REVIEW

On the psychology of poverty

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Poverty remains one of the most pressing problems facing the world; the mechanisms through which poverty arises and perpetuates itself, however, are not well understood. Here, we examine the evidence for the hypothesis that poverty may have particular psychological consequences that can lead to economic behaviors that make it difficult to escape poverty. The evidence indicates that poverty causes stress and negative affective states which in turn may lead to short-sighted and risk-averse decision-making, possibly by limiting attention and favoring habitual behaviors at the expense of goal-directed ones. Together, these relationships may constitute a feedback loop that contributes to the perpetuation of poverty. We conclude by pointing toward specific gaps in our knowledge and outlining poverty alleviation programs that this mechanism suggests.

More than 1.5 billion people in the world live on less than $1 a day (purchasing power parity in December 2013 dollars) (*1*). This lack of financial means has far-reaching consequences: In Africa, the average person dies 21 years earlier than in Europe, one-third of the population is illiterate (*1*), and one in three children is stunted in growth (*2*). Economic poverty means living in squalor, dying early, and raising children who face similar prospects.

But does poverty affect people's affective states and their economic choice patterns, i.e., the way they feel and act? Here, we discuss recent findings that suggest that poverty causes negative affect and stress—defined as an organism's reaction to environmental demands exceeding its regulatory capacity—and that this effect may change people's behaviorally revealed preferences. Poverty may, in particular, lower the willingness to take risks and to forgo current income in favor of higher future incomes. This may manifest itself in a low willingness to adopt new technologies and in low investments in long-term outcomes such as education and health, all of which may decrease future incomes. Thus, poverty may favor behaviors that make it more difficult to escape poverty.

Two caveats are in order at the outset. First, poverty is characterized not only by insufficient income but also by dysfunctional institutions, exposure to violence and crime, poor access to health care, and a host of other obstacles and inconveniences. This diversity complicates a single and simple account of the relationship between poverty and psychology. However, a first, useful step can be made by focusing on material poverty as a central feature and powerful predictor of the ancillary features of poverty described above. Second, in asking whether poverty reinforces itself through psychological channels, we are not suggesting that the poor bear blame for their poverty. Rather, an environment of poverty into which one happens to have been born can trigger processes that reinforce poverty. On this view, any one of us might be poor if it were not for certain environmental coincidences.

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The Effect of Poverty on Risk-Taking and Time-Discounting

People living in poverty, especially in developing countries, have repeatedly been found to be more risk averse and more likely to discount future payoffs than wealthier individuals. For example, discount rates of poor U.S. households are substantially higher than those of rich households (*3*); likewise, studies of Ethiopian farm households (*4*) and a South Indian sample (*5*) find that lower wealth predicts substantially higher (behaviorally measured) discount rates. Wealthier households or those with higher annual incomes also display lower levels of risk aversion in representative samples (*6*, *7*).

In addition to these correlations between wealth/income and preference measures, there is also evidence suggesting that poverty has a causal effect on risk-taking and time-discounting. In (*7*), the potential reverse causality problem—that low risk aversion may on average lead to higher incomes or wealth—is tackled by using windfall gains as an instrumental variable (IV). The IV estimates show a substantial negative effect of income/wealth on risk aversion. The assumption needed for this approach to work is that windfall gains are positively correlated with household income/wealth—which they are—and that they only affect risk aversion through the income/wealth channel—which is plausible. In another study (*8*), experimentally measured discount rates of Vietnamese respondents were negatively related to income; that is, poorer households were more likely to choose smaller and earlier monetary rewards over larger, delayed ones. Here, the potential reverse causality problem—that high incomes may cause low discount rates—was solved by using rainfall as an instrumental variable for income. Rainfall is significantly correlated with income, and on the assumption that it affects the discounting of future payoffs only through income it is a valid instrument. The IV estimates confirm the negative relationship between the discount rate and income, suggesting that poverty may causally affect time-discounting. In addition, the results show marginally more risk aversion in poorer participants.

Negative income shocks are a pervasive feature of the lives of the poor, and they are particularly vulnerable to these shocks because of limited access to credit markets (*9*, *10*). It is therefore interesting to study the effect of negative income shocks on economic choice. In (*11*), subjects were randomly assigned to income shocks in a laboratory experiment after they had first earned some income in an effort task. The authors compared the discounting of future payoffs of subjects who experienced a negative shock with those of a control group that had not experienced an income shock; importantly, a suitable choice of initial endowments ensured that the two groups had the same absolute income when they performed the discounting task. In addition, the potential reverse causality between income levels and time-discounting could be perfectly controlled in the laboratory setting through exogenous manipulation of income levels. Controlling for absolute income, subjects who received a negative income shock exhibited more present-biased economic behavior than those whom the shock did not affect. No opposite effect was found for positive income shocks. Thus, negative income shocks—a pervasive feature of poverty—appear to increase time-discounting.

In a similar study, subjects were randomly assigned to a smaller ("poor condition") or a larger ("rich condition") budget (*12*) and were then asked to make a series of "purchasing" decisions. Naturally, those with a smaller budget faced more difficult trade-offs because they could afford fewer of the desirable goods. Because decision-making under difficult trade-offs is likely to consume scarce cognitive resources, subjects with a small budget were hypothesized to be impaired in subsequent tasks that require willpower and executive control (*13*). The study indeed found that previous decision-making in the poor condition—but not the rich condition—impaired behavioral control, as measured by the duration of time subjects were able to squeeze a handgrip and their performance in a Stroop task. Thus, poverty appears to affect decision-making by rendering people susceptible to the willpower and self-control depleting effects of decision-making. Because willpower and self-control are hypothesized to be important components of the ability to defer gratification,

