The Effect of Debt on Cognitive Functioning and Decision Making in the Poor*

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Abstract

We study how changes in indebtedness and resources affect human functioning. Highly indebted low-income households in Singapore benefited from a one-off, unanticipated debt relief program that delivered a financial shock equivalent to several months’ household income. We measured household finances, anxiety, cognitive functioning, and economic decision making pre- and post-debt relief. Debt relief significantly improved cognitive functioning and reduced anxiety, risk aversion, and present bias. However, we do not find evidence that relief-driven changes in cognitive functioning are linked to changes in economic decision making. A key mechanism explaining why debt relief improves cognitive functioning is that indebted households are burdened by financial management. Targeting cognitive resource constraints, such as through eliminating debt accounts, could be more effective at alleviating poverty than providing untargeted transfers.

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*Preliminary; revisions expected soon. Please do not circulate, but kindly refer interested parties to the corresponding author. We apologize in advance to the many parties who have contributed to our project for not including acknowledgements in this draft.

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1 Introduction

Recent studies have challenged the conventional view that entrenched poverty stems from structural factors and patterns of rational but sub-optimal decision making (Bertrand et al., 2004; Baer et al., 2012; Shah et al., 2012; Mani et al., 2013; Haushofer and Fehr, 2014; Cavarlho et al., 2016). The alternative hypothesis is that scarcity itself harms human functioning, by sapping cognitive resources and causing stress and anxiety, which then impairs the quality of decision making. Under this view, the risky and impatient decisions made by the poor may be rooted in scarcity-driven deficits in human or psychological functioning (Lawrance, 1991).

Understanding whether and how scarcity harms human functioning is important for informing interventions designed to alleviate poverty. For example, interventions aiming to improve individual attitudes and decision making may be futile if psychological functioning remains impaired from scarcity. However, the basic question of whether poverty causes significant changes in cognitive functioning is far from settled. While the rural poor experience significant deficits in cognitive functioning when exposed to annual harvest cycles (Mani et al. 2014), no such effects on functioning are found in the urban poor over the payday cycle (Carvalho et al. 2016).

We address this question by studying the effects of a sharp, unanticipated positive wealth shock through a one-off debt relief program targeted at highly indebted low-income households in Singapore. Similar to the existing field literature, we use the exogenous changes in real resource constraints provided by debt relief to identify the causal relationship between poverty and human functioning. We conducted a comprehensive household financial survey, augmented with measures of anxiety and cognitive functioning on the beneficiaries of the debt relief program shortly before and three months after the announcement of program application results.

Our main finding is that households receiving debt relief exhibit improved cognitive functioning, and reduced anxiety, risk aversion, and present bias. This supports the hypothesis that scarcity causes significant harms to human functioning, and also demonstrates realistic interventions can remedy these deficiencies. Our results also reconcile contrasting evidence from the literature, and suggest that significant shocks to scarcity are required before the impacts on human functioning are apparent (Mani et al. 2014), particularly in a developed economy context, where social safety nets may render the effects of small payday cycles on the urban poor insignificant (Carvalho et al. 2016).

However, the basic finding that poverty impairs human functioning is insufficient to motivate realistic policy interventions. We thus investigate the potential chain effects of scarcity on psychological functioning, and hence economic decision making. Prior studies have generally focused on piecemeal components of the chain, either on poverty and cognitive functioning, or on cognitive functioning and suboptimal economic decision making. Other than field studies by Mani et al. (2014) and Carvalho et al. (2016), the evidence is generally based on laboratory experiments or observational data (Raghunathan & Pham, 1999; Dohmen et al., 2010; Benjamin et al., 2012; Haushofer et al., 2014); we are unaware of other studies that attempt to link, in a field population, the relationship between scarcity, functioning, and decision making. We find only partial evidence for the ‘chain effect’: while debt relief does induce significant improvements in cognitive functioning and reduces anxiety, these changes do not explain reductions in risk aversion and present bias. This suggests further work is needed to investigate whether the locus for changes in economic decision making resides outside the measures of psychological functioning that are typically used.
We also provide evidence on the policy-relevant economic mechanisms through which resource shocks affect human functioning. While the current literature tends to abstractly treat scarcity as the aggregate absence of resources (Mani et al. 2014; Carvalho et al. 2016), the details of how scarce resources are managed matter. For example, a household with more creditors must make more complex and cognitively costly financial decisions than one owing the same aggregate sum to only one creditor. Based on variation in how debt relief was assigned by program administrators to debt accounts, we show that the cognitive and psychological costs of managing complex household debt accounts are just as if not more important than the aggregate absence of resources. Eliminating one debt account improves cognitive functioning by a comparable amount to reducing aggregate debt by SGD1238. In particular, targeting financial assistance to eliminate a debt account significantly reduces anxiety, whereas the magnitude of aggregate assistance has no impact on affect whatsoever. This suggests that targeted financial assistance could potentially generate larger improvements in human functioning than cash transfers, if policymakers use insights from the literature to eliminate specific types of resource constraints that disproportionately affect functioning.

