Reducing debt improves psychological functioning and changes decision-making in the poor

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We examine how chronic debt affects behavior by studying how a large, unanticipated debt-relief program affected psychological functioning and economic decision-making in beneficiaries. A charity granted low-income households debt relief worth up to Singapore dollars 5,000 (~3 month's household income). We exploited quasiexperimental variation in the structure of debt relief: For the same dollar amount of relief, some beneficiaries had more debt accounts eliminated, while others had fewer paid off. Comparing 196 beneficiaries before and after debt relief, and controlling for debt-relief amount, having an additional debt account paid off improves cognitive functioning by about one-quarter of a SD and reduces the likelihood of exhibiting anxiety by 11% and of present bias by 10%. To achieve the same effect on cognitive functioning of eliminating one debt account, a beneficiary must receive debt relief worth ~1 month's household income. There is no effect of debt-relief magnitude on anxiety and decision-making. We exclude training and calendar effects, debt-causing behaviors, and liquidity constraints as explanations. Instead, these results support the hypothesis that chronic debt impairs behavior because the mental-accounting costs of owing distinct debt accounts consume mental bandwidth. Poverty-alleviation policies aimed at the indebted poor should consider addressing mental accounting and bandwidth taxes.

poverty | debt | mental accounting | cognitive functioning | present bias

Recent studies provide a new perspective on the causes of poverty traps: The demands of daily life under scarcity create "bandwidth taxes" that sap mental resources, impairing cognitive ability and causing counterproductive behavior which perpetuates poverty (1–3). While this theory has opened a new frontier on poverty research and policy, the pathways through which poverty reinforces itself through bandwidth taxes remain a black box.

We shed light on these pathways by examining how chronic indebtedness creates bandwidth taxes for the poor. Chronic indebtedness is endemic to poverty in rich and poor nations alike (4, 5). The burden of debt is severe: One in four US families in the lowest income quintile spend >40% of household income on servicing debt (5). The monetary costs of debt exacerbate poverty because the repayment burden diverts resources from more productive uses (6). However, the way debts are structured may create large bandwidth costs that are just as, if not more, detrimental. The reason is that debt, like money, is not perceived to be fungible. People do not think about personal finances in a consolidated way and instead think narrowly about the gains and losses of separate mental accounts for their mortgage, their car loan, their power bill, and their other debts (7, 8).

This implies that debt structure matters. Conditional on owing the same amount, having more creditors is costlier psychologically because more accounts are "in the red," and losses loom larger, on the margin, for the first few dollars of each debt (7–9). These debt mental-accounting costs are painful and explain why laboratory subjects pay off smaller debts entirely when possible rather than minimize overall interest costs (10). Under this view, the poor may have great difficulty improving their situation simply because debt mental accounting imposes a background cognitive load, causing bandwidth tax that impairs cognitive functioning. In addition, the psychological pain from multiple debt mental accounts may explain why chronic debt is frequently associated with stress and negative affect (11, 12). Impaired cognition and negative affect, in turn, may focus attention on safer choices that yield immediate benefits at the expense of longer-term risky investments and may impair the ability of the deliberative, economically rational "system 2" to restrain "system 1" impulses to seek safe, near-term benefits (1–3, 13–15).

Although debt mental accounting is not limited to the poor, the poor are more likely than the nonpoor to owe multiple chronic debts because they lack the financial resources to streamline debts. Consider a household replacing a fridge which unexpectedly fails. A richer household could pay from savings or consolidate the purchase with others on a credit card. No new debt account is added. In contrast, a poorer household may have to pay using store credit or by borrowing from informal lenders, creating a new debt account and increasing their cognitive burden. While an unexpected expenditure is painful for both groups, the psychological cost of payment is short-lived for the nonpoor, but could linger as chronic debt for the poor.

