test except the adaptation effect on satisfaction with quality of floors.

Country Specific Estimates. In Table 5, we report the estimates separately by country. The estimated magnitudes of the short-run effect on subjective well-being, γ_1, are statistically significant for all three countries and are the same magnitudes for El Salvador and Mexico. The effect size for Uruguay is half of what it is for the other two countries. The hedonic adaptation effect, γ_2, is consistent across countries but is only statistically significant for Mexico, most likely owing to the smaller size of the sample. The magnitudes of the estimates for the γ_2 parameters are about the same relative to the estimated γ_1 parameters in all three countries, which is consistent with the finding that the degree of hedonic adaptation is the same for all three countries. In addition, we cannot reject the null hypothesis that the estimated coefficients are jointly equal for all countries (see the p-value for the F-Test for the pooling of countries). The evidence is robust across models, which lends credibility to the external validity of the results.

Standardized Measure of Subjective Well-Being: Our analysis thus far has considered a binary state of satisfaction, which ignores substantial variance in the outcomes. As described above, we repeated the exercise using the formation of the dependent variable proposed in Kling et al. (2007) and Ludwig et al. (2012). Specifically, we constructed standardized satisfaction outcomes, as well as a summary index of subjective well-being. The summary index is computed as the sum of standardized satisfaction variables (with the sign of each measure oriented so that more beneficial outcomes have higher scores) divided by the number of satisfaction variables. This summary index aggregates information across related outcomes and is useful both as a summary statistic and possibly as a means of augmenting the statistical power to detect effects of the intervention that are consistent across groups of outcomes.

First, as shown in Table 6, treatment substantially increased the subjective well-being of the short-exposure beneficiaries (γ_1), which is consistent with the results presented for binary outcomes. While the beneficiaries' satisfaction with housing quality increases by between 0.56 and 0.81 standard deviations, gains in their general subjective well-being are about 0.48 standard deviations relative to the control group.

In terms of adaptation (γ_2), we find that the treatment effect on satisfaction with quality of life is around 50% lower in households treated in Phase I than in those treated in Phase II; this is about the same extent of the adaptation effect found using a binary life satisfaction measure. With respect to satisfaction with housing quality (floor, roof, walls and protection from rain), we find overall positive effects from treatment that decrease from short to long exposure by a proportion similar to that detected for the adaptation effects found using binary satisfaction measures.

Finally, all the estimated effects except those for satisfaction with the quality of floors remain significant after adjusting the *p*-values for multiple outcomes, which rules out the presence of false positives in our analysis. Indeed, based on our summary index of satisfaction, we find that, after 16 months of exposure to the TECHO program, beneficiaries' satisfaction with their housing and life increased by 0.66 standard deviations but that 47% of that gain had disappeared eight months later.

Effect Size in Context: The estimated effect on subjective well-being is large even accounting for hedonic adaptation. Using baseline data, the effect size in the long-run (0.25 standard deviations) is equivalent to six times the average difference in subjective well-being between households whose incomes are above (0.24) and below the median (0.20) in Phase I (long exposure). The effect size is also equal to the difference in subjective well-being between non-beneficiary slum dwellers whose monthly income per capita differs by around US$125 – a huge effect given that the average monthly income per capita in the control group at baseline is US$55. In other words, the effect on subjective well-being is roughly equivalent to quadruplicate the average monthly per capita income. Considering that beneficiary households invested US$100 as a co-payment to obtain the TECHO house (worth about US$1,000), then, on average, their return on the housing investment was around 100% in terms of subjective well-being – in other words, around two times as much as their baseline average income yielded a subjective well-being equivalent to the level of subjective well-being that they would obtain if they earned four times as much as their baseline income.

An advantage of the standardized measure is that it also allows us to compare the order of magnitude of the effects with those found in other studies. Using standardized data on general subjective well-being from the World Values Surveys in El Salvador (1999), Uruguay (2011) and Mexico (2012), our estimated effect is somewhat higher than the difference in average subjective well-being of those who completed the tertiary level of education and those who just completed elementary education – a huge effect considering that the control group in our study had 3.9 years of schooling, on average, at

baseline. The effect size is also equivalent to the difference in subjective well-being between individuals who report being in the eighth decile (third richest) and those who report being in the third decile (third poorest) of the income distribution.[21]

7. Alternative Interpretations

Housing Quality: One concern regarding our interpretation of the results is that housing quality may have deteriorated over time. In this case, γ_2 could represent a decline in satisfaction due to reduced housing quality rather than hedonic adaptation. We test for this possibility by estimating equation (1) for various measures of housing quality. In general, the results reported in Table 7 show a large and significant increase in the housing quality of the TECHO houses (γ_1), but no difference in housing quality between Phase I and Phase II (γ_2).

Material Well-being: A second concern regarding our interpretation of the results is that income and wealth may have deteriorated over time. In this case, γ_2 could represent a decline in satisfaction due to reduced material well-being rather than hedonic adaptation. We test for this possibility by estimating equation (1) for various measures of material well-being, including assets, income and labor-force participation. In general, the results reported in Table 8 show no difference between treatment and control groups in Phase II (γ_1), and no difference in the treatment effect across phases (γ_2).

Relative Status Effects: Finally, Clark, Frijters and Shields (2008b) and Di Tella, Haisken-De New and MacCulloch (2010) hypothesize that if people only care about their relative position or "status", then the dissipation of income effects on happiness would be explained by relative position effects to which individuals do not adapt. In this case, increasing levels of income would not buy happiness unless higher incomes generate positive changes in a person's relative position.