The remaining paper is structured as follows. Section 2 provides the details of our field study. Section 3 presents the results while Section 4 compares our findings with Mani et al. (2013) and Carvalho et al. (2016). The final section concludes.

2 Field Study

2.1 Debt relief program

In 2015, a Singapore-based charity, Methodist Welfare Services, administered a one-off debt relief program targeted at chronically indebted low-income Singapore resident households. Participation was restricted to households with monthly per capita incomes of less than SGD1500, and who had outstanding eligible chronic debts of at least six months’ duration. Eligible debts included housing arrears (mortgage or rental), utilities arrears, town council arrears, telco arrears and hire purchase arrears. Other types of debt were considered on a case by case basis. In particular, unsecured consumer debts were generally excluded because such debts are rare amongst low-income households in Singapore due to income-based restrictions on credit access, and because the charity targeted debts attributable to non-discretionary spending.

The program was administered through a network of Family Service Centres, which provide local social services to needy families throughout Singapore. Family Service Centres are operated by charities and are financially supported by the Singapore Government, which assigns centres to serve specific geographic areas. Family Service Centre social workers identified eligible participants from existing clients, and endorsed and filed applications on their clients’ behalf. While we have no data on how social workers identified participants, the

1 Although the charity is affiliated with the Methodist Church, charitable institutions in Singapore are required to serve the general public to qualify for tax-exempt status. Program recipients were representative of low-income households in Singapore.

2 The per-capita income limit of SGD1500 means households in the lowest three deciles of the income distribution in Singapore would qualify for the program. Household per-capita income in the third decile in 2015 was SGD1446. (Department of Statistics Singapore 2016)

3 As Family Service Centres serve a specific geographic area, clients are generally not permitted to ‘shop around’ to receive services from a Centre serving a neighbouring region.
charity did not advertise the program directly to potential clients, so the program was effectively unanticipated.

The debt relief program attracted 656 applications, of which 94% were approved. Program payouts were consistent with the eligible debt guidelines, with 593 beneficiaries (95% of all approved applications) receiving debt reduction in at least one eligible debt type. We study only clients who received all relief dollars in eligible debts, as other relief granted suggests circumstances were exceptional for reasons we do not observe.

The three most common debt types paid were utilities (52%), housing (43%) and telco (33%). Beneficiaries received debt relief ranging from SGD75.50 to SGD5000; the average was SGD2394, and the median SGD1994. 21% of beneficiaries received the maximum debt relief of SGD5000. Beneficiaries did not receive cash transfers, as the charity paid creditors directly.

2.2 Survey sample

Due to personal data protection laws, we were unable to directly solicit study participation from a master list of all applicants to the debt relief program. Instead, we worked with Family Service Centres to refer applicants to our study. At the time of recruitment and referral, beneficiaries knew that they had applied for the debt relief program, but were unaware of program approval. Additionally, several months had elapsed between program application and the study recruitment date.

Our study design consists of a comprehensive household financial survey, augmented with measures of psychological and cognitive functioning. Study participants were provided with compensation for their time, and economic decision making tasks were incentivized. The study’s first wave was designed to capture data pre-debt relief, while the second wave captured data three months post-debt relief.

Our first wave captured data on 241 debt relief program participants; the second wave successfully followed-up with 238 participants. However, our analysis excludes participants with incomplete data on household finances, psychological functioning, or economic decision making. We also excluded 29 participants who received relief for ‘non-eligible’ debts, as their debts are unrepresentative of typical low-income household finances, and because their circumstances must have been exceptional for program administrators to provide such relief. Because the distribution of household debt is skewed with a few participants reporting very large debts, we exclude those with pre-relief debt levels above the 95th percentile. Our analysis sample consists of a balanced panel of 175 participants.