If debt mental accounting creates bandwidth tax, policy interventions that streamline debts would significantly improve cognitive and psychological functioning and reduce counterproductive behavior. We test this hypothesis with quasiexperimental evidence from a charity-funded debt-relief program, which restructured and

Significance

The impact of chronic debt on the poor is psychological, not just financial. We hypothesize that chronic debt impairs psychological functioning and decision-making, contributing to the poverty trap. This is because debt is not considered fungible and is viewed as costly mental accounts that consume cognitive bandwidth. We test this using quasiexperimental evidence from a one-off, unanticipated debt-relief program worth several months' household income. Comparing the poor before and after debt relief, those with more debt accounts paid off experienced greater improvements in cognitive functioning, reported less anxiety, and became less present-biased. These findings provide actionable evidence for poverty-alleviation policy.

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repaid debts owed by participating low-income, chronically indebted households in Singapore. Because social workers (and not participants) allocated debt relief, debt structure varied quasiexperimentally: For a given dollar amount of relief, some participants had more debt accounts cleared, while others had fewer (*SI Appendix*, Fig. S1). We studied the same participant before and after debt relief, testing whether their chronic indebtedness affected their cognitive functioning, anxiety, and attitudes toward risk and time discounting. We then tested whether changes in debt accounts had greater impact, compared with changes in overall debt levels.

The key concern with our research design is that social workers may structure debt relief to maximize the outcomes of interest or select participants with greater potential for improvement, leading us to overestimate the effects of debt relief. However, institutional features mitigate this. Social workers had no formal training in debt restructuring and had no incentive to select only high-potential participants because they were not directly accountable to, or financially dependent on, the program sponsor. Moreover, selection effects were naturally limited; each social worker was only responsible for a few potential applicants, as eligible households were distributed throughout the country and were served by the closest social-service agency.

To further limit bias, we avoided discussing the study outcomes during the fieldwork to ensure that social workers could not target improvement in our outcome measures. We were also careful to account for training and calendar effects, debt-causing behaviors, and liquidity constraints as confounding explanations. Nevertheless, the caveat remains: As our evidence is quasiexperimental rather than from a randomized controlled trial, identification concerns cannot be completely eliminated.

Two additional caveats must be noted. First, chronic indebtedness in the poor has complex causes. Besides the structural financial stresses of poverty—such as irregular employment, low wages, and exposure to uninsurable health and income shocks—it is possible that counterproductive behavioral traits exacerbate indebtedness. But regardless of cause, if debt impairs cognitive and psychological functioning, it could be extremely challenging for the indebted poor to escape poverty.

Second, apart from mental-accounting costs, other psychological mechanisms play a role in explaining the persistence and burden of chronic debt. Previous studies have examined how repayment strategies affect motivation to pay off debts (16, 17). We set aside the question of how to best repay debts and focused instead on elucidating the psychological burden of indebtedness. Our study also does not directly separate mental accounting from the other bandwidth costs of managing debt, such as scheduling and optimizing repayments (2). However, subjects in laboratory experiments eliminate debt accounts even when there are no costs of debt-account management (10), suggesting that mental-accounting costs are substantial. More importantly, the link between mental accounting and bandwidth tax motivates new policy interventions that consolidate multiple mental accounts, rather than just providing payment reminders or financial counseling to the poor.

Field Study

In 2015, a Singapore-based charity, Methodist Welfare Services, administered a one-off debt-relief program for chronically indebted, low-income Singapore households. Participation was restricted to households with monthly per capita income less than Singapore dollars (SGD) 1,500 (the lowest third of households by income) and that had outstanding chronic debts owed for at least 6 mo. In 2015, one SGD was worth $1.15 United States dollars (USD) at purchasing power parity exchange rates, so participant households had monthly purchasing power less than USD 1,725 per capita. Eligible debts included housing (mortgage or rental), utilities, town council taxes, telco bills, and hire purchase debts. Other debts were considered on a case-by-case basis. Unsecured consumer debts were generally excluded because low-income households in Singapore are restricted by policy from accessing consumer credit and because the charity targeted debts from nondiscretionary spending.

The program was administered through Family Service Centres, which provide local social services in Singapore. Family Service Centre social workers had discretion to identify and endorse eligible clients and debts for relief. Clients could not apply directly. Thus, while clients with greater outstanding debts generally received more relief (up to the program limit of SGD 5,000), conditional on initial debt structure, there was extensive idiosyncratic variation in both the amount of relief granted and the number of debt accounts paid off.