We examine whether the dissipation of satisfaction gains can be explained through relative status effects by testing for heterogeneous effects of housing improvements on hedonic adaptation across high versus low socio-economic status (SES) groups. Since all beneficiaries received the same kind of house, we hypothesize that the lower-income beneficiaries within a slum increased their wealth proportionally more than their richer counterparts, in which case differences in the adaptation effects

[21] The subjective well-being measure taken from the World Values Survey (WVS) consists of a four-point response scale to the question: "Taking all things together, would you say you are very happy, happy, not very happy, not happy at all?". While TECHO's subjective well-being question also includes a four-point response scale, TECHO's phrasing and scale responses are not exactly the same as those of the WVS survey, which implies that there may be differences in cardinality across the surveys' subjective well-being questions. Therefore, these results should be interpreted cautiously.

across SES groups may be indicative of the presence of relative status effects. To look more closely at this possibility, we extend model (1) and estimate the following linear probability model:

$$Y_{ij} = \alpha + \gamma_1 Treat_{ij} + \gamma_2 Treat_{ij} \times PhaseI_j + \gamma_3 Treat_{ij} \times HighStatus_{ij} + \gamma_4 Treat_{ij} \times HighStatus_{ij} \times PhaseI_j + \gamma_5 HighStatus + \beta X_{ij} + \mu_j + \varepsilon_{ij} \quad (2)$$

The parameters of interest are γ_3, the relative treatment effect for high-status Phase II (short exposure) households with respect to their low-status counterparts; $\gamma_3 + \gamma_4$, the relative treatment effect for high-status Phase I (long exposure) households with respect to their low-status counterparts; and γ_4, the relative degree of hedonic adaptation for high-status households with respect to households with a low status within the settlement – i.e., the relative difference in the treatment effect between Phase I (long exposure) and Phase II (short exposure) across high- and low- status groups. A negative γ_4 is consistent with a relative differential in hedonic adaptation in favor of the low-status group. In other words, low-status households (those that increased their wealth proportionally more and thus are more likely to improve their relative position within the slum) adapt less than high-status counterparts do, with the difference in the patterns of adaptation across SES groups explained by the larger relative positional changes experienced by low-status households as compared to their high-status counterparts.

We use two different measures of SES. First, we construct a summary index of housing quality of a number of housing quality measures (see Table A1). We first standardize each outcome variable by subtracting the mean value of the control group in the settlement and by dividing by its standard deviation. The summary index is then computed as the sum of standardized outcome variables in the group with the sign of each measure oriented so that more beneficial outcomes have higher scores divided by the number of outcome variables. Then, households with a positive z-score summary index are considered to have a high status of housing, and accordingly, those with a zero or negative z-score are considered to have a low status. Second, we use income status where households with a monthly income per capita above the within-settlement median income were classified as high-income status and those below that median were classified as low-income status.

As shown in Tables 10 and 11, there is no evidence that higher status measured either by housing quality or income play any role in the hedonic adaptation of beneficiary households. Overall, both

high and low status households hedonically adapt at the same pace to the housing improvements over time and we cannot reject the null hypothesis of no differences in hedonic adaptation across them.

8. Conclusion

A fundamental question in economics is whether happiness increases *pari passu* with material conditions or whether people grow accustomed to better conditions over time. Previous research has tested these ideas in high-income countries where most residents have already met their basic needs and hedonic adaptation is likely to be the strongest. In contrast, we test these ideas in the slums of three low-income countries where adaptation is less likely to occur.

Specifically, we use data from a large-scale, multi-country field experiment to examine what kind of impact the provision of housing to extremely poor slum dwellers in Latin America has on subjective well-being and to test whether poor populations display hedonic adaptation to the happiness derived from reducing the shortfall in the satisfaction of their basic need for housing. To the best of our knowledge, we are the first to test the hypothesis of hedonic adaptation to a change in the level of satisfaction of basic necessities among poor populations.

Our results are conclusive. We find that subjective perceptions of well-being are substantially higher after 16 months for recipients of improved TECHO housing but that after, on average, another eight months, 60% of that gain disappears. What it is more, our results are consistent across different satisfaction indicators, from satisfaction with quality of life to satisfaction with quality of housing characteristics. Thus, we conclude that hedonic adaptation, at least to a partial degree, is a common human trait that is present even among poor populations that experience a major improvement in the level of satisfaction of their basic necessities. Our results are consistent with the theoretical work of Pollak (1970), Wathieu (2004), Rayo and Becker (2007), and Graham and Oswald (2010).

Interestingly, Ludwig et al. (2012) measure the long-run effects of the randomly assigned MTO program on subjective well-being and find that after the program had been in effect for 10 to 15 years, a one standard deviation decline in neighborhood poverty (13 percentage points) increased the subjective well-being of MTO beneficiaries by an amount equal to two thirds of the gap in subjective well-being between U.S. blacks and whites, or equivalent to the gap between people whose per capita incomes differ by around US$250 per month –a large effect given that the annual income of the control group in that study is around US$400 per capita per month. Note, however, that the effect of

the MTO program on subjective well-being is roughly equivalent to a 60% increase in the per capita monthly income of an average household, which is a proportionally smaller effect than that of the TECHO intervention, even after considering an adaptation effect of 50%. While the populations and treatment exposures across studies are not totally comparable (subjective well-being measures are relatively similar across samples, but TECHO beneficiaries are much poorer than their MTO counterparts), what this evidence suggests is that even though poor populations in developing countries exhibit hedonic adaptation in their satisfaction of basic housing needs, improvements in the housing and neighborhood conditions of poor households seems to have a greater effect in developing countries than in developed ones.