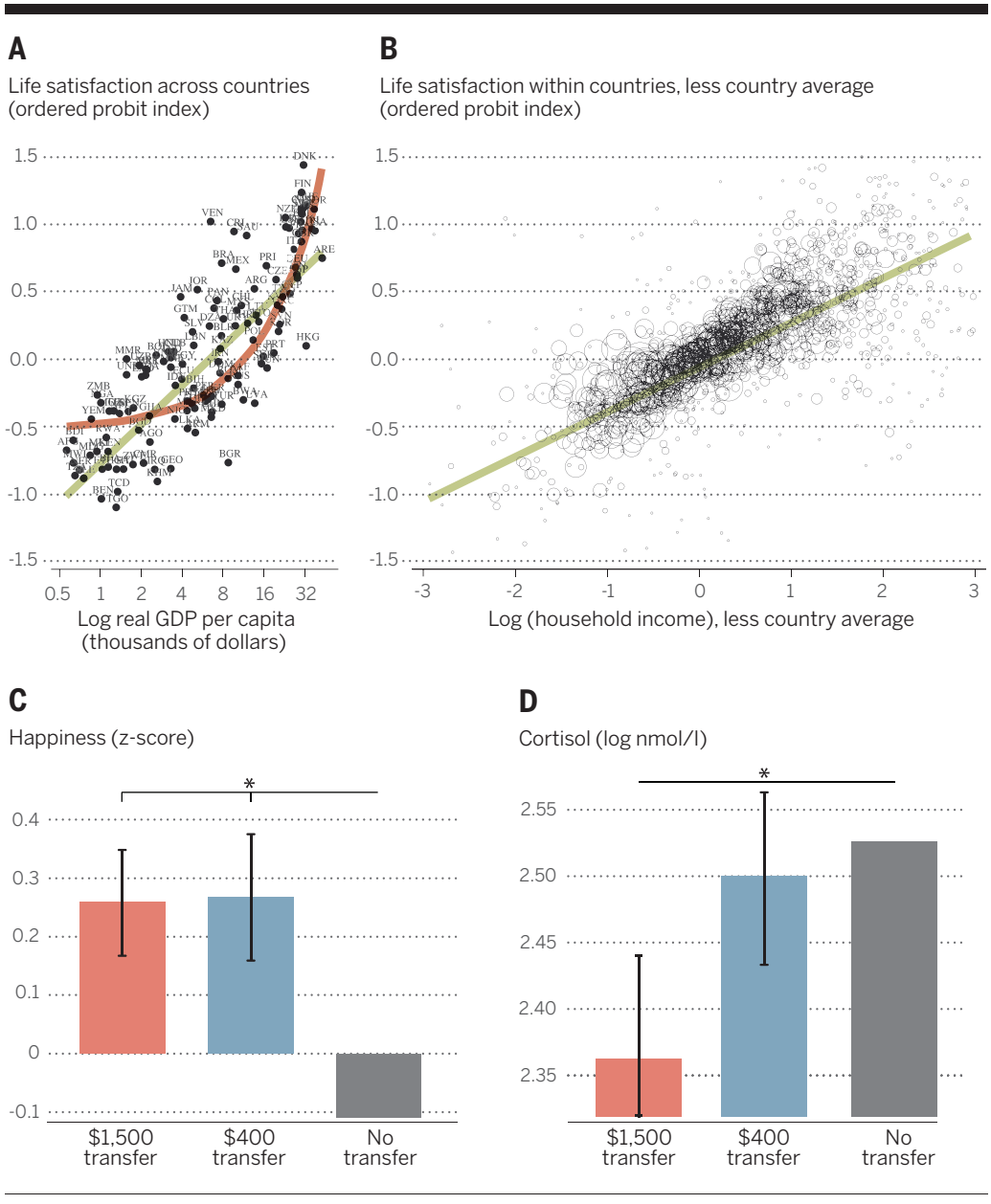

Fig. 1. The relationship between poverty, affect, and stress. The top panels show the relationship between income and life satisfaction, adapted from (*21*), using data from the Gallup World Poll, (**A**) across and (**B**) within countries. We plot standardized responses of 102,583 respondents from 131 countries to the question "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. Suppose we say that the top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?" In (A), we plot country mean responses against country gross domestic product (GDP) per capita (purchasing power parity in constant 2000 international dollars). The dashed line is fitted from an ordinary least squares (OLS) regression; the dotted line is fitted from a lowess estimation. In (B), each circle represents one income bracket in one country, with its diameter proportional to the population of that income category in that country, and the horizontal axis represents the log of household income after subtracting the country average. (**C**) *Z*-scored happiness responses of $N = 1440$ poor households in Kenya to the happiness question from the World Values Survey ("How happy are you with your life as a whole these days?" on a scale from 1 to 10). Data are from (*32*). Households received unconditional transfers of either $1500 (red) or $400 (blue) or no transfer (gray), and happiness responses were measured about 1 year after the start of the program. (**D**) Levels of the stress hormone cortisol of the same households in Kenya. The error bars in (C) and (D) represent the standard errors of the regression coefficients of the $1500 and the $400 dummy variable in an OLS regression, with happiness or cortisol levels, respectively, as dependent variables. Significant differences ($P < 0.05$) between conditions are marked with an asterisk.

such effects may also affect time-discounting behavior.

Why Does Poverty Affect Risk-Taking and Time-Discounting?

The economic and social conditions under which poor people live may affect discount rates and risk-taking behavior, even though the intrinsic time and risk preferences of the poor may be identical to those of wealthier people. For example, poor people often have no access to formal credit markets (*9*, *10*) and are forced to borrow through informal channels from money lenders, friends or merchants. They often face very high interest rates for credit, and frequently the lenders constrain the amount they lend to them (*9*, *14*), implying that they are much more likely to be liquidity-constrained. Thus, if a poor individual has the choice between a current and a delayed payment in an experiment, he or she may opt for the current payment not because of an intrinsic preference for present payments but because of the credit market imperfections present in informal markets.

In support of this view, a recent study (*17*) measures time preferences of U.S. households shortly before versus shortly after payday. Those surveyed before payday have 22% less cash, and they spend 20% less than those after payday, suggesting that households are liquidity-constrained with regard to money before payday. The study further shows that households surveyed before payday are more present-biased, and this effect is specific to monetary tasks and does not extend to nonmonetary real effort tasks. Because liquidity constraints cannot play a role with regard to effort, this result suggests that liquidity constraints before payday are the source of the apparent present bias for monetary outcomes.

The anticipation of future liquidity constraints may also induce an individual to prefer a safe payment over a risky payment (e.g., in an experiment) (*15*); again, this may occur not because the individual is intrinsically risk averse but because the safe payment helps alleviate liquidity constraints. In addition, poor individuals often face uninsurable, nondiversifiable

"background" risks such as crop failure. They may therefore display less risk-taking behavior with regard to avoidable risks (e.g., in an experiment) even though their risk preferences may not differ from those who are less exposed to background risks (*16*). Indeed, higher background risks have been shown to be associated with higher levels of risk aversion (*7*).

Thus, economic theory and empirical evidence suggest that poor households may display a lower willingness to take risks and to forgo current income for larger future incomes, even though their intrinsic time and risk preferences are not necessarily different from those of richer households. However, we will provide evidence suggesting that this is not the whole story. In a first step, we will show that poverty is associated with negative affect and with stress, and in a second step we will discuss evidence suggesting that negative affect and stress change subjects' risk-taking and time-discounting. In the second part, in particular, we will focus on experiments in which subjects are randomly assigned to treatment conditions and in which the usual economic channels for changes in time and risk-taking behavior—e.g., liquidity constraints or economic background risks—cannot play a role. It is therefore impossible to attribute differences in behavior across treatment to these channels.

The Effect of Poverty on Affect and Stress

Correlations Between Poverty, Affect, and Stress

For several decades, the prevalent view on the relationship between income and psychological well-being was what became known as the Easterlin Paradox (*18*), according to which income, self-reported happiness, and life satisfaction are correlated within but not across countries and are uncorrelated above income levels required to meet basic needs. In addition, higher incomes were thought to be uncorrelated with increased happiness and satisfaction over time. However, larger and newer data sets now suggest that higher incomes are associated with more happiness and life satisfaction both within and across countries, that no saturation point exists (although there are decreasing happiness returns to income), and that as countries grow richer, they also grow happier (*19*–*21*). Fig. 1 shows a correlation between self-reported life satisfaction and income across countries (Fig. 1A) and within countries (Fig. 1B).

In addition to happiness and life satisfaction, poverty is also more broadly related to mental health. According to the 2003 World Health Report, the poorest population quintiles in rich countries exhibit a depression and anxiety disorder prevalence that is 1.5 to 2 times as high as that of the richest quintiles (*22*). A recent comprehensive review of 115 studies (*23*) on the relationship between mental health and poverty in low- and middle-income countries finds a negative association between poverty indicators and good mental health outcomes in 79% of studies. Finally, income and socioeconomic status are also correlated with levels of the stress hormone cortisol. Several studies have shown elevated cortisol levels in persons with lower income and education (*24*, *25*) and lower lifetime economic position as measured by occupational status (*26*, *27*). Similar results have been obtained in infants and children (*27*–*31*).

Together, these findings show that poverty correlates with unhappiness, depression, anxiety, and cortisol levels. But is this relationship causal?

Causal Effect of Poverty on Affect and Stress

The effect of reductions in poverty on affect and stress is usually studied in the context of randomized field experiments or natural experiments such as lottery wins. One such study (*32*) examined the effects of an unconditional cash transfer program in Kenya on psychological well-being. Households were randomly chosen to receive unconditional transfers of either $0, $400, or $1500. Psychological well-being was measured with the happiness and life satisfaction questions from the World Values Survey, and stress and depression were measured using the Center for Epidemiologic Studies Depression Scale, Cohen's Perceived Stress Scale, and levels of the stress hormone cortisol in saliva. The study finds substantial improvements in all of these variables when households receive positive transfers (Fig. 1C), but the stress hormone cortisol was only reduced in those who received large transfers (Fig. 1D). Similarly, several other studies (*33*–*37*) report results from randomized controlled trials that show that cash transfers reduce distress and depression scores (*38*).