Table 1 reports income and debt characteristics of our sample. In general, our sample is representative of very low-income, vulnerable households in Singapore. Prior to debt relief, average household income per capita conditional on employment income was SGD 359,

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4 At the time of study recruitment, we were informed by the program administrator that all valid applications with eligible debts would be approved up to the per-beneficiary relief cap of SGD 5,000. As far as we know, this information was never communicated to applicants.

5 As is standard for household surveys, participants could refuse to answer questions without penalty. We included participants with missing data, as long as the participant answered all questions on household finances, psychological and cognitive functioning, and economic decision making.
compared to SGD 541 for the first income decile in Singapore.\(^6\) 17% reported zero household income from work, although such households typically receive some public assistance.\(^7\) Income characteristics three months after debt relief are similar.

Pre-debt relief, the average debt was SGD3780, and the median SGD2949. The median household (conditional on having positive income) owed approximately 1.77 times total household income in debts. Our participants received an average debt relief of SGD2319, with 19% receiving the maximum debt reduction of SGD5000. Participants’ debt relief amounts are broadly comparable to those received by program beneficiaries in general, as reported above.

Our survey results show that debt relief provides an effective wealth shock and significantly alleviates resources constraints. Three months post-debt relief, the average debt level fell from SGD3780 to SGD1944, while 90% of participants reported holding less debt. Average outstanding debt accounts also fell from 3.17 to 1.30.\(^8\) These statistics also suggest partial conversion of debt relief ‘wealth’ into consumption, as there is a net difference of $483 between the average debt relief amount, and the actual change in average debt held three months after relief.

Table 1. Summary Statistics of Study Participants Pre- and Post-Debt Relief

<table>
<thead>
<tr>
<th>Variables</th>
<th>Statistics</th>
<th>Pre Debt Relief</th>
<th>Post Debt relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total debt</td>
<td>Mean</td>
<td>3,780</td>
<td>1944</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>2,941</td>
<td>2668</td>
</tr>
<tr>
<td>Number of debt accounts outstanding</td>
<td>Mean</td>
<td>3.17</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>1.34</td>
<td>1.29</td>
</tr>
<tr>
<td>Debt relief amount</td>
<td>Mean</td>
<td></td>
<td>2319</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>1587</td>
</tr>
<tr>
<td>Debt relief accounts</td>
<td>Mean</td>
<td></td>
<td>1.68</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.91</td>
</tr>
<tr>
<td>Proportion of respondents with zero household income per capita</td>
<td>%</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>Household income per capita (SGD) (for households with at least one working member)</td>
<td>Mean</td>
<td>359</td>
<td>371</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>204</td>
<td>222</td>
</tr>
<tr>
<td>Household Size(^1)</td>
<td>Mean</td>
<td>4.91</td>
<td>4.86</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>1.98</td>
<td>2.00</td>
</tr>
<tr>
<td>Employed</td>
<td>%</td>
<td>53%</td>
<td>60%</td>
</tr>
<tr>
<td>Female</td>
<td>%</td>
<td>78%</td>
<td>78%</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>175</td>
<td>175</td>
</tr>
</tbody>
</table>

\(^6\) Department of Statistics Singapore, 1\(^{st}\) to 10\(^{th}\) Decile, Average Monthly Household Income from Work Per Household Member Among Resident Employed Households, 2015.

\(^7\) While our survey asked about income from various sources, the table reports only income from work. In general, households in Singapore have more difficulty recalling and reporting income from Government transfers and non-work sources, compared to work income.

\(^8\) The results hold when we exclude those who had a increase in debt despite benefiting from debt relief.
2.3 Identification

Because debt relief is capped by the lower of eligible debts or SGD 5,000, households with greater debt at program application receive more relief on average. This affects our analysis if debt is endogenous. Households with more debt might have a larger difference between income and desired consumption, or, may have lower costs (mental or otherwise) of managing chronic debts.

We address these identification concerns several ways. First, if households who have greater debt management abilities also hold more debt, this biases our estimates of the effect of debt relief towards zero, as it implies that their cognitive abilities should be less badly affected by debt. Our estimates are likewise biased towards zero if households carry more debt due to pressing domestic concerns, such as caregiving or chronic illnesses. Debt relief does not directly address underlying domestic concerns, which independently pressure cognitive abilities, so we should expect less improvement.