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Table 1. Length of Treatment Exposure and Sample Sizes

	Phase I Construction	Phase II Construction	Combined
El Salvador			
Average Exposure	25 months	17 months	
Household Sample Size	288	368	656
Number of Settlements	8	15	23
Uruguay			
Average Exposure	27 months	17 months	
Household Sample Size	353	375	728
Number of Settlements	6	6	12
Mexico			
Average Exposure	20 months	15 months	
Household Sample Size	286	540	826
Number of Settlements	15	24	39
All Countries			
Average Exposure	24 months	16 months	
Household Sample Size	927	1,283	2,210
Number of Settlements	29	45	74

Table 2: Sample Size, Attrition and Compliance

	Phase I			Phase II			Combined Phases I and II			Phase I vs Phase II		
	Treat.	Control	Diff.	Treat.	Control	Diff.	Treat.	Control	Diff.	Phase I	Phase II	Diff.
Number of Households												
Baseline	653	342		703	675		1,356	1,017		995	1,378	
Follow-Up	611	316		658	625		1,269	941		927	1,283	
Attrition Rate	0.07 (0.01)	0.08 (0.01)	-0.01 (0.02)	0.06 (0.01)	0.07 (0.01)	-0.01 (0.01)	0.06 (0.01)	0.07 (0.01)	-0.01 (0.01)	0.07 (0.01)	0.07 (0.01)	0.00 (0.01)
Compliance With Treatment/Control Assignment												
Compliance Rate	0.88	0.99		0.86	1.00		0.87	1.00		0.92	0.93	

Table 3: Baseline Balance Within and Between Phases

	Phase I			Phase II			Phase I vs Phase II		
	Treat.	Control	Diff.	Treat.	Control	Diff.	Phase I	Phase II	Diff.
Satisfaction with Floor Quality	0.19	0.21	0.01	0.25	0.27	0.01	0.20	0.26	-0.06
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	[0.02]	[0.04]	[0.04]
Satisfaction with Wall Quality	0.15	0.18	-0.02	0.16	0.16	0.02	0.16	0.16	-0.01
	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	[0.02]	[0.02]	[0.03]
Satisfaction with Roof Quality	0.17	0.20	-0.02	0.16	0.17	0.02	0.18	0.16	0.01
	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	[0.02]	[0.02]	[0.03]
Satisfaction with Rain Protection	0.15	0.18	-0.01	0.15	0.14	0.03	0.17	0.14	0.02
	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	[0.02]	[0.02]	[0.03]
Satisfaction with Quality of Life	0.28	0.25	0.02	0.28	0.27	0.01	0.27	0.27	0.00
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	[0.02]	[0.03]	[0.03]
Assets Per Capita	58.54	49.38	-0.16	45.25	42.13	-0.92	48.75	45.23	3.52
	(6.50)	(4.33)	(9.02)	(2.92)	(2.57)	(3.97)	[4.93]	[2.98]	[5.71]
Monthly Income Per Capita	59.85	49.45	-8.61	58.74	52.86	-5.08	53.08	55.77	-2.69
	(4.29)	(2.63)	(5.99)	(2.94)	(2.54)	(4.32)	[4.01]	[4.27]	[5.82]
Head of Household's Years of Schooling	4.09	4.34	-0.01	4.37	3.87	0.26	4.18	4.13	0.05
	(0.14)	(0.20)	(0.21)	(0.12)	(0.12)	(0.17)	[0.52]	[0.29]	[0.59]
Head of Household is Male	0.69	0.69	-0.01	0.69	0.71	0.00	0.69	0.70	-0.01
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	[0.04]	[0.03]	[0.05]
Head of Household's Age	42.09	41.33	0.52	41.20	40.73	1.01	41.83	40.97	0.86
	(0.63)	(0.77)	(1.07)	(0.59)	(0.61)	(0.87)	[0.95]	[0.70]	[1.17]

Note: This table reports baseline means and differences in means of the sample. For the Phase I and Phase II columns, differences in means are estimated by regressions that include settlement fixed effects, and robust standard errors are reported in parentheses. For the Phase I vs Phase II columns, standard errors clustered at the settlement level are reported in brackets. In the case of monetary variables, observations over the 99th percentile were excluded. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 4: Hedonic Adaptation in Satisfaction with Quality of Life and Housing Characteristics
(Dependent variable = 1 if satisfied or very satisfied and zero otherwise)

	Mean Control Group	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase I
		γ_1	γ_2	γ_1	γ_2
Satisfaction with Quality of Life	0.53	0.20 (0.03)***	-0.12 (0.05)***	0.20 (0.03)***	-0.12 (0.05)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.04		0.04	
Satisfaction with Floor Quality	0.37	0.20 (0.03)***	-0.05 (0.05)	0.20 (0.03)***	-0.05 (0.05)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Wall Quality	0.30	0.29 (0.03)***	-0.16 (0.05)***	0.29 (0.03)***	-0.16 (0.05)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Roof Quality	0.32	0.29 (0.03)***	-0.12 (0.05)***	0.29 (0.03)***	-0.12 (0.05)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Rain Protection	0.29	0.25 (0.03)***	-0.12 (0.05)***	0.25 (0.03)***	-0.13 (0.05)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	

Note: Each row represents a separate dependent variable. The dependent variable is an indicator equal to 1 if the respondent reports being "satisfied" or "very satisfied" and zero otherwise. The first column reports the mean of the dependent variable for the control group measures at follow-up. The next two columns, under the heading Model 1, report the results of a regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated coefficients and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the *p*-values of the F-tests of the null hypothesis that the estimated coefficient on treatment + the estimated coefficient on treatment × Phase I = 0 for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%. The Bonferroni corrected for multiple outcomes *p*-value is 0.02, for a significance level of 0.10.