Our study sample consisted of 196 participants, recruited from 656 applicants to the debt-relief program (*Methods*). Participants were surveyed before receiving debt relief and again 3 mo after debt relief. Table 1 reports income and debt characteristics of our sample; additional data and comparisons with all program applicants are in *SI Appendix*, Table S1. Before debt relief, average monthly household income per capita (conditional on positive income) was SGD 364, compared with SGD 541 for the first income decile in Singapore. Although Singapore does not have an official poverty line, the average five-member household in our sample had annual purchasing power worth USD 24,674, below the US Census poverty line of USD 28,741 for a family of five. The average and median debt was SGD 6,257 and SGD 3,574, respectively; the median debt-to-monthly-income ratio was 2.27 (conditional on positive income). On average, households had 3.27 debt accounts. There were some very large debts exceeding the sample average annual income, mostly due to mortgages in arrears; these did not affect the results (*SI Appendix*, Table S2).

Participants received an average debt relief of SGD 2,548, with 25% receiving the maximum relief of SGD 5,000. Three months after debt relief, average debts fell from SGD 6,257 to SGD 4,265, while median debts fell from SGD 3,574 to SGD 1,128, and 90% of participants reported holding less debt. Average debt accounts fell from 3.27 to 2.21.

The Effect of Debt Relief

We measured the effects of debt relief by studying prepost changes in psychological functioning and economic decision-making. We did not ask about attitudes toward debt relief to minimize experimenter demand effects and to avoid social pressure on the participants to appear grateful for debt relief (18). All measures are detailed in *Methods* and *SI Appendix*, sections 1–3.

Cognitive and Psychological Functioning. Poverty is linked to impairments in both cognitive and affective aspects of psychological functioning (1–3). We measured cognitive functioning using the Eriksen flanker test, a standard inhibition-control task from the NIH Toolbox (19, 20). We constructed a combined cognitive-functioning

Table 1. Participant summary statistics pre- and post-debt relief

Variables	Pre-DR	Post-DR
Total debt, SGD	6,257 (8,081)	4,265 (7,957)
Debt accounts outstanding	3.27 (1.32)	2.21 (1.52)
Debt-relief amount, SGD		2,548 (1,671)
Debt-relief accounts paid in full		1.69 (1.02)
Total household income, SGD	1,788 (1,002)	1,754 (1,062)

$n = 196$ participants, except where noted. Mean value is reported, with SD reported in parentheses. Total household income is conditional on positive income (164 participants pre-DR; 167 post-DR). DR, debt relief.

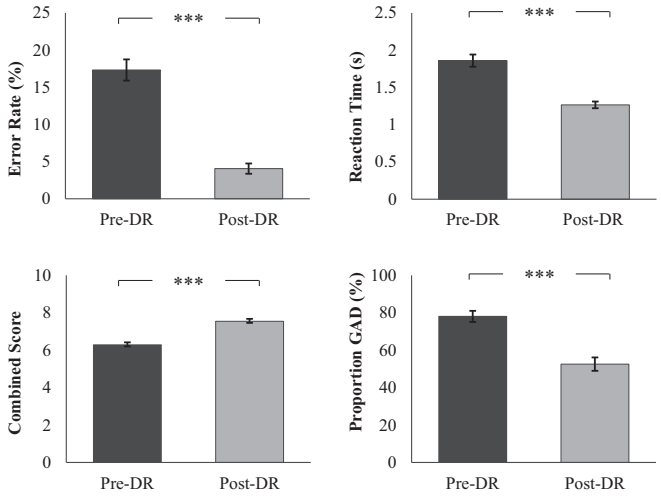

Fig. 1. Psychological functioning measures pre-debt relief (Pre-DR) and post-debt relief (Post-DR). (*Upper Left*) Flanker task error rate. (*Upper Right*) Flanker task trial median reaction time. (*Lower Left*) Flanker task combined score. (*Lower Right*) Proportion with GAD symptoms. $n = 196$ participants. See *SI Appendix*, Table S3 for statistics. Error bars reflect ±1 SEM. Top horizontal bars show statistical significance. ***$P < 0.01$.

score based on the combination of speed (median reaction time) and accuracy (proportion of errors) of the participants' responses. We measured negative affect using the *Diagnostic and Statistical Manual of Mental Disorders IV* (DSM-IV) criteria for generalized anxiety disorder (GAD) (21). We interpreted GAD symptoms as a measure of the psychological response to poverty and indebtedness and not as a mental-disorder diagnosis (11, 12, 22, 23).