Second, our empirical estimates are based on administrative data on debt relief payments rather than the difference in self-reported debt between waves. The net difference in self-reported debt is endogenous for the reasons discussed above, as households adjust finances during the three months after debt relief and the second survey wave, and may translate part of debt relief into consumption.

Finally, our key results are based on pre-post comparisons of the same individual as they benefit from the debt relief wealth shock. In general, we do not consider cross-sectional analyses because of the obvious difficulty in making causal inferences between an individual’s endogenous debt status and their cognitive functioning. This discussion indicates our results may be taken as a lower bound of the effects of debt relief on functioning, as the most obvious sources of endogeneity bias our estimates towards zero.

3 Results

3.1 Psychological functioning

Prior literature established a potential causal link between resource scarcity (‘poverty’) and impaired psychological and cognitive functioning, based on the hypothesis that scarcity creates mental ‘overhead’ costs when the poor manage limited resources to meet basic consumption needs (Mani et al., 2013).

Our study provides insights on several channels through which scarcity – proxied by indebtedness – affects functioning. The simplest channel is that wealth allows low-income households to consume more, and to manage consumption needs better. Debt relief is effectively a wealth shock, and the summary statistics earlier suggest households translated a portion of relief into consumption.

The second channel is that liquidity constraints may prevent low-income households from managing consumption efficiently. Low-income households with greater debts are effectively more liquidity constrained. Low-income households may strategically use billing accounts as credit sources to smooth consumption, since creditors continue to provide services even if
bills are in default. The housing authority, for example, hesitates to evict low-income residents behind on their rent. However, creditors consider the magnitude and duration of unpaid bills when deciding whether to terminate services. High indebtedness creates a significant risk of service termination, increasing liquidity constraints.

A final channel where indebtedness affects psychological functioning is through the cognitive load imposed by managing multiple debt accounts. Previous research suggests individuals are debt account averse, and target paying off debt accounts rather than minimizing borrowing costs (Amar et al., 2011) – suggesting mental costs of debt account management are substantial. In our context, participants who have multiple accounts in default must carefully channel limited funds to paying off each account sufficiently to forestall creditor sanctions. The mental costs of managing multiple accounts in default are compounded by creditor debt recovery actions, such as threats of legal action or service termination. Additionally, the mental accounting framework (Thaler 1999) implies the indebted view each creditor account as a separate cause of stress, rather than take an aggregate view of the household’s savings and debts. Therefore, the first dollar of debt in a new debt account may cause more distress than the marginal dollar in an existing debt account.

While our study extends the literature in providing evidence on both the liquidity constraint channel, and the debt accounting channel, we recognize that the debt relief design cannot cleanly separate effects. Program administrators did not randomly assign debt relief allocations, but instead followed the principle of attempting to close as many accounts as possible, up to the relief cap. In addition, relaxing the liquidity constraint channel in our study effectively means providing a wealth shock – unlike Mani et al. (2014) and Carvalho et al. (2016) where the anticipated income shocks should not have increased wealth. Nonetheless, we believe the results provide useful insights into the relative importance of the magnitude of liquidity constraints versus debt accounts on psychological functioning.

### 3.1.1 Cognitive functioning

We measured cognitive functioning using the Eriksen Flanker test, a well-established inhibitory control task adopted from the NIH toolbox (Zelazo et al. 2013), and also used in Carvalho et al. (2016). In each test trial, a central stimulus is presented, together with potentially distracting surrounding stimuli (“Flankers”). The respondent must consciously ignore the distracting stimuli to identify the central stimulus quickly and accurately. Each Flanker test consisted of 20 trials. Following Zelazo et al. 2013, we constructed a composite

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9 As discussed earlier, low-income households in Singapore do not access consumer credit to smooth consumption. However, our results should hold in contexts where consumer credit is extended to low-income households, since financial institution decisions to offer consumer credit are obviously affected by current indebtedness. Even when consumer credit is available, low-income households may find that the implied rates of interest on using billing accounts for informal credit may be lower than that charged by financial institutions.