Table 5: Hedonic Adaption in Satisfaction with Quality of Life, by Country
(Dependent variable = 1 if satisfied or very satisfied and zero otherwise)

	Sample Size	Mean Control Group	Model 1		Model 2	
			Treatment	Treatment × Phase I	Treatment	Treatment × Phase I
			γ_1	γ_2	γ_1	γ_2
El Salvador	606	0.51	0.25 (0.05)***	-0.13 (0.10)	0.25 (0.06)***	-0.13 (0.10)
Uruguay	715	0.45	0.13 (0.05)**	-0.07 (0.08)	0.13 (0.05)**	-0.07 (0.08)
Mexico	822	0.60	0.22 (0.04)***	-0.14 (0.07)**	0.22 (0.04)***	-0.14 (0.07)**
All Countries	2,143	0.53	0.20 (0.03)***	-0.12 (0.05)***	0.20 (0.03)***	-0.12 (0.05)***
p-value for F-test of Pooling Countries			0.54		0.50	

Note: Each row represent a different country. The dependent variable is an indicator equal to 1 if the respondent reports being "satisfied" or "very satisfied" and zero otherwise. The second and third columns report the sample size and the mean of the dependent variable for the control group at follow-up. The next two columns, under the heading of Model 1, report the results of a regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated coefficients and robust standard errors. The last two columns, under the heading of Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the *p*-values of F-tests of the null hypothesis that the estimated coefficients on treatment and the estimated coefficient on treatment × Phase I are jointly equal to all countries for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 6: Hedonic Adaptation in Satisfaction with Quality of Life and Housing
(Dependent variable = satisfaction Z-score)

	Mean Control Group	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase I
		γ_1	γ_2	γ_1	γ_2
Satisfaction with Quality of Life	0.00	0.48 (0.06)***	-0.23 (0.09)**	0.48 (0.06)***	-0.23 (0.09)**
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Floor Quality	0.00	0.56 (0.06)***	-0.17 (0.10)*	0.56 (0.06)***	-0.17 (0.10)*
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Wall Quality	0.00	0.81 (0.07)***	-0.47 (0.11)***	0.81 (0.07)***	-0.48 (0.11)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Roof Quality	0.00	0.74 (0.06)***	-0.30 (0.10)***	0.75 (0.06)***	-0.31 (0.10)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction with Rain Protection	0.00	0.69 (0.06)***	-0.35 (0.10)***	0.70 (0.07)***	-0.36 (0.10)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Satisfaction Summary Index	0.00	0.66 (0.05)***	-0.31 (0.08)***	0.66 (0.05)***	-0.31 (0.08)***
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	

Note: Each row represents a separate dependent variable. Satisfaction measures are z-scores, standardized by the control group mean and standard deviation within each settlement. The satisfaction summary index is defined as the average of the z-scores of all the variables in the table, with the sign of each measure oriented so that the more beneficial outcomes have higher scores. The first column reports the mean of the dependent variable for the control group measures at follow-up. The next two columns, under the heading Model 1, report the results of a regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated coefficients and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the *p*-values of F-tests of the null hypothesis that the estimated coefficient on treatment + the estimated coefficient on treatment × Phase I = 0 for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%. The Bonferroni corrected *p*-value for multiple outcomes is 0.02 for a significance level of 0.10.

Table 7: Adaptation in Housing Quality

	Mean Control Group	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase II
		γ_1	γ_2	γ_1	γ_2
Share of Rooms with Good Quality Floors	0.44	0.18 (0.02)***	-0.01 (0.03)	0.19 (0.02)***	-0.01 (0.03)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Share of Rooms with Good Quality Walls	0.35	0.20 (0.02)***	-0.06 (0.04)*	0.20 (0.02)***	-0.06 (0.04)*
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Share of Rooms with Good Quality Roof	0.43	0.17 (0.02)***	-0.02 (0.03)	0.17 (0.02)***	-0.01 (0.04)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	
Share of Rooms with Windows	0.36	0.18 (0.02)***	-0.02 (0.03)	0.18 (0.02)***	-0.02 (0.03)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.00		0.00	

Note: Each row represents a separate dependent variable. The first column reports the mean of the dependent variable for the control group measures at follow-up. The next two columns, under the heading Model 1, report the results of a regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated coefficients and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the p-values of F-tests of the null hypothesis that the estimated coefficient on treatment + the estimated coefficient on treatment × Phase I = 0 for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 8: Adaptation in Income, Assets and Labor Outcomes