Similarly, using natural experiments such as the introduction of guaranteed incomes, lottery payouts, access to a pension scheme, and payouts to Native Americans from a casino opening, several studies find that the resulting increases in income lead to a reduction in hospitalization for mental health problems (*39*), lower consumption of anxiolytics (*40*), and increases in self-reported mental health (*41*–*44*). Less direct alleviations of poverty have also shown effects; several randomized controlled trials report increases in psychological well-being when participants receive health insurance (*45*), improved housing (*46*), and access to water (*47*).

Conversely, the effect of increases in poverty on well-being is usually studied using unexpected shocks such as spells of bad weather for farmers. One such study examined whether random negative income shocks to farmers in Kenya, generated by periods of drought, lead to increases in cortisol levels (*48*). The study finds that farmers have higher levels of cortisol and self-reported stress during drought periods when crops are likely to fail. This relationship does not hold for nonfarmers and is more pronounced among farmers who depend solely on agriculture for their income than among those who also have other sources of earnings. In addition, it is robust to controlling for physical activity, suggesting that changes in labor supply are not the driving factor; the plausibility of this alternative account is further reduced by the fact that the increase in cortisol levels is mirrored by an increase in self-reported stress. Another study (*49*) measured cortisol levels in a sample of 354 Swedish blue-collar workers before and after a subset of these workers lost their jobs. Cortisol levels were significantly higher in those workers who lost their jobs. Importantly, the layoffs were due to a plant closure, arguing against the possibility that job loss might be a consequence rather than a cause of high cortisol levels in individual workers. However, the fact that only one plant was studied and attrition among participants over the course of the study was non-negligible weakens the finding. A further study (*50*) uses declining industries as an exogenous source of variation for job loss and finds an effect of job loss on family mental health using this approach.

These findings thus suggest causal links between poverty, psychological well-being, and stress levels. Altogether, we identified 25 studies that report the effect on psychological well-being of an increase or decrease in poverty, induced either in randomized controlled trials or natural experiments [see the supplementary material (*51*)]. Of these, 18 studies show a positive effect of poverty alleviation on psychological well-being or stress, 5 studies show effects on some psychological variables related to well-being or stress (e.g., certain mental disorders), but not others, and 2 show no results. The mixed or inconsistent findings in these studies may reflect deficiencies or noise of some of the measures used, heterogeneity in the interventions tested, or heterogeneity in the effect of changes in poverty on particular psychological constructs; future studies need to assess these different explanations.

Thus, the large majority of the findings suggests that increases in poverty often lead to negative affect and stress, and decreases in poverty have the opposite effect. We now ask whether negative affect and stress influence risk-taking and time-discounting and could therefore be among the channels through which poverty affects economic behavior.

The Effect of Negative Affect and Stress on Risk-Taking and Time-Discounting

The existence of severe credit constraints and uninsurable background risks implies that the poor are particularly vulnerable to income and health shocks; that is, they are less able to exert control over their life circumstances. As discussed above, this leads to stress and negative affective states such as unhappiness and anxiety, and it raises the question whether such states exert an independent effect on decision-making.

Effects on Risk-Taking

In a recent paper (*52*), subjects were randomly assigned to the threat of receiving unpredictable, randomly administered high or low electrical shocks to their hands during a risk-taking task. The administration of unpredictable shocks is a reliable method for inducing a state of fear and stress (*53*). Subjects in the high-threat condition showed significantly higher risk aversion than those in

the low-threat condition (Fig. 2A). In another study (*54*), subjects' fear was exogenously induced by making them watch a horror video that shows a young man being inhumanly tortured; this fear induction also led to significantly higher risk aversion compared with subjects who saw a control video. Fear induction also led to more risk-averse choices in several other studies (*55*, *56*), and it has also been shown that risk-averse choice can be reduced through cognitive reappraisals that undo the fear effect of a fear-inducing video (*57*). Thus, it is possible not only to increase risk aversion through fear induction but also to reduce risk aversion by reducing fear.

Although the majority of the studies show an unambiguous positive effect of fear and anxiety on risk aversion (*51*), we found one study that does not show such an effect (*58*). However, this study fails to document the specificity of the fear induction and confronts subjects with 100 different choice problems after the fear induction. If induced emotions are not continuously sustained through an appropriate induction procedure—for example, through the threat of aversive shocks—their emotional effect is likely to be short-lived. It may thus be the case that the fear induction was no longer effective for a sizeable part of the 100 choice problems.

Increased risk aversion can also be induced by administering hydrocortisone, which raises cortisol levels in the brain and thus mimics some of the neurobiological effects of stress. In a placebo-controlled experiment (*59*), half of the volunteers received hydrocortisone over a period of 8 days, enabling the study of the acute (on day 1) and the chronic effects (on subsequent days) of the substance. Interestingly, the acute effects of hydrocortisone did not cause changes in risk-taking, whereas the chronic administration led to strong increases in risk aversion: Subjects in the placebo and the acute cortisone condition chose the risky alternative in a risk-taking task in roughly 50% of the cases, but subjects in the chronic hydrocortisone condition chose it only in slightly more than 20% of the cases (Fig. 2B). Other studies (*60*–*63*) have used well-known behavioral stress inductions—the cold pressor task or the Trier Social Stress Test (TSST)—to show that stress typically induces more risk aversion, although this holds only for the domain of gains and not for losses in (*61*) and only for women in (*63*). However, the stress induction did not work for men in the latter study because their cortisol levels in the stress and the control conditions were identical. Thus, taken together, both the evidence from experiments on fear and on stress induction indicates that fear and stress cause higher levels of risk aversion.