10 We note that our analysis generalizes beyond the case of low-income households with quantifiable financial debts. To the extent that low-income households depend on the goodwill of peers, neighbours, and society at large – for example, for favours when times are tight – there may be many social debts accounts that the household must manage.
cognitive functioning score based on the combination of speed (median reaction time for each decision) as well as accuracy (proportion of errors) of the respondents’ responses.\textsuperscript{11}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Comparison of Cognitive Functioning (measured by Eriksen Flanker Test) Pre and Post Debt Relief: Error Rate (Top left), Median Reaction Time (Top right), Combined Score (Bottom left) and Comparison of Proportion of Respondents with Generalized Anxiety Disorder Pre and Post Debt Relief (Bottom right). Error bars reflect ±1SEM. Top horizontal bars show statistical significance. *p<0.10, **p<0.05, ***p<0.01}
\end{figure}

For ease of comparison with previous studies, Figure 1 reports the error rate and median reaction time of respondents separately, in addition to the composite score and the proportion with generalized anxiety disorder (discussed shortly). We find that cognitive functioning significantly improves post-debt relief. The average proportion of errors fell from 18\% pre-relief to 4\% post-relief (Two-sample Wilcoxon rank-sum test, $z=6.557$, $p < 0.000$, $n = 175$ respondents). The median reaction time improved from 2.08 seconds pre-relief to 1.41 seconds post-relief (Two-sample Wilcoxon rank-sum test, $z=5.443$, $p < 0.000$, $n = 175$ respondents). The composite score confirms a significant increase in cognitive functioning, rising from 6.25 to 7.48 post-relief (Two-sample Wilcoxon rank-sum test, $z=6.174$, $p < 0.000$, $n = 175$ respondents).

Table 2 reports results from fixed effects regressions on cognitive functioning. We find that the magnitude of debt relief is positively associated with larger improvements in cognitive functioning, reducing both error rates and median response times, and improving the composite score. But the number of debt accounts fully paid off also significantly and

\begin{itemize}
\item Respondents who score high on speed but low on accuracy exhibit poor inhibition and executive control. Hence, the combined measure only gives respondents who have high accuracy scores (at least 80\% correct answers) additional score for speed. See Zelazo et al. 2013 for details.
\end{itemize}
independently affects cognitive functioning. The point estimates suggest that clearing one debt account has an effect on cognitive functioning comparable to providing approximately SGD1,006 – SGD1,904 of debt relief.

Table 2. Fixed effects regressions on Cognitive Functioning and Generalized Anxiety Disorder Scores

<table>
<thead>
<tr>
<th>Cognitive functioning</th>
<th>Error Rate</th>
<th>Log Median Response Time</th>
<th>Combined Score</th>
<th>GAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt Relief Amount</td>
<td>-0.0315***</td>
<td>-0.0492**</td>
<td>0.256***</td>
<td>-0.00544</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.022)</td>
<td>(0.062)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Debt Accounts Paid Off</td>
<td>-0.0317***</td>
<td>-0.0937***</td>
<td>0.317***</td>
<td>-0.133***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.029)</td>
<td>(0.098)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.174***</td>
<td>0.544***</td>
<td>6.298***</td>
<td>0.775***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.024)</td>
<td>(0.068)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Observations</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.299</td>
<td>0.179</td>
<td>0.291</td>
<td>0.217</td>
</tr>
<tr>
<td>N</td>
<td>175</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
</tbody>
</table>

Debt Relief Amount is specified as SGD Thousands. Error rate refers to the number of wrong answers out of 20 trials in the task. Log median response time is the median response time taken to enter an answer in 20 trials. Combined score is scale of 0 to 10, comprising of the accuracy score (the inverse of the error rate, rescaled to a maximum score of 5) with a bonus time score (maximum score of 5) given to those with accuracy 80% and above. GAD is a variable equal to 1 if the respondent has GAD symptoms and 0 otherwise. Robust standard errors are in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

3.1.2 Generalized anxiety disorder

We measure anxiety based on whether participants exhibit Generalized Anxiety Disorder (GAD) symptoms, based on a battery of eight questions used in the DSM-IV criteria for GAD (Liebowitz, M. R., 1996). While GAD as a clinical disorder can only be diagnosed by a qualified professional, previous studies have shown that symptoms of GAD – which can be assessed through the diagnostic battery – may arise due to severe environmental deficits (Baer et al., 2012). The latter property makes GAD appropriate as a measure of psychological functioning that may be affected by scarcity.