Cognitive functioning significantly improved post-debt relief (Fig. 1). The average error rate fell from 17% to 4% postrelief (two-sample t test, two-tailed test: $t = 8.361$, $P < 0.000$). Median reaction time improved from 1.86 to 1.27 s postrelief (two-sample t test, two-tailed test, $t = 6.356$, $P < 0.000$). The combined score rose from 6.29 to 7.54 postrelief (two-sample t test, two-tailed test, $t = -8.130$, $P < 0.000$). The effects of chronic debt on cognitive functioning were large. The standardized effect size is comparable to that of one night's sleep deprivation on the flanker task (24) and is in the upper range of published effects of sleep deprivation on cognitive-functioning tasks (25). The effects were also equivalent to the age adjustment required to normalize the score of a 50-y-old with that of a 23-y-old on the flanker task (26).

Relieving chronic debts also reduced anxiety. Fig. 1, *Lower Right* shows that the proportion of participants exhibiting GAD symptoms fell from 78% to 53% postrelief (two-sample proportions, two-tailed test: $z = 5.306$, $P < 0.000$). Notably, 38% of the participants with GAD prerelief stopped exhibiting symptoms postrelief. These improvements are consistent with observational studies linking indebtedness to poor psychological health (11, 12).

Economic Decision-Making. We study risk and intertemporal choices because the poor exhibit greater risk aversion and present bias (27–29). We measured risk aversion using a lottery-choice experiment which trades off payoff variance against expected payoff (30). This lottery task is relatively simple and generates less measurement noise, especially from participants with poorer math skills (31). The lottery choice provides the participant's constant relative risk aversion (CRRA) parameter interval, with higher CRRA parameters indicating greater risk aversion.

We measured time discounting using a money-earlier-or-later experiment with two incentivized multiple price lists (32–34). Participants chose between receiving a varying smaller payoff earlier and a larger fixed payoff later; one price list included an immediate payoff. Present bias is characterized by dynamically inconsistent choices—that is, greater impatience (preferring an earlier, smaller payoff to a larger, later payoff) when an immediate payoff is available and less impatience when both payoffs are in the future. To avoid confounding uncertainty over future payoffs with impatience (35), we gave participants the researchers' contact information on a dated payment slip and promised to deliver future-dated payments in cash. Our main analysis used a binary indicator for present bias, based on 149 participants with consistent choices in all time-discounting experiments. The results were broadly similar when inconsistent participants were included (*SI Appendix*, section 3 and Table S4).

Fig. 2, *Left* shows a significant reduction in risk aversion after debt relief, as participants shift toward more risky lotteries (two-sample Wilcoxon rank-sum test: $z = 3.327$, $P < 0.001$). Notably, the proportion choosing the no-risk lottery "(28, 28)" fell from 32% to 20% after debt relief, while the median CRRA parameter fell from $0.71 < r < 1.16$ to $0.50 < r < 0.71$. This reduction is comparable in magnitude to the gender gap in risk aversion (30) and is similar to the reduction in risk aversion going from the lower to the upper half of the IQ distribution (36).

Fig. 2, *Right* shows that present bias fell significantly from 44% to 33% after debt relief (two-sample proportions, two-tailed test: $z = 1.907$, $P < 0.057$); see *SI Appendix*, Table S5 for results in terms of "beta-delta" quasihyperbolic discount parameters (33, 37).