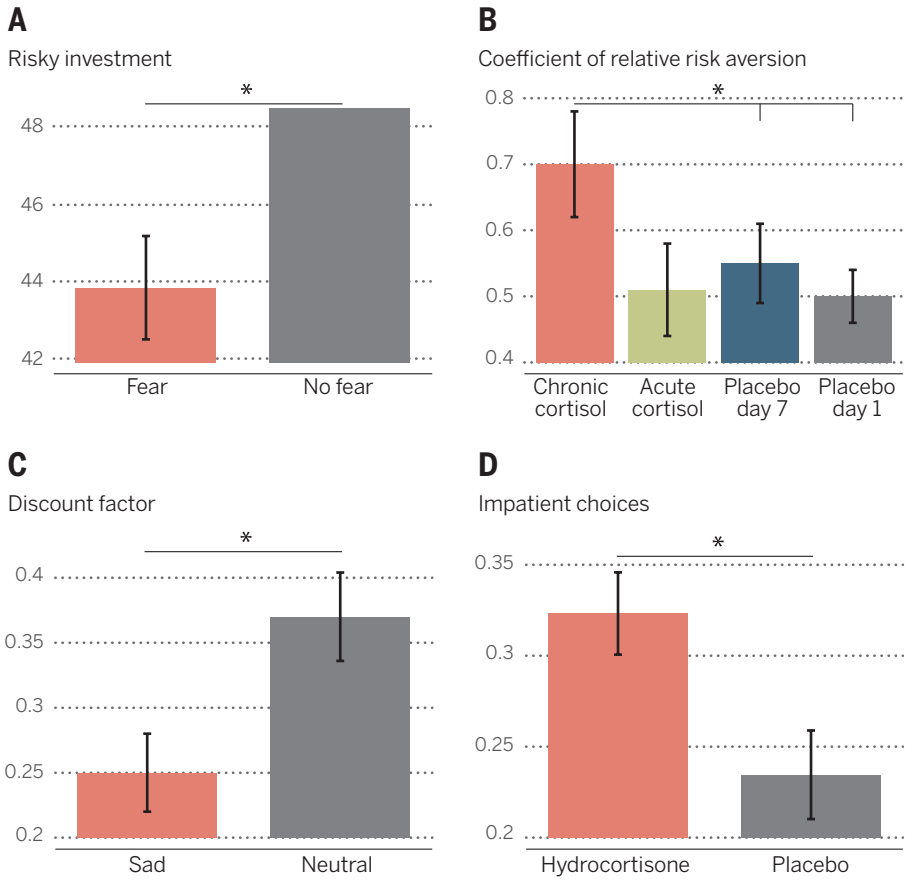

Fig. 2. Effect of negative affect and stress on risk and time preferences. (**A**) Amount invested in the risky asset (out of a total of CHF 24) when subjects (N = 41) faced the threat of receiving a painful electrical shock (fear condition, red bar) and when they received only a mild shock that was not painful (no fear condition, gray bar). Data are taken from (*52*). Subjects who faced the threat of a painful shock were less likely to make risky investments ($P < 0.05$). The error bar indicates the standard error of the regression coefficient for the fear dummy in an OLS regression with risky investment as the dependent variable. (**B**) Coefficient of relative risk aversion (mean ± SEM) of N = 36 subjects that were exposed to either repeated pharmacological elevation of cortisol levels through administration of hydrocortisone over 1 week (red), acute administration (1 day, green), or placebo (day 7, blue; day 1, gray). Data are taken from (*59*). Chronic administration led to an increase in the coefficient of relative risk aversion (CRRA) relative to placebo on both day 1 ($P < 0.05$) and day 7 ($P < 0.05$). (**C**) Discount factors (mean ± SEM) of N = 189 subjects who were exposed to either a sad or a neutral prime. Data are from (*64*). Subjects in the sad condition exhibited lower discount factors ($P < 0.05$), implying greater discounting of the future (because a low discount factor indicates a low valuation of future payoffs relative to present payoffs). (**D**) Share of impatient choices (mean ± SEM) of N = 53 subjects who received either hydrocortisone or placebo. Data are from (*66*). Subjects in the hydrocortisone condition were more impatient ($P < 0.05$) in a discounting task; i.e., they showed greater discounting of future payoffs. Significant differences ($P < 0.05$) between conditions are marked with an asterisk.

Effects on Time-Discounting

A number of recent studies show that negative affect and stress lead to increases in time-discounting (*51*, *64*–*66*). One study (*64*) induced sadness by showing participants film clips that were independently verified to induce the desired emotional state. They subsequently offered subjects choices between smaller amounts of money available immediately or larger amounts available after a delay. This task measures temporal discounting, i.e., the degree to which delayed rewards are devalued. Subjects who had viewed the sadness-inducing film clip were less likely to choose larger, delayed payments than those in the control condition; that is, they discounted future payments more strongly, indicating that sadness reduces patience (Fig. 2C). Conversely, another recent study (*65*) induced positive affect through film clips and found that it increased patience in a similar task.

As in the domain of risk-taking, pharmacological elevation of the stress hormone cortisol through hydrocortisone administration has also been found to increase time-discounting. A recent study administered 10 mg of hydrocortisone or placebo orally to healthy subjects (*66*). After administration, subjects performed a temporal discounting task similar to that described above. Subjects who had been given hydrocortisone

showed an increase in temporal discounting compared with placebo 15 min after administration; that is, they valued the present more highly relative to the future (Fig. 2D). Thus, both negative affect and elevated cortisol levels increase time-discounting, whereas positive affect has the opposite effect (*64*–*67*). Future studies will have to elucidate whether chronic stress in conditions of poverty has similar behavioral effects as acute stress induced under laboratory conditions.

Exactly how might negative affect and stress lead to increased discounting? One possibility lies in the fact that stress has recently been shown to induce a shift from goal-directed to habitual behavior (*68*). If the habitual behavior is to consume immediately, this mechanism would predict that stress should increase temporal discounting by favoring habitual responses. A related possibility is that stress and negative affect may bias attention toward salient cues. If immediate consumption is more salient than delayed consumption, this mechanism would also predict that stress and negative affect should increase time-discounting. In line with this view, Shah *et al.* (*69*) showed that decision-making under scarcity—whether this scarcity is temporal, financial, or of another type—shows signs of the irrationality frequently observed in decision-makers in settings of poverty and that this effect is due to attentional capture by salient cues. More recently, Mani *et al.* (*70*) found that poor individuals (in contrast to the rich) performed worse on tasks measuring intelligence and cognitive control after they had been asked to think about their finances; similarly, farmers performed worse on these tasks before the harvest, when they were relatively poor, than after the harvest. In both cases, material scarcity seems to change people's allocation of attention in ways that are detrimental for their performance. It is possible that similar attentional mechanisms are behind the effect of poverty on risk-taking and time-discounting, in that they induce a focus on immediate and safe payoffs; data on this question are not yet available, however.

Emerging Issues

We have outlined a feedback loop in which poverty reinforces itself through exerting an influence on psychological outcomes, which may then lead to economic behaviors that are potentially disadvantageous. This feedback loop may prolong the climb out of poverty for poor individuals, or even make the escape from poverty impossible if the relationships described above are strong enough.

A number of questions and concerns arise from the previous discussion. First, in our view, the weakest link in the relationship between poverty, psychological outcomes, and economic choice is the effect of stress and negative affect on economic choice. Despite intriguing initial results, it remains incompletely understood exactly which psychological aspects of stress, and which types of negative affect, influence economic behaviors. In addition, the evidence on this link is currently restricted to laboratory studies, and the literature does little to distinguish between the effects of acute and chronic stress on economic choice. Because poverty is usually a chronic condition, future studies should examine the effect of changes in chronic stress on economic choices in the laboratory as well as in field settings. Second, there is still little evidence on the causal effects of different poverty alleviation interventions on life satisfaction and well-being. We do not know whether some interventions work better, per dollar spent, than others. For example, are cash transfers more effective than the provision of health insurance or crop failure insurance? Third, the temporal dimension remains almost entirely unexplored. Little is known about whether poverty alleviation leads to a permanent or only a temporary increase in psychological well-being. To address this problem, repeated surveying after interventions is necessary.

A further open question is whether the relationships outlined above could constitute a poverty trap. For this to be the case, a strong nonlinearity in the relationship between poverty and psychological outcomes, or psychological outcomes and economic choice, would be required (*71*). No evidence is present for the former; existing studies on the relationship between income and psychological outcomes show no strong signs of being nonlinear. In contrast, the famous Yerkes-Dodson law states that stress and performance may exhibit a nonlinear relationship resembling an inverted U (*72*): According to this law, moderate increases in arousal lead to improvements in performance, whereas extreme levels of arousal lead to performance decrements (*73*, *74*). However, little evidence exists on whether this holds for economic behavior; this is a fruitful area for future research.

Finally, what types of welfare programs or interventions would break the relationships discussed above? If the proposed feedback loop holds true, three possibilities seem promising for breaking the cycle and improving welfare: The first is to target poverty directly, the second is to target its psychological consequences, and the third is to target the economic behaviors that result from them. These possibilities are not mutually exclusive, of course, but should be studied in isolation as well as in combination to understand their effect.

With regard to the first possibility—targeting poverty directly—a number of studies have tested the effect of direct poverty alleviation programs on psychological outcomes and economic behavior. Most of these studies examine cash transfer programs, which have produced broadly encouraging results on general welfare in recent years (*32*, *37*, *41*, *75*–*79*). Regarding the third possibility—targeting economic behaviors directly—a number of programs provide small nudges to economic behaviors with large positive welfare consequences—for instance, commitment savings accounts (*80*, *81*), reminders to save (*82*), or the provision of a lockable metal box with a deposit slit at the top (like a piggy bank) (*83*) all led to considerable increases in savings.

In our view, the second possibility, i.e., targeting the psychological consequences of poverty, holds much promise for future work. Although an early randomized controlled trial showed that group interpersonal psychotherapy helped people complete daily economic tasks in Uganda (*84*), research on the economic effects of such interventions is otherwise still in its infancy. Most important, this study targeted depressed individuals, whereas the evidence discussed in this article shows that the debilitating effects of stress and negative affect on economic behavior may occur even in individuals who do not suffer from full-fledged clinical depression. This insight suggests that psychotherapy-like interventions may have economic benefits even in nonclinical populations (*85*).