We find that debt relief significantly reduces the incidence of GAD symptoms (Figure 1, last panel). The proportion exhibiting GAD fell from 78% to 53% post-relief (Two-sample proportions, two-tailed test: z= 4.955, p < 0.000). This change is driven almost entirely by a reduction in GAD symptoms among those identified with GAD pre-relief. 37% of respondents with GAD pre-relief, no longer exhibited symptoms post-relief, contributing to a 29 percentage point reduction in the GAD proportion. Only 6 respondents acquired GAD symptoms post-relief.

Column 4 of Table 2 reports results from fixed effects regressions on the incidence of GAD symptoms. While there is no virtually no relationship between debt relief magnitudes and GAD, having a greater number of debt accounts paid off significantly reduces the likelihood
of exhibiting GAD symptoms post-relief. Indeed, the point estimate of debt relief magnitudes is so small it suggests that tens of thousands of dollars of relief are equivalent to only one debt account clearance. In other words, it is the number of debt accounts that matters for anxiety, not aggregate quantum owed.

3.2 Economic decision-making

Scarcity may affect economic decision making through psychological/cognitive channels, as well as through neoclassical economic channels. In our context, the burdens of indebtedness may impair cognitive functioning, which in turn increases risk aversion and impatience (Dohmen et al. 2010). At the same time, indebtedness combined with liquidity constraints sharply increases the marginal utility of consumption, increasing risk aversion for any rational decision maker. Indeed, present bias may be a rational response to sharp liquidity constraints (Dean and Sautmann 2015; Epper 2015; Cavarlho et al., 2016) find that low-income individuals are more present biased before payday.

Investigating the relative effects of psychological versus economic channels is difficult because the scarcity shocks considered in the literature have been limited. Evidence from laboratory experiments demonstrates exogenous shocks to fear, anxiety, and cognitive ability increase risk aversion and present bias (Hinson et al., 2003, Whitney et al., 2008, Benjamin et al., 2013, Haushofer et al., 2016), while observational studies find in a variety of settings that declining cognitive ability is linked with greater risk aversion and present bias (Dohmen et al. 2010; Benjamin et al. 2013; James et al. 2015). These findings are consistent with dual process theories proposing decisions result from the combination of the patient, risk neutral deliberative system, as well as the impulsive, risk-averse emotional system (Dohmen et al. 2010). However, shocks to psychological and cognitive functioning in laboratory experiments are limited compared to the constraints faced by low-income households in the field.

Our study exploits the substantial and unanticipated wealth shock of debt relief, which generates exogenous variation in both psychological and economic channels on low-income households in the field. This allows us to study the relative impact of financial constraints and psychological functioning on economic decision-making; we are not aware of other studies that are able to study both channels jointly. Our general approach in this section is to analyse the effects of the economic variables and psychological variables separately and then jointly to determine their relative importance.

3.2.1 Risk attitudes

We used the incentivized risk choice task designed by Eckel and Grossman (2002) to measure risk aversion. The task requires participants to choose one of six lotteries: (SGD28/SGD28), (SGD36/SGD24), (SGD44/SGD20), (SGD52/SGD16), (SGD60/SGD12), and (SGD70/SGD2), each with a 50-50 chance of winning the higher or the lower reward. The six lotteries are ordered by decreasing Constant Relative Risk Aversion parameters.\[12\]

[\[12\]This lists (participant choice):(CRRA Parameter Intervals). (SGD28/SGD28):(3.46, +\(\infty\)); (SGD36/SGD24): (1.16, 3.46); (SGD44/SGD20):(0.71, 1.16); (SGD52/SGD16):(0.50, 0.71); (SGD60/SGD12):(0.0, 0.5); (SGD70/SGD2):(-\(\infty\), 0)]
The lottery payoffs are structured such that only participants who are risk neutral or risk seeking would choose the last two lotteries of (SGD60/SGD12) or (SGD70/SGD2). All other choices indicate at least some degree of risk aversion, allowing lottery choices to be coded on a binary basis, where 1 indicates risk aversion by choosing any of the first four lotteries with highest CRRA. In our analysis, we use the CRRA parameter ranges implied by the participant’s lottery choice as the variable of analysis. Our results are similar if we use the binary risk aversion measure instead.

Figure 3