Debt Structure and Bandwidth Taxes

The prepost debt-relief analysis showed that chronic debts significantly impair psychological functioning and increase risk aversion and present bias. As with ref. 2, these findings alone do not explain how bandwidth taxes impair psychological functioning. To address this, we examined the role that debt structure plays in creating bandwidth taxes. The hypothesis is that a debtor who owes more debt accounts will bear greater bandwidth costs because mental-accounting processes cause each additional debt account to become a separate source of cognitive load. If so, a participant who has more debt accounts cleared (controlling for debt-relief amount) should have their bandwidth taxes reduced by a greater extent and would experience larger improvements in psychological functioning and decision-making. The quasiexperimental variation in debt structure generated by social workers assigning debt relief allowed us to separately identify the effect of debt accounts and debt-relief amounts.

We conducted an intent-to-treat analysis of the debt-relief program, using administrative data on the structure of debt relief granted, rather than changes in actual debt structure from the survey. This addressed concerns that changes in actual debt structure are endogenous, because participants had 3 mo postrelief

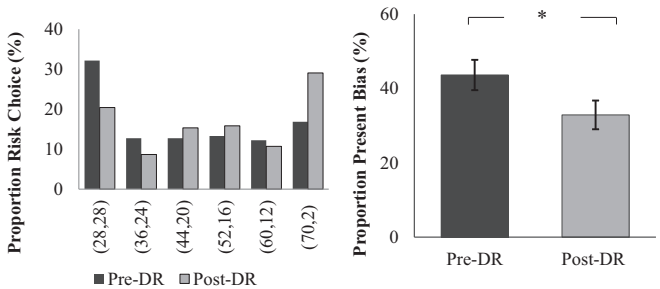

Fig. 2. Economic decision-making pre-debt relief (Pre-DR) and post-debt relief (Post-DR). (*Left*) Proportion making risk choice (196 participants). (*Right*) Proportion with present bias (149 participants). Error bars reflect ±1 SEM. Top horizontal bars show statistical significance. *$P < 0.10$.

to alter their debts. Our results are supported by an instrumental variables model estimating the causal effect of the (endogenous) change in actual debt structure, using exogenous debt-relief grants as an instrument (*SI Appendix*, Table S6).

The Effect of Changes in Debt Structure. Consistent with our hypotheses, we found that reductions in debt accounts were associated with large and significant improvements in psychological and cognitive functioning and with reduced present bias. In comparison, the amount of debt relief granted had a relatively small, and often statistically insignificant, impact on participant outcomes.

Clearing one debt account was associated with an improvement in cognitive functioning comparable to granting SGD 1,340–2,182 of debt relief ("flanker" columns, Table 2). The debt-account effect on the flanker composite score corresponded to an improvement of nearly one-quarter of a SD at the population level, when our effect sizes were calibrated to the population norm based on the NIH Toolbox (26). Improvements in anxiety were also significantly linked to debt-account clearance, while there was no effect of debt-relief amount ("GAD," Table 2). The coefficient estimate suggests that thousands of dollars of relief are equivalent to only one debt-account clearance in reducing anxiety. Taken together, debt mental-accounting costs appear to cause greater impairment of psychological and cognitive functioning than debt levels do.

The effects of debt accounts on economic decision-making were mixed. There was no significant relationship between changes in debt structure and risk aversion ("Risk Aversion," Table 2). While some subsamples (*SI Appendix*, Tables S2 and S7–S9) showed greater debt relief, and more debt accounts cleared were weakly correlated with reductions in risk aversion, overall, the evidence did not support a clear link. However, reductions in debt accounts were significantly associated with reduced present bias, while debt-relief amounts had no effect ("Present Bias," Table 2). The effects of debt accounts on present bias were statistically significant across robustness checks and were also broadly consistent (albeit less statistically significant) when the beta parameter was the measure of present bias (*SI Appendix*, Table S5).

Confounding Factors for the Effects of Debt Structure. The prepost research design does not control for training effects and calendar effects. Training effects are a concern for the flanker-task measure of cognitive function because response speed and accuracy may improve with practice. However, simple training effects do not explain why debt-account reductions are strongly correlated with improvements in cognitive function.

To test for whether training effects might explain average improvements postrelief, we conducted a simulation analysis that created a counterfactual where all cognitive-function improvements were due purely to training effects. The results showed that it is very unlikely that even half of the average improvement in cognitive function was attributable to training effects (*SI Appendix*, Fig. S2). Further evidence comes from the timing of debt-relief notification. We found that the average improvement in cognitive function was smaller among participants who were already aware of debt-relief approval at the point of the prerelief survey (*SI Appendix*, Fig. S2). These anticipation effects suggest that the average improvements in cognitive function were due to debt-relief effects rather than training effects.