More broadly, we propose that an increased understanding of the relationship between poverty, its psychological consequences, and their potentially disadvantageous effects on economic choice will lead to poverty alleviation programs that achieve two goals. First, they will take both the psychological costs of poverty and, conversely, the psychological benefits of poverty alleviation into account. Second, they will consider psychological variables as novel intervention targets for poverty alleviation. It is our hope that this will lead to a more refined understanding of poverty and thus contribute to the solution of this lingering global problem.

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67. In our systematic review, we also identified two studies that found no effect of affect or stress on time preferences. One study (*87*) exposed subjects to an easy or difficult test, thus inducing feelings of relative success or failure, and then measured time-discounting. No effect of test difficulty on time-discounting was found. However, in this study, the time-preference task was administered at the end of a battery of behavioral tests; it is possible that the negative affect induction had already worn off by then. Alternatively, it is possible that the induction of mood through this manipulation is less powerful than movie clips or that subtly different types of affect may differentially affect time preference. Another study used the TSST to induce stress, then measured temporal discounting and found no effect (*88*). A potential explanation for this finding is that the TSST induces acute stress (i.e., concurrent glucocorticoid and noradrenergic activity), whereas hydrocortisone administration lacks some of the components of acute stress (e.g., noradrenergic coactivation). The lack of an effect of the TSST on discounting could thus suggest that acute stress does not affect discounting, whereas chronic stress may. This account is superficially consistent with a recent finding (*89*) showing that the combined administration of hydrocortisone and yohimbine, an α2-adrenoceptor antagonist, has different behavioral consequences than hydrocortisone in isolation.
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SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/344/6186/862/suppl/DC1
Supplementary Text
Literature Reviews
Fig. S1
Table S1
References (*90*–*94*)

10.1126/science.1232491

www.sciencemag.org/cgi/content/full/344/6186/862/DC1

Supplementary Materials for

On the psychology of poverty

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This PDF file includes:

Literature review search strategy

In order to identify causal studies of the effect of economic interventions on mental well-being, we conducted a comprehensive literature search, using the electronic databases IDEAS/RePeC, PubMed, and Social Science Research Network. Terms used to capture studies concerned with psychological outcomes were “mental health”, “psychological”, “neurobiological”, “well-being”, “stress”, “sadness”, happiness”, “affect”, “emotion”, “depression”, and “cortisol”. We used the terms “income”, “poverty”, “poor”, “wealth”, “rich”, and “development” to capture studies concerning economic status, and “randomized trial”, “experiment”, “lottery”, “shock”, “exogenous”, “regression discontinuity”, and “instrumental variable” to capture studies with a causal interpretation.

We conducted a second literature search to identify studies of the relationship between affect and economic choice. As in the above search, there were no search restrictions on language, date, journal, or publication status. We conducted the search on the online databases IDEAS/RePeC, PubMed, and Social Science Research Network. The search terms used to find articles on affective state were “affect”, “happiness”, “sadness”, “stress”, “power”, “well-being”, “emotion”, “depression”, and “cortisol”, while the search terms used to identify studies related to choice were “economic choice”, “risk”, “rational”, “intertemporal”, “time preference”, “discounting”, “decision making”, “social preference”, and “loss aversion”. Members of the Economic Science Association mailing list suggested additional papers.

To assess relevance in both literature searches, we initially screened papers by title. Papers with plausibly applicable titles were further screened by their abstracts; we included them after reading them in full. When multiple versions of a paper were available, we selected the published version, or most recent working paper version in the case of unpublished manuscripts. After compiling the initial list from these sources, we asked scholars in the field if they had personally performed any research on the topic. We also asked them if they were aware of any relevant research that was not already included on the list. Finally, we examined citations from the identified papers to check for any relevant research that the other components of the literature searches might have missed. All papers identified in this fashion are listed below.

Factor structure of psychological variables

The literature we summarize in this paper refers to a number of different psychological constructs, such as happiness, sadness, stress, and depression. How are these constructs related to each other? In our view, to a first approximation, many of these constructs can be viewed on a single underlying psychological dimension, i.e. positive vs. negative affect. To show this, we conducted factor analysis on two datasets to ask whether the measures of psychological well-being measure similar constructs. The first dataset, from (*32*), contains data from the CESD depression questionnaire, a custom worries scale, Cohen's Perceived Stress Scale, the Happiness, Life Satisfaction, and Trust questions from the World Values Survey, a Locus of Control Index composed of the Rotter score and the World Value Survey question on locus of control, Scheier's Optimism Scale, and Rosenberg's Self-esteem Scale from

a large sample of Kenyan respondents. The second dataset, from (*90*), contains data from the happiness, life satisfaction, trust, and locus of control questions from the World Values Survey in 43 countries around the world. In **Table S1**, we show pairwise correlations between the variables; in **Fig. S1,** we show scree plots of the eigenvalues of the factors obtained in the factor analysis. We find significant and high correlations among many of the psychological variables in both datasets, suggesting that they are closely related. In addition, the first factor in the factor analysis has an eigenvalue of 0.80; i.e., an overwhelming proportion of the variance in the data can be explained by a single factor. Together, these results suggest that the different survey questions about psychological well-being are closely related.

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(A)

	Depression (CESD)	Worries	Stress (Cohen)	Happiness (WVS)	Life satisfaction (WVS)	Trust (WVS)	Locus of control	Optimism (Scheier)	Self-esteem (Rosenberg)
Depression (CESD)	1.00								
Worries	0.35 (0.00)	1.00							
Stress (Cohen)	0.29 (0.00)	0.36 (0.00)	1.00						
Happiness (WVS)	-0.16 (0.00)	0.01 (0.81)	-0.03 (0.32)	1.00					
Life satisfaction (WVS)	-0.18 (0.00)	-0.23 (0.00)	-0.13 (0.00)	0.13 (0.00)	1.00				
Trust (WVS)	0.05 (0.07)	0.07 (0.01)	-0.02 (0.50)	0.06 (0.02)	-0.07 (0.00)	1.00			
Locus of control	0.08 (0.00)	0.07 (0.00)	-0.00 (0.97)	0.03 (0.21)	-0.04 (0.09)	-0.02 (0.50)	1.00		
Optimism (Scheier)	-0.22 (0.00)	-0.16 (0.00)	-0.15 (0.00)	0.12 (0.00)	0.14 (0.00)	-0.02 (0.39)	-0.04 (0.16)	1.00	
Self-esteem (Rosenberg)	0.03 (0.19)	0.12 (0.00)	0.07 (0.00)	-0.02 (0.36)	-0.00 (0.84)	0.05 (0.04)	0.01 (0.72)	-0.01 (0.65)	1.00

(B)

	Happiness	Life-satisfaction	Locus of control	Trust
Happiness	1.00			
Life-satisfaction	0.50 (0.00)	1.00		
Locus of control	0.11 (0.00)	0.19 (0.00)	1.00	
Trust	(0.09) (0.00)	0.08 (0.00)	0.01 (0.00)	1.00

Table S1. Correlation matrix (p-values in parentheses) of the psychological variables in two datasets: **(A)** shows the correlations between the psychological outcome variables in the baseline dataset used in (*32*). They are: CESD depression score (*91*), Cohen's Perceived Stress Scale (*92*), a custom worries scale, the happiness, life satisfaction, trust, and locus of control questions from the World Values Survey, Scheier's Optimism Scale (*93*), and Rosenberg's Self-Esteem Scale (*94*). Similarly, **(B)** shows the correlations between the World Value Survey questions on happiness, life satisfaction, trust, and locus of control questions in the original World Value Survey dataset (N = 59,055, 45 countries). In both cases, many psychological variables correlate highly with each other, suggesting that the different survey questions about psychological well-being may tap into similar underlying constructs.