	Mean Control Group	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase II
		γ_1	γ_2	γ_1	γ_2
Assets Value Per Capita	60	-1.21	-1.65	-0.08	-2.80
		(7.89)	(11.53)	(7.77)	(11.27)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.73		0.73	
Monthly Income Per Capita	59	-1.83	1.73	-2.24	1.70
		(4.91)	(7.92)	(4.99)	(7.91)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.99		0.93	
Hours Worked Last Week by Head of Household	40	0.03	1.86	0.28	1.55
		(1.33)	(2.18)	(1.33)	(2.13)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.28		0.27	
Hours Worked Last Week by Spouse	34	-2.27	3.46	-2.08	3.58
		(2.48)	(3.80)	(2.51)	(3.82)
p-value ($\gamma_1 + \gamma_2 = 0$)		0.68		0.60	

Note: Each row represents a separate dependent variable. The first column reports the mean of the dependent variable for the control group measures at follow-up. The next two columns, under the heading Model 1, report the results of a regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated coefficients and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the p-values of F-tests of the null hypothesis that the estimated coefficient on treatment + the estimated coefficient on treatment × Phase I = 0 for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 9: Hedonic Adaptation across Housing Quality Status
(Dependent variable = 1 if satisfied or very satisfied and zero otherwise)

	Mean Control Group High Status	Model 1		Model 2	
		Treatment × High Status	Treatment × High Status × Phase I	Treatment × High Status	Treatment × High Status × Phase I
		γ_3	γ_4	γ_3	γ_4
Satisfaction with Quality of Life	0.55	-0.02	-0.06	-0.02	-0.07
		(0.05)	(0.09)	(0.05)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.27		0.24	
Satisfaction with Floor Quality	0.39	-0.08	0.06	-0.08	0.05
		(0.05)	(0.09)	(0.05)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.78		0.64	
Satisfaction with Wall Quality	0.30	-0.04	0.03	-0.04	0.01
		(0.05)	(0.09)	(0.05)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.88		0.64	
Satisfaction with Roof Quality	0.32	-0.05	0.01	-0.05	0.01
		(0.05)	(0.09)	(0.05)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.60		0.54	
Satisfaction with Rain Protection	0.27	0.01	-0.01	0.05	-0.02
		(0.05)	(0.09)	(0.05)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.97		0.95	

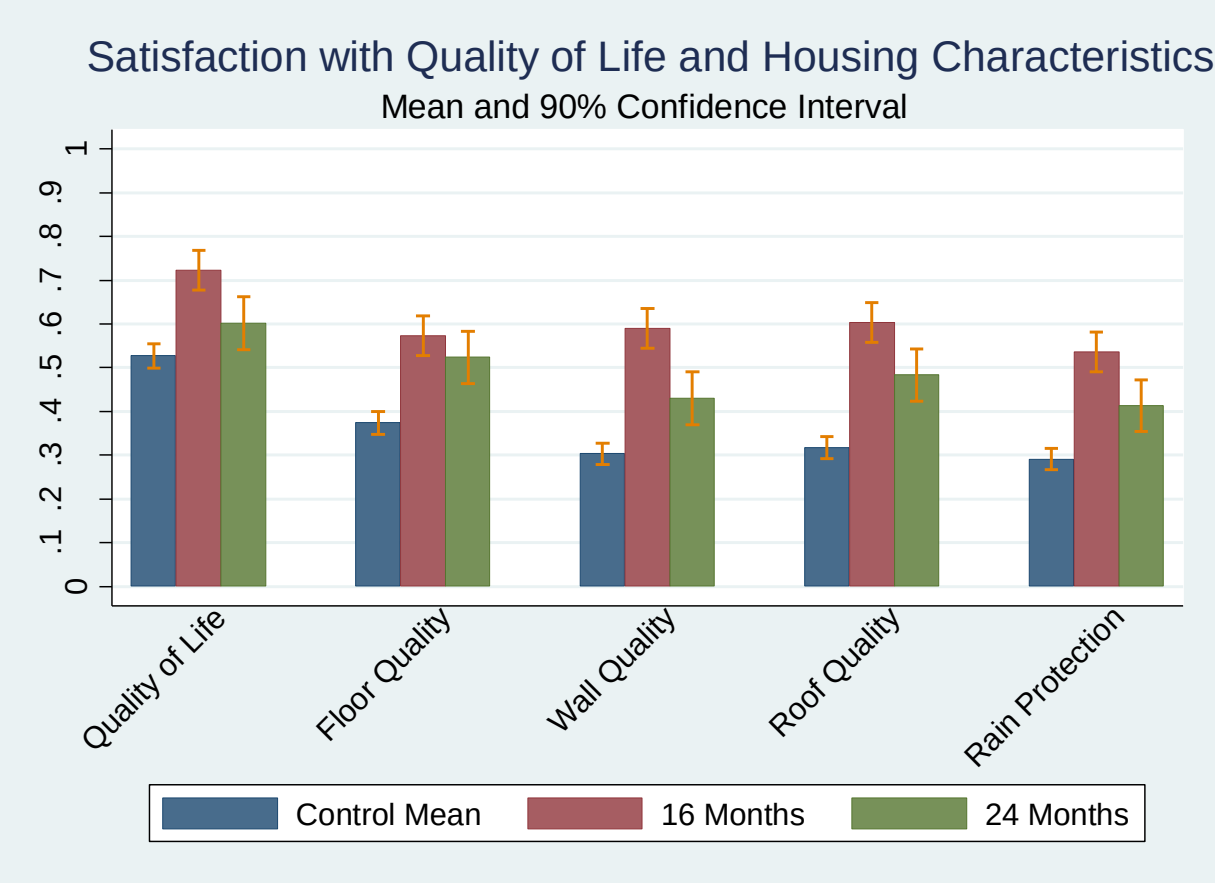
Note: Each row represents a separate dependent variable. The dependent variable is an indicator equal to 1 if the respondent reports being `satisfied" or ``very satisfied" and zero otherwise. High status is a dummy variable that equals one if the (within settlement) normalized z-score on housing quality is positive and zero otherwise. The first column reports the mean of the dependent variable for control households with high status on housing quality measured at follow-up. The next two columns, under the heading Model 1, report the results of estimating $Y_{ij} = \alpha + \gamma_1 Treat_{ij} + \gamma_2 Treat_{ij} \times PhaseI_j + \gamma_3 Treat_{ij} \times HighStatus_{ij} + \gamma_4 Treat_{ij} \times HighStatus_{ij} \times PhaseI_j + \gamma_5 HighStatus_{ij} + \mu_j + \varepsilon_{ij}$. Reports are the estimated coefficients and robust standard errors of γ_3 and γ_4. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the p-values of F-tests of the null hypothesis that $\gamma_3 + \gamma_4 = 0$ for each model. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 10: Hedonic Adaptation by Income Status
(Dependent variable = 1 if satisfied or very satisfied and zero otherwise)