Training effects were of less concern for our other measures. The anxiety measure was a battery of questions on whether the participant experienced anxiety symptoms, and the risk-aversion and time-discounting measures were incentivized choices. None of these measures should change systematically with prior exposure.

Calendar effects, such as holidays or seasonal shocks at the point of survey, can introduce spurious correlation. To minimize calendar effects, we designed the fieldwork schedule to avoid holiday periods when possible, as these might affect participant debt levels, incomes, and study outcomes. Other than holidays, our setting has minimal seasonal income or expenditure shocks. Singapore is a tropical city with the same weather year-round, and while some employers pay annual bonuses, these payments are idiosyncratic to the employer and thus occur throughout the year. However, due to fieldwork constraints, we were unable to completely avoid Ramadan, the Muslim fasting month. Since blood glucose levels may affect psychological functioning and decision-making (38), we prioritized interviewing non-Muslims during the 1 wk of fieldwork overlapping Ramadan, and we also show that our results are robust to excluding participants interviewed on days potentially affected by calendar effects, as well as to religion-based subsamples (*SI Appendix*, Table S8).

Reverse causality is another potential confound, since individual behaviors—such as risk aversion and time preferences—could determine indebtedness, rather than the opposite. We can rule out reverse causality because the changes in debt we studied resulted from exogenously granted debt relief. However, our estimate of the effects of debt relief may still be biased if debt relief is strongly correlated with initial debts.

To address this, we show that the debt-relief decisions made by social workers resulted in substantial variation, so that more-indebted participants did not always receive more relief. We found that 72% of our participants received significantly less relief than their total eligible debts, and, overall, debt relief amounts were only moderately correlated (0.55) with initial debt levels. On average, relief granted was SGD 3,709 less than total eligible debts, and the SD of the difference was SGD 7,293. As a further robustness check, we excluded participants who had all eligible debts relieved (*SI Appendix*, Table S9) and found broadly similar results.

Table 2. The effect of changes in debt structure on psychological functioning and economic decision-making

Variables	Error rate (flanker)	Response time (flanker)	Combined score (flanker)	GAD	Risk aversion	Present bias
Debt-relief amount	−0.026*** (0.006)	−0.043*** (0.016)	0.222*** (0.048)	−0.020 (0.018)	−0.110 (0.072)	0.029 (0.017)
Debt accounts paid off	−0.035*** (0.010)	−0.095*** (0.024)	0.353*** (0.086)	−0.113*** (0.025)	−0.220 (0.140)	−0.100*** (0.032)
Constant	0.170*** (0.007)	0.445*** (0.021)	6.337*** (0.065)	0.773*** (0.018)		0.430*** (0.026)
Observations	392	392	392	392	196	298
Number of participants	196	196	196	196	196	149

Each column reports a separate ordinary least-squares regression model with controls for individual fixed effects, except for "Risk Aversion," which uses an interval regression model on first-differenced data. "Debt-Relief Amount" is in SGD thousands. The "Error Rate" dependent variable is the proportion of incorrect flanker trials (1.0 = all trials incorrect). The "Response Time" dependent variable is the log of median response time in seconds, based on all flanker trials for that participant. The "Combined Score" dependent variable is a 0–10 scale that combines flanker error rate and response time. The "GAD" dependent variable is 1 for GAD symptoms and 0 for no GAD. The "Risk Aversion" dependent variable is the change in the CRRA parameter interval pre- and post-debt relief. The "Present Bias" dependent variable is 1 for present bias and 0 for no present bias, and it excludes respondents with inconsistent time-discounting choices. *SI Appendix*, section 3 details the measures. Robust SEs are in parentheses. ***$P < 0.01$.

Next, we considered liquidity constraints as an alternative explanation: Highly indebted participants may exhibit present bias and risk aversion because having money in hand is more important when it is difficult to borrow (13). If so, changes in decision-making may be attributable to improvements in liquidity constraints, rather than changes in debt structure.