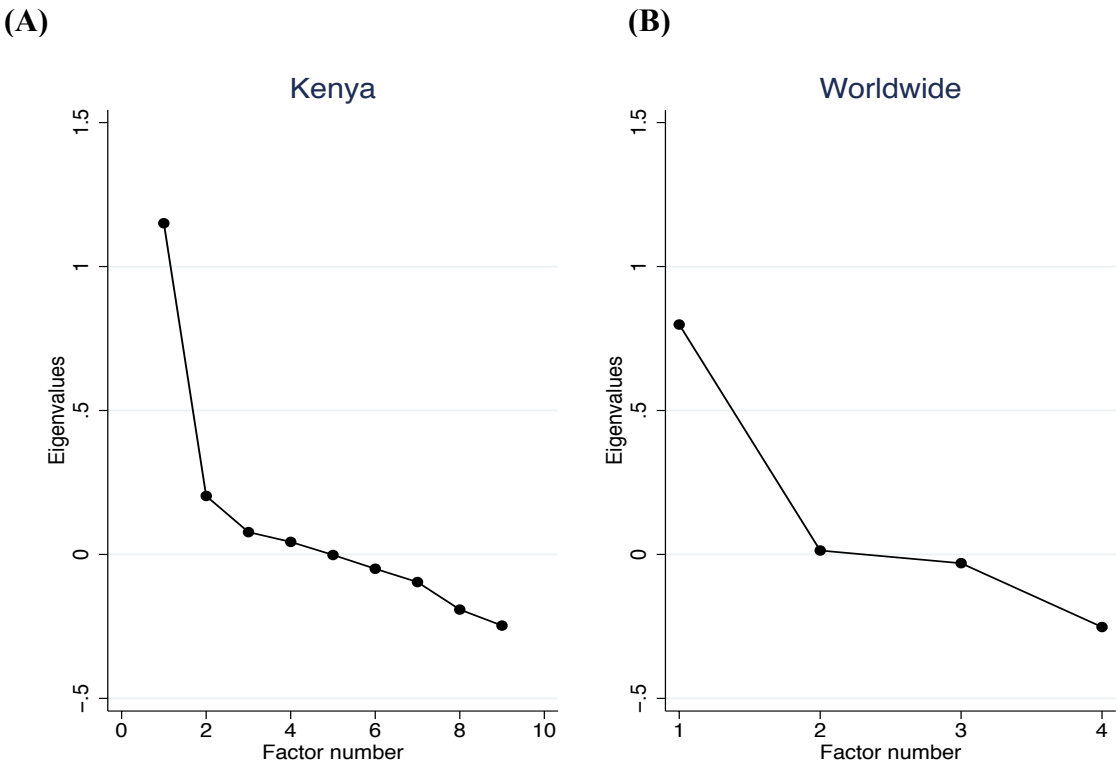

Fig. S1. Scree plots of the eigenvalues of the factors obtained by factor analysis on the psychological variables in two datasets: **(A)** shows the eigenvalues for the first 9 factors obtained through factor analysis on the psychological outcome variables (CESD depression score, Cohen's Perceived Stress Scale, a custom worries scale, the WVS happiness, life satisfaction, trust, and locus of control questions, Scheier's Optimism Scale, and Rosenberg's Self-Esteem Scale) in the baseline dataset used in (*32*). The first factor has an eigenvalue of 1.15, the second factor an eigenvalue of 0.20 ($N = 1569$). Similarly, **(B)** shows eigenvalues for the first three factors obtained through factor analysis on the World Value Survey dataset in *(90)* for the happiness, life satisfaction, trust, and locus of control questions ($N = 59{,}055$, 45 countries). The first factor has an eigenvalue of 0.80, the second factor has an eigenvalue of 0.01. Thus, a single factor in both data sets accurately explains a large proportion of the variance in psychological well-being, suggesting that the different survey questions about psychological well-being may tap into similar underlying constructs.

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TSST induces acute stress (i.e., concurrent glucocorticoid and noradrenergic activity), whereas hydrocortisone administration lacks some of the components of acute stress (e.g., noradrenergic coactivation). The lack of an effect of the TSST on discounting could thus suggest that acute stress does not affect discounting, whereas chronic stress may. This account is superficially consistent with a recent finding (*89*) showing that the combined administration of hydrocortisone and yohimbine, an α2-adrenoceptor antagonist, has different behavioral consequences than hydrocortisone in isolation.

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Literature review on the impact of poverty on affect and stress

[Chronological order. "(in)consistent" indicates (in)consistency with the hypothesis that increases in poverty lead to negative affect and stress, while decreases lead to positive affect and reductions in stress.]

References	Type of intervention	Outcome variable	Result	Identification strategy
Arnetz *et al.* (1991) B. B. Arnetz, et al., Neuroendocrine and immunologic effects of unemployment and job insecurity. *Psychother. Psychosom.* **55**, 76-80 (1991).	Job loss	Cortisol	Significantly elevated cortisol levels among workers who were laid off. **"consistent"**	Natural experiment
Costello *et al.* (2003) E.J. Costello, S.N. Compton, G. Kessler, A. Angold, Relationships between poverty and psychopathology: a natural experiment. *J. Amer. Med. Assoc.* **290**(15), 2023-2029 (2003).	Casino payouts to Native American populations	Mental disorders	Fewer symptoms of conduct and oppositional defiant disorders; no effect on anxiety and depression symptoms. **"mixed"**	Natural experiment
Kling *et al.* (2007) J.R. Kling, J.B. Liebman, L.F. Katz, Experimental analysis of neighborhood effects. *Econometrica* **75**(1), 83-119 (2007).	Moving to Opportunity	Several mental health measures, 4-7 years after intervention	Moving to Opportunity reduced distress (K6), and increased calm and peaceful feelings; no effect on probability of a Major Depressive Episode **"mixed"**	RCT

References	Type of intervention	Outcome variable	Result	Identification strategy
Gardner & Oswald (2007) J. Gardner, A. J. Oswald, Money and mental wellbeing: A longitudinal study of medium-sized lottery wins. *J. Health Econ.* **26**(1), 49-60 (2007).	Lottery payouts	Mental strain as measured by GHQ	Increase in GHQ scores (1.4 points after 2 years, compared to non-winners or small winners). **"consistent"**	Natural experiment
Paxson & Schady (2007) C. Paxson, N. Schady, Does money matter? The effects of cash transfers on child health and development in rural Ecuador. *World Bank Working Paper* (2007).	Cash transfer	Depression	No effect. **"inconsistent"**	RCT
Kuhn *et al.* (2008) P.J. Kuhn, P. Kooreman, A.R. Soetevent, A. Kapteyn, The own and social effects of an unexpected income shock: evidence from the Dutch Postcode Lottery. *NBER Working Paper* No. w14035 (2008).	Lottery payouts	Happiness	No effect 6 months later. **"inconsistent"**	Natural experiment
Apouey & Clark (2009) B.H. Apouey, A. Clark, Winning big but feeling no better? The effect of lottery prizes on physical and mental health. *IZA Discussion Paper* 4730, (2009).	Lottery payouts	Score on general health questionnaire	Improved general mental health. **"consistent"**	Natural experiment

References	Type of intervention	Outcome variable	Result	Identification strategy
Ozer *et al.* (2009) E.J. Ozer, L. Fernald, J.G. Manley, P.J. Gertler, Effects of a conditional cash transfer program on children's behavior problems. *Pediatrics* **123**(4), e630-e637 (2009).	CCT (Oportunidades)	Aggression; anxiety; depression	Decreased aggression in children, no effects on anxiety and depression **"mixed"**	RCT but compares participants to non-participants.
Ssewamala *et al.* (2009) F.M. Ssewamala, C.-K Han, T.B. Neilands, Asset ownership and health and mental health functioning among AIDS-orphaned adolescents: findings from a randomized clinical trial in rural Uganda. *Soc. Sci. Med.* **69**(2), 191–198 (2009).	Economic empowerment intervention (matched savings accounts, mentorship, financial management workshops)	Self-esteem	Increased self-esteem. **"consistent"**	RCT
Fernald & Gunnar (2009) L. Fernald, M.R. Gunnar, Effects of a poverty-alleviation intervention on salivary cortisol in very low-income children. *Soc. Sci. Med.* **68**(12), 2180-2189 (2009).	CCT (Oportunidades)	Cortisol	Reduction in cortisol in children **"consistent"**	RCT but compares participants to non-participants.
Case (2010) A. Case, Does money protect health status? Evidence from South African pensions. *NBER Working Paper* No. w8495 (2010).	Pension payments	Self-reported mental health	Improved mental health. **"consistent"**	Natural experiment