	Mean Control Group High Status	Model 1		Model 2	
		Treatment × High Status	Treatment × High Status × Phase I	Treatment × High Status	Treatment × High Status × Phase I
		γ_3	γ_4	γ_3	γ_4
Satisfaction with Quality of Life	0.51	0.04	0.05	0.03	0.06
		(0.06)	(0.10)	(0.06)	(0.10)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.24		0.23	
Satisfaction with Floor Quality	0.35	0.05	0.06	0.05	0.05
		(0.06)	(0.09)	(0.06)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.17		0.20	
Satisfaction with Wall Quality	0.31	0.02	0.03	0.02	0.03
		(0.06)	(0.09)	(0.06)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.55		0.57	
Satisfaction with Roof Quality	0.30	0.08	-0.05	0.07	-0.04
		(0.06)	(0.09)	(0.06)	(0.09)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.68		0.64	
Satisfaction with Rain Protection	0.26	0.11	-0.11	0.10	-0.10
		(0.06)*	(0.09)	(0.06)*	(0.10)
p-value ($\gamma_3 + \gamma_4 = 0$)		0.93		0.99	

Note: Each row represents a separate dependent variable. The dependent variable is an indicator equal to 1 if the respondent reports being `satisfied" or ``very satisfied" and zero otherwise. High status is a dummy variable that equals one if the household income is above the median income within the settlement and zero otherwise. The first column reports the mean of the dependent variable for control households with high status on housing quality measured at follow-up. The next two columns, under the heading Model 1, report the results of estimating the linear probability model $Y_{ij} = \alpha + \gamma_1 Treat_{ij} + \gamma_2 Treat_{ij} \times Phase I_j + \gamma_3 Treat_{ij} \times HighStatus_{ij} + \gamma_4 Treat_{ij} \times HighStatus_{ij} \times Phase I_j + \gamma_5 HighStatus_{ij} + \mu_j + \varepsilon_{ij}$. Reports are the estimated coefficients and robust standard errors of γ_3 and γ_4. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. Finally, we report the p-values of F-tests of the null hypothesis that $\gamma_3 + \gamma_4 = 0$. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Figure 3



Note: This figure displays the estimated parameters reported in Table 4. The groups of bars represent estimated satisfaction with quality of life and various aspects of the quality of housing. The first bar denotes the mean level of satisfaction for the control group measured at follow-up. The next bar represents the mean level of satisfaction for the treatment group measured 16 months after construction, on average. It is computed as the mean of the control group plus the treatment effect for Phase II. The last bar represents the mean level of satisfaction of the treatment group 24 months after construction, on average, and is estimated as the mean of the control group plus the treatment effect for the Phase I group. The difference between the first bar and the second bar represents the effect of the treatment on the subjective level of well-being for the Phase II group; the difference between the second and third bar can be interpreted as the extent of hedonic adaptation.

Online Appendix

Table A1: Description of Variables and Sample Sizes. Intention to Treat Groups. Follow Up Survey