In practice, the effect of debt relief on liquidity constraints is limited. Liquidity from access to consumer credit is unlikely to improve postrelief because financial institutions in Singapore are required to implement an income test to grant credit, and, hence, our sample does not qualify for credit, even after debt relief. Consumer credit reports also do not track the debt types covered by the program.

Liquidity from access to secured credit may be affected because about one in four participants received debt relief for past-due mortgage installments. Although housing regulations restrict home-equity loans, home equity could be tapped through sale or rental. We tested for liquidity effects and found that improvements in present bias were no greater for homeowners who experienced increases in housing equity (*SI Appendix*, Table S10).

Debt relief may improve liquidity through informal credit access: When debt accounts are cleared, creditors may allow greater flexibility with payments. However, the value of informal credit is low. The most conservative estimate, based on the difference between relief granted and actual changes in debt, suggests that, on average, informal credit access is worth up to SGD 556 over 3 mo. As low-income households in Singapore already receive social assistance, this modest improvement in liquidity may not provide sufficient improvement in living standards to change psychological functioning (3, 14). More importantly, there was little correlation between informal credit access and debt-account clearance, suggesting that the effects of debt-account clearance were not simply proxies for improvements in informal credit access (*SI Appendix*, Fig. S3). Nonetheless, we acknowledge that we cannot completely rule out all liquidity effects in our analysis.

Linking Psychological Functioning to Decision-Making. Although we have treated psychological functioning and economic decision-making as independent outcomes, a rich body of theory and evidence suggests that the two are closely related (3, 39–42). We provide descriptive evidence on this relationship; causal inference is challenging because we only measure limited aspects of negative affect and cognitive function, and the debt-relief intervention alters multiple aspects of psychological functioning simultaneously, making it difficult to isolate impacts.

First, we explored the connection between negative affect and decision-making. We found that participants with reduced anxiety postrelief expressed lower risk aversion (*SI Appendix*, Table S11). This is consistent with earlier evidence linking exposure to chronic stress with increased risk aversion (42). What remains an open question is whether the effects of chronic stress can be fully reversed through debt relief. Scarring may permanently alter decision-making, so our evidence may represent only a partial recovery to cognitive processes before chronic indebtedness (43). In addition, psychological affect may change because debt relief may motivate participants to alter their own behavior. For example, self-efficacy may be strengthened as participants use debt relief to improve their personal finances, hence reducing negative affect and improving decision-making (17, 44).

Next, we considered the link between cognitive functioning and decision-making. We found that participants with greater improvements in cognitive functioning also expressed greater consistency in the money-earlier-or-later experiment (*SI Appendix*, Table S12). However, we did not find evidence of other associations between improved cognition and decision-making (*SI Appendix*, Table S11). Future research could unpack other dimensions of cognitive functioning impacted by debt and identify the cognitive pathways most closely linked to economic decision-making (15).

Overall, our results, due to their quasiexperimental nature, should not be taken as a complete picture of the relationship between debt, psychological functioning, and decision-making. Still, they demonstrate that the bandwidth costs of debt mental accounts are a pathway that impairs psychological functioning and alters decision-making.

Comparison with Previous Studies. To explore external validity, we compared our study to the two closest field studies examining the effects of poverty on psychological functioning and decision-making (2, 13). These studies are of interest because their results contrast: Ref. 2 found significant changes in cognitive functioning in farmers after the harvest, while ref. 13 did not find meaningful changes in psychological functioning or in decision-making (except in present bias) in the urban poor after payday. We focused on cognitive functioning and risk aversion, which have directly comparable measures across the studies. Each study measures the inhibition-control aspect of executive cognitive function (14, 45), with our study and ref. 13 using the flanker task, while ref. 2 uses the Stroop task. Our study and ref. 13 measure risk aversion using the same elicitation experiment, including the same lottery values in nominal terms.

Our comparison, reported in *SI Appendix*, Table S13, shows that debt-relief-induced improvements in cognitive functioning are somewhat larger than those found in farmers postharvest (2) and more than 10 times larger than the (statistically insignificant) point estimates found in the urban poor postpayday (13). While debt relief significantly reduces risk aversion, there is no effect of payday on risk aversion (13).