References	Type of intervention	Outcome variable	Result	Identification strategy
Jagannathan *et al.* (2010) R. Jagannathan, M.J. Camasso, U. Sambamoorthi, Experimental evidence of welfare reform impact on clinical anxiety and depression levels among poor women. *Soc. Sci. Med.* **71**(1), 152-160 (2010).	Welfare reform	Depression; anxiety	Increased depression, but reduced anxiety; heterogeneous treatment effect. **"mixed"**	RCT
Rosero & Oosterbeek (2011) J. Rosero, H. Oosterbeek, Trade-offs between different early childhood interventions: evidence from Ecuador. *Tinbergen Institute Discussion Paper* 11-102/3 (2011).	Home visits	Mother's psychological well-being	Improved psychological well-being. **"consistent"**	RDD (discontinuity in the funding scheme of home visits and child care centers)
Ozer *et al.* (2011) E.J. Ozer, L. Fernald, A. Weber, E.P. Flynn, T.J. VanderWeele, Does Alleviating Poverty Affect Mothers' Depressive Symptoms? A Quasi-Experimental Investigation of Mexico's Oportunidades Programme. *Int. J. Epidemiol.* **40**(6), 1565–76 (2011).	CCT (Oportunidades)	Depression	Lower depression (and behavioral problems inventory, BPI). **"consistent"**	RCT but compares participants to non-participants.

References	Type of intervention	Outcome variable	Result	Identification strategy
Devoto *et al.* (2011) F. Devoto, E. Duflo, P. Dupas, W. Pariente, V. Pons, Happiness on tap: piped water adoption in urban Morocco. *NBER Working Paper* No. w16933 (2011).	Access to running water	Happiness	Increased happiness. **"consistent"**	RCT
Forget (2011) E.L. Forget, The town with no poverty: The health effects of a Canadian guaranteed annual income field experiment. *Can. Public Pol.* **37**(3), 283-305 (2011).	Guaranteed annual income	Hospitalization for mental health problems	Decreased hospitalization for mental health problems. **"consistent"**	Natural experiment; propensity score matching
Tseng & Petrie (2012) F.M. Tseng, D. Petrie, Handling the endogeneity of income to health using a field experiment in Taiwan. *Dundee Discussion Papers in Economics* 263, (2012).	Pensions	Depression; life satisfaction	Decrease in depression, no effects on life satisfaction. **"mixed"**	Natural experiment (cash injection for senior farmers), DiD

References	Type of intervention	Outcome variable	Result	Identification strategy
Finkelstein *et al.* (2012) A. Finkelstein, *et al.*, The Oregon health insurance experiment: evidence from the first year. *The Q. J. Econ.* **127**(3), 1057-1106 (2012).	Insurance lottery	Self-reported mental health	Insured were more likely to report good mental health (30 days), and less likely to screen positive for depression. They also displayed large increases in happiness. **"consistent"**	RCT
Ssewamala *et al.* (2012) F. M. Ssewamala, T. B. Neilands, J. Waldfogel, L. Ismayilova, The impact of a comprehensive microfinance intervention on depression levels of AIDS-orphaned children in Uganda. *J. Adolescent Health* **50(**4), 356-352 (2012).	Economic empowerment intervention (matched savings accounts, mentorship, financial management workshops)	Depression	Decreased depression. **"consistent"**	RCT

References	Type of intervention	Outcome variable	Result	Identification strategy
Mendolia (2013) S. Mendolia, The impact of job loss on family mental health. *School of Economics University of New South Wales Working Paper* (2013).	Job loss	Family mental health	Poorer mental health in families exposed to job loss. **"consistent"**	Natural experiment
Ludwig *et al.* (2013) J. Ludwig, *et al*., Long-term neighborhood effects on low-income families: evidence from Moving to Opportunity. *NBER Working Paper* No. w18772 (2013).	Moving to Opportunity	Distress, happiness; 10-15 years after intervention	Moving to Opportunity reduced distress (K6), and increased happiness. Large effects. Significant effects especially among women and young people 10-15 years later. **"consistent"**	RCT
Cesarini *et al.* (2013) D. Cesarini, E. Lindqvist, R. Östling, B. Wallace, Estimating the causal impact of wealth on health: Evidence from the Swedish lottery players. *New York University Working Paper* (2013).	Lottery payouts	Anxiolytics consumption	Decrease in consumption of anxiolytics. **"consistent"**	Natural experiment

References	Type of intervention	Outcome variable	Result	Identification strategy
Haushofer & Shapiro (2013) J. Haushofer, J. Shapiro, Household response to income changes: Evidence from an unconditional cash transfer program in Kenya. *Massachusetts Institute of Technology Working Paper* (2013).	Cash transfer	Psychological well-being; cortisol	Increased psychological well-being; cortisol only reduced with large transfers. **"consistent"**	RCT
Chemin *et al.* (2013) M. Chemin, J. de Laat, J. Haushofer, Poverty and stress: rainfall shocks increase levels of the stress hormone cortisol. *Massachusetts Institute of Technology Working Paper* (2013).	Income shock	Psychological well-being; cortisol	Elevated cortisol levels and decreased psychological well-being in farmers hit with a negative income shock. **"consistent"**	Natural experiment
Baird *et al.* (2013) S. Baird, J. de Hoop, B. Özler, Income Shocks and adolescent mental health. *J. Hum. Resour.* **48**(2), 370–403 (2013).	Cash transfer	Distress	Reduced distress among adolescent girls, though effects were smaller when additional transfers were conditional on them attending school. **"consistent"**	RCT

Literature review on the impact of affect and stress on risk taking

[Chronological order. "(in)consistent" indicates (in)consistency with hypothesis that fear and stress decrease risk taking, while reductions of fear and stress increase it]

References	Affect/Stress induction	Outcome variable	Result	Induction method
Raghunathan & Pham (1999) R. Raghunathan, M.T. Pham, All negative moods are not equal: motivational influences on anxiety and sadness on decision making. *Organ. Behav. Hum. Dec.* **79**(1), 56-77 (1999).	Anxiety, sadness	Risk aversion	Anxious subjects show higher risk aversion. **"consistent"**	Reading task
Lerner & Keltner, 2001 J.S. Lerner, D. Keltner, Fear, anger, and risk. *Journal of Personality and Social Psychology*, **81**(1), 146-159 (2001).	Fear, anger	Risk estimates	Fear increases pessimistic risk estimates. **"consistent"**	Describing situations that induce fear
Lerner et al., 2003 J.S. Lerner, R.M. Gonzalez, D.A. Small, B. Fischhoff, Effects of fear and anger on perceived risks of terrorism: A national field experiment. *Psychological Science*, **14**(2), 144-150 (2003).	Fear, anger	Risk estimates	Fear increases pessimistic risk estimates. **"consistent"**	Describing fear/anger/sadness induced by September 11 attacks

References	Affect/Stress induction	Outcome variable	Result	Induction method
Mather et al. (2009) M. Mather, M. Gorlick, N. Lighthall, To brake or accelerate when the light turns yellow? Stress reduces older adults risk taking in a driving game. *Psychol. Sci.* **20**(2), (2009).	Stress	Risk aversion	Increases risk aversion. **"consistent"**	Cold pressor
Porcelli & Delgado (2009) A.J. Porcelli, M.R. Delgado, Acute stress modulates risk taking in financial decision making. *Psychol. Sci*. **20**(3), 278–283 (2009).	Stress	Risk aversion	Higher risk aversion in gains domain, more risk seeking in loss domain. **"consistent in gains domain"**	Cold pressor
Lighthall *et al.* (2009) N. Lighthall, M. Mather, M. Gorlick, Acute stress increases sex differences in risk seeking in the balloon analogue risk task. *PLoS One* **4**(7), (2009).	Stress	Risk aversion	Under stress, women take less risk, while men take more. However, the stress induction did not lead to higher cortisol in men. **"consistent in women"**	Cold pressor

References	Affect/Stress induction	Outcome variable	Result	Induction method
Heilman *et al.* (2010) R. M. Heilman *et al.*, Emotion regulation and decision making under risk and uncertainty. *Emotion* **10**(2), 257 (2010).	Fear	Risk aversion	Risk aversion can be undone by assuaging the fear. **"consistent"**	Film
Kugler *et al.* (2012) T. Kugler, T. Connolly, L.D. Ordóñez, Emotion, decision, and risk: betting on gambles versus betting on people. *J. Behav. Decis. Making* **25**(2), 123-134 (2012).	Fear	Risk aversion	Higher risk aversion in fear state. **"consistent"**	Writing task
Conte *et al.* (2013) A. Conte, M.V. Levati, C. Nardi, The role of emotions on risk preferences: an experimental approach. *Jena Economic Research Papers* No. 2013-046 (2013).	Fear (and sadness, joviality, anger)	Risk aversion	Fear leads to more risk seeking behavior. **"inconsistent"**	Film
Cohn *et al.* (2013) A. Cohn, J. Engelmann, E. Fehr & M. Maréchal. Evidence for countercyclical risk aversion: an experiment with financial professionals. *UBS International Center of Economics in Society Working Paper* No. 004 (2013).	Stress, fear	Risk aversion	Higher stress/fear subjects were more risk averse. **"consistent"**	High or low unpredictable electrical shocks

References	Affect/Stress induction	Outcome variable	Result	Induction method
Guiso *et al.* (2013) L. Guiso, P. Sapienza & L. Zingales. Time varying risk aversion. *NBER Working Paper* No. w19284 (2013).	Fear	Risk aversion	Higher fear subjects were more risk averse. **"consistent"**	Film
Kandasamy *et al.* (2013) N. Kandasamy et al., Cortisol shifts financial risk preferences. *P. Natl. Acad. Sci. USA* (2013).	Cortisol	Risk aversion	No effect on risk taking with acute cortisol, but decreased risk taking from chronic cortisol administration. **"consistent"**	Administered cortisol
Cingl & Cahlikova (2013) L. Cingl, J. Cahlikova, Risk preferences under acute stress. *IES Working Paper* No. 17/2013 (2013).	Stress	Risk aversion	Stressed subjects displayed higher risk aversion. **"consistent"**	Trier Social Stress Test

References	Affect/Stress induction	Outcome variable	Result	Induction method
Drichoutis & Nayga (2013) A.C. Drichoutis, R.M. Nayga Jr., Eliciting risk and time preferences under induced mood states. *J. Behav. Exp. Econ*. **45**, 18-27 (2013).	Negative/positive mood states	Time and risk preference	Negative mood increased risk aversion while positive mood had no effect on risk taking. However, the results depend on whether risk takers are modelled as expected utility maximizers or as rank-dependent utility maximizers. **"inconsistent"**	Success/failure experience in an easy/hard test
Engelmann *et al.* (2013) J. Engelmann *et al.*, The neural circuitry of affect-induced distortions of trust. *University of Zurich Working Paper* (2013).	Fear and stress	Social risk-taking of first movers in a trust game	Subjects anticipating aversive shocks show less trust in strangers in a trust game, i.e. they are less willing to accept socially constituted risks. **"consistent"**	Tactile stimulation
Kim & Lee (2013) Y.-I. Kim, J. Lee, The Long-Run Impact of Traumatic Experience on Risk Aversion. *Sogang University Working Paper* (2013).	Exposure to conflict	Risk preference	Exposure to conflict is associated with greater risk aversion. **"consistent"**	Korean War

References	Affect/Stress induction	Outcome variable	Result	Induction method
Callen *et al.* (2013) M. Callen *et al.*, Violence and Risk Preference: Experimental Evidence from Afghanistan. UCSD Working Paper (2013).	Exposure to violence	Risk preference	Exposure to violence is associated with greater risk aversion. **"consistent"**	Afghanistan War

Literature review on the impact of affect and stress on time discounting

[Chronological order. "(in)consistent" indicates (in)consistency with the hypothesis that negative affect and stress increase discounting, while positive affect and the absence of stress decrease it. Studies on self-control are included in this review due to its close relationship to time discounting.]

References	Affect/Stress induction	Outcome variable	Result	Induction method
Seeman & Schwarz (1974) G. Seeman, J.C. Schwarz, Affective state and preference for immediate versus delayed reward. *J. Res. Pers.* **7**(4), 384-394 (1974).	Positive or negative mood	Discounting	More discounting after failure than after success **"consistent"**	Experience of success or failure
Fry (1975) P.S. Fry, Affect and resistance to temptation. *Dev. Psychol.* **11**(4), 466-472 (1975).	Positive or negative mood	Self-control	Less self-control under negative than positive mood **"consistent"**	Thinking about positive vs. negative events
Moore *et al.* (1976) B. S. Moore, A. Clyburn and B. Underwood, The role of affect in delay of gratification. *Child Development* 47(1), 273-276 (1976).	Positive or negative mood	Discounting	More discounting under negative than positive mood **"consistent"**	Thinking about sad, neutral or happy events
Schwarz & Pollack (1977) J.C. Schwarz, P.R. Pollack, Affect and delay of gratification. *J. Res. Pers.* **11**(2), 147-164 (1977).	Positive or negative mood	Discounting	More discounting under negative than positive mood **"consistent"**	Thinking about positive vs. negative events

References	Affect/Stress induction	Outcome variable	Result	Induction method
Fedorikhin & Patrick (2010) A. Fedorikhin, V.M. Patrick, Positive mood and resistance to temptation: the interfering influence of elevated arousal. *J. Consum. Res.* **37**(4), 698-711 (2010).	Positive mood	Self-control	Greater self-control under positive mood. **"consistent"**	Film
Ifcher & Zarghamee (2011) J. Ifcher, H. Zarghamee, Happiness and time preference: the effect of positive affect in a random-assignment experiment. *Am. Econ. Rev.* **101**(7), 3109–3129 (2011).	Happiness	Discounting	Happy subjects discount less. **"consistent"**	Film
Lerner *et al.* (2013) J.S. Lerner, Y. Li, E.U. Weber, *The financial costs of sadness. Psychol. Sci*. **24**(1), 72–79 (2013).	Sadness	Discounting	Sad subjects discounted more. **"consistent"**	Film
Cornelisse *et al.* (2013) S. Cornelisse, *et al*., Time-dependent effect of hydrocortisone administration on intertemporal choice. *SSRN Working Paper Series* (2013).	Cortisol	Discounting	Subjects administered cortisol discounted more. **"consistent"**	Administered cortisol

References	Affect/Stress induction	Outcome variable	Result	Induction method
Drichoutis & Nayga (2013) A.C. Drichoutis, R.M. Nayga Jr., Eliciting risk and time preferences under induced mood states. *J. Behav. Exp. Econ*. **45**, 18-27 (2013).	Negative/positive mood states	Time and risk preference	No effect on time discounting **"inconsistent"**	Success/failure experience in an easy/hard test
Haushofer *et al.* (2013) J. Haushofer, et al., No effects of psychosocial stress on intertemporal choice. *PloS one* **8**(11), e78597 (2013).	Stress	Discounting	No effect. **"inconsistent"**	Trier Social Stress Test
DeSteno *et al.* (2014) D. DeSteno *et al.*, Gratitude: A Tool for Reducing Economic Impatience. *Psychological Science*, advance online publication, doi:10.1177/0956797614529979	Gratitude, happiness	Discounting	Gratitude decreases time discounting **"consistent"**	Describing situations that induce gratitude/ happiness