Variable	Description	Phase I		Phase II		All	
		Obs. Control	Obs. Treat.	Obs. Control	Obs. Treat.	Obs. Control	Obs. Treat.
Monthly Income Per Capita (USD)	Monthly Income per capita in US dollars of July 2007. It is calculated as the sum of the monthly earnings of each household's member divided by the household size.	265	513	532	557	797	1,070
Assets Value Per Capita (USD)	Total Asset Value per capita reported by the household.	316	611	625	658	941	1,269
Head of HH's Age	Age of head of household in years.	312	601	618	651	930	1,252
Head of HH's Gender	Indicator equal to one if the head of household is a man.	316	611	625	658	941	1,269
Head of HH's Years of Schooling	Years of Schooling of head of household equivalent to the higher level of education reached.	313	594	609	649	922	1,243
Hours worked last week by Head	Hours worked last week by Head of Household	230	469	469	504	699	973
Hours worked last week by Spouse	Hours worked last week by the Spouse of Head of Households	107	190	143	179	250	369
Satisfaction with Floor Quality	Indicator equal to one if the respondent reports being satisfied or very satisfied with the quality of floors, measured by a Likert scale of 4 categories: "Unsatisfied", "Regular", "Satisfied", "Very Satisfied".	313	606	623	657	936	1,263
Satisfaction with Wall Quality	Indicator equal to one if the respondent reports being satisfied or very satisfied with the quality of walls, measured by a Likert scale of 4 categories: "Unsatisfied", "Regular", "Satisfied", "Very Satisfied".	313	607	623	657	936	1,264
Satisfaction with Roof Quality	Indicator equal to one if the respondent reports being satisfied or very satisfied with the quality of roofs, measured by a Likert scale of 4 categories: "Unsatisfied", "Regular", "Satisfied", "Very Satisfied".	313	607	623	657	936	1,264
Satisfaction with Rain Protection	Indicator equal to one if respondent reports being satisfied or very satisfied with the house's protection against water when it rains, measured by a Likert scale of 4 categories: "Unsatisfied", "Regular", "Satisfied", "Very Satisfied".	313	607	623	657	936	1,264
Satisfaction with Quality of Life	Indicator equal to one if respondent reports being satisfied or very satisfied with the quality of life of her family in that house, measured by a Likert scale of 4 categories: "Unsatisfied", "Regular", "Satisfied", "Very Satisfied".	293	584	622	644	915	1,228
Share Rooms Good Quality Floors	Proportion of rooms with floors made of good quality materials like cement, brick, or wood (observed by the enumerator).	312	608	625	658	937	1,266
Share Rooms Good Quality Walls	Proportion of rooms with walls made of good quality materials like wood, cement, brick or zinc metal (observed by the enumerator).	316	610	621	658	937	1,268
Share Rooms Good Quality Roof	Proportion of rooms with roofs made of good quality materials like cement, brick, tile and zinc metal (observed by the enumerator).	315	609	623	657	938	1,266
Share Rooms with Windows	Proportion of rooms with at least 1 window (observed by the enumerator).	315	610	625	658	940	1,268
High Housing Status	Indicator equal to one if the equally weighted average of z-scores of Number of Rooms, Share of Rooms with Good Quality Floors, Share of Rooms with Good Quality Walls, Share of Rooms with Good Quality Roofs, and Share of Rooms with Window is positive at baseline, and zero otherwise.	316	610	625	658	940	1,268
High Income Status	Indicator equal to one if the household's Monthly Income Per Capita is above the median income within the settlement at baseline, and zero otherwise.	265	513	532	557	797	1,070

Table A2: Hedonic Adaptation in Satisfaction with Quality of Life and Housing Ordered Probit
(Dependent variable = 1 if "Very Satisfied"; 2 if "Satisfied"; 3 if "Neither Satisfied nor Unsatisfied"; and 4 if "Unsatisfied")

	"Very Satisfied" in the Control Group (Prop.)	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase I
		γ_1	γ_2	γ_1	γ_2
Satisfaction with Quality of Life	0.14	0.07 (0.01)***	-0.03 (0.01)**	0.07 (0.01)***	-0.03 (0.01)**
Satisfaction with Floor Quality	0.02	0.05 (0.01)***	-0.01 (0.01)	0.05 (0.01)***	-0.01 (0.01)
Satisfaction with Wall Quality	0.02	0.06 (0.01)***	-0.02 (0.01)**	0.06 (0.01)***	-0.02 (0.01)**
Satisfaction with Roof Quality	0.02	0.07 (0.01)***	-0.02 (0.01)*	0.07 (0.01)***	-0.02 (0.01)*
Satisfaction with Rain Protection	0.02	0.06 (0.01)***	-0.02 (0.01)*	0.06 (0.01)***	-0.02 (0.01)*

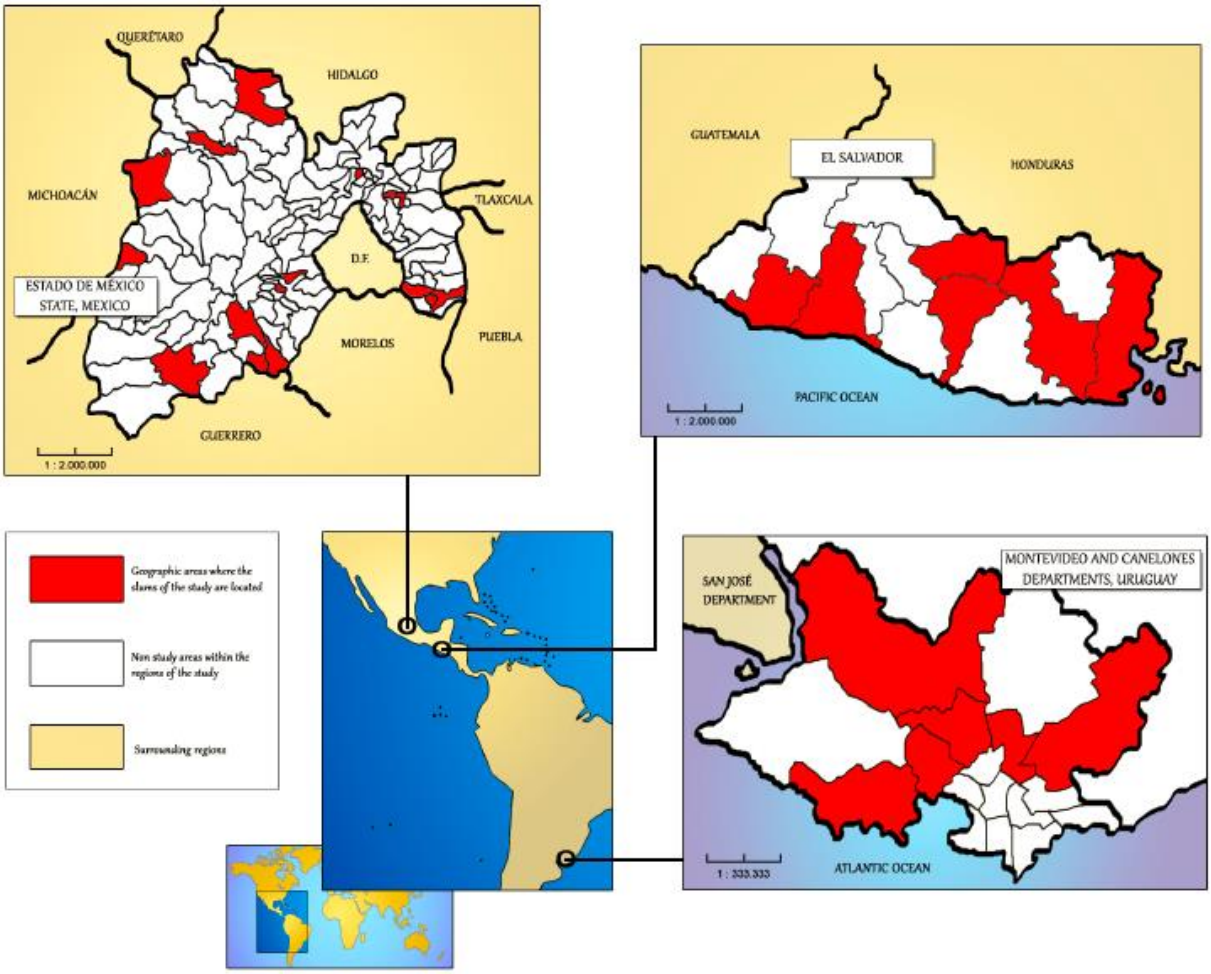
Note: Each row represents a separate categorical dependent variable that equals 1 if the individual is "Very satisfied"; 2 if "Satisfied"; 3 if "Neither Satisfied nor Unsatisfied"; and 4 if "Unsatisfied". The first column reports the proportion of individuals in the control group that report being "Very satisfied" at follow-up. The next two columns, under the heading Model 1, report the results of an ordered probit regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated marginal effects for the first category and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table A3: Hedonic Adaptation in Satisfaction with Quality of Life and Housing Ordered Probit
(Dependent variable = 1 if "Unsatisfied"; 2 "Neither Satisfied nor Unsatisfied"; 3 if "Satisfied"; 4 if "Very Satisfied")

	"Unsatisfied" in the Control Group (Prop.)	Model 1		Model 2	
		Treatment	Treatment × Phase I	Treatment	Treatment × Phase I
		γ_1	γ_2	γ_1	γ_2
Satisfaction with Quality of Life	0.20	-0.12 (0.01)***	0.05 (0.02)**	-0.12 (0.01)***	0.05 (0.02)**
Satisfaction with Floor Quality	0.36	-0.17 (0.02)***	0.03 (0.03)	-0.17 (0.02)***	0.03 (0.03)
Satisfaction with Wall Quality	0.38	-0.21 (0.02)***	0.09 (0.03)***	-0.22 (0.02)***	0.09 (0.03)***
Satisfaction with Roof Quality	0.38	-0.22 (0.02)***	0.06 (0.03)*	-0.22 (0.02)***	0.06 (0.03)*
Satisfaction with Rain Protection	0.40	-0.20 (0.02)***	0.06 (0.04)*	-0.20 (0.02)***	0.06 (0.04)*

Note: Each row represents a separate dependent variable that equals 1 if the individual is "Unsatisfied"; 2 if "Neither Satisfied nor Unsatisfied"; 3 if "Satisfied"; and 4 if "Very satisfied". The first column reports the proportion of individuals in the control group that report being "Unsatisfied" at follow-up. The next two columns, under the heading Model 1, report the results of an ordered probit regression of the dependent variable on treatment assignment and treatment assignment interacted with Phase I plus settlement fixed effects. Reports are the estimated marginal effects for the first category and robust standard errors. The last two columns, under the heading Model 2, additionally control for the household head's years of schooling, gender and age, as well as the value of household assets per capita and monthly income per capita, all of which were measured during the baseline round. Following the standard procedure, when a control variable has a missing value, we impute a value equal to 0 and add a dummy variable equal to 1 for that observation, which indicates that the control variable was missed. *Significant at 10%. **Significant at 5%. ***Significant at 1%.

Figure A1


QUERÉTARO
HIDALGO
MICHOACÁN
TLAXCALA
D.F.
ESTADO DE MÉXICO
STATE, MEXICO
MORELOS
PUEBLA
GUERRERO
1 : 2.000.000
GUATEMALA
EL SALVADOR
HONDURAS
PACIFIC OCEAN
1 : 2.000.000
Geographic areas where the shores of the study are located
Non study areas within the regions of the study
Surrounding regions
SAN JOSÉ DEPARTMENT
MONTEVIDEO AND CANELONES DEPARTMENTS, URUGUAY
1 : 333.333
ATLANTIC OCEAN