These results show that resource shocks improve cognitive functioning across different poverty contexts, and not just under absolute poverty. They also suggest that resource shocks must meaningfully alter the structure of household finances to affect psychological functioning and decision-making. In our study, participants received extensive debt relief and restructuring, while in ref. 2, many farmers used harvest income to repay accumulated debts. In contrast, the payday cycle studied in ref. 13, while having a measurable impact on expenditures, appears insufficient to allow households to restructure their finances.

Discussion

The impact of debt on the poor is psychological, not just financial. Debt causes significant psychological and cognitive impairment and alters decision-making. However, debt has these effects not just because of the economic costs of holding debt, but because debt mental accounting creates bandwidth taxes that impair cognitive processes. Understanding this pathway motivates new approaches to poverty policy. As an illustration, consider two possible housing policies to improve the cognitive functioning of low-income tenants who fall behind on their bills. A policy that considers mental-accounting costs would combine bills for rent, power, water, and maintenance into one statement instead of billing tenants separately. But a policy which ignores mental-accounting costs might simply apply automatic payments, send tenants reminders, or coordinate billing on the same repayment schedule (46). Our study suggests that policies which consider mental-accounting costs may be more effective.

Going further, we propose two important emerging areas for policy and research. The first is to examine the relative cost-effectiveness of targeting the psychological, vs. economic, costs of debt. While debt relief is effective, it is costly and must be implemented with care to avoid dependence. In comparison, debt restructuring and financial consolidation to reduce mental-accounting costs in the poor may be a more sustainable policy.

The second is to critically evaluate the bandwidth tax trade-offs of policies that encourage people to narrowly bracket decisions as

mental accounts to shape behavior. These include commitment devices such as child-education accounts or job-performance targets in the task economy. When people have resources, mental accounting may help motivate people to overcome their self-control problems and achieve outcomes that are genuinely welfare enhancing. But in tandem with poverty, or any other deficit of resources, encouraging excessive mental accounting, particularly when loss frames are evoked, imposes psychological costs that may far outweigh other benefits.

Methods

Recruitment and Ethics. The National University of Singapore (NUS) Institutional Review Board approved the study (NUS 2518). All participants provided informed consent. Participation was voluntary, could be withdrawn at any time, and did not affect debt-relief benefits. We recruited our sample of 196 participants through social-worker referral (with participant consent) from the 656 applicants to the program. Privacy laws prevented access to applicant data for random sampling. We received 281 referrals and completed initial interviews with 238. After excluding debt-relief rejections, clients receiving relief for noneligible debts (indicating exceptions to policy), and clients uncontactable in the follow-up wave, we were left with 196 participants.

Measures of Psychological Functioning and Economic Decision-Making. Cognitive functioning was measured with the Eriksen flanker task (20). Each participant completed 20 trials, where a central stimulus was presented, surrounded by distracting stimuli ("flankers"). The participant exercised executive control to ignore the distracting stimuli and identify the central stimulus quickly and accurately. Psychological functioning was measured by using self-reported responses to the eight-question battery for GAD in the DSM-IV (21). Risk aversion was measured with a lottery-choice task (30). Participants chose one of six lotteries: (SGD 28/SGD 28), (SGD 36/SGD 24), (SGD 44/SGD 20), (SGD 52/SGD 16), (SGD 60/SGD 12), or (SGD 70/SGD 2), each with a 50–50 chance of winning the higher or the lower reward. Time discounting was measured with two multiple-price lists (32–34). In each price list, participants traded off receiving a varying smaller payoff earlier (the smallest was SGD 32) vs. a larger fixed payoff of SGD 50 at a later date. The first price list offered payoffs today vs. 1 mo later, while the second offered payoffs at 6 mo vs. 7 mo later. More details are in *SI Appendix*, sections 1–3.

Data Sharing. Debt-relief program administrative data are owned by the charity and are not publicly available. These administrative data were required to compute *SI Appendix*, Table S1. The charity can be contacted at https://mws.sg. All other data required to replicate all analyses in the paper are available as Datasets S1 and S2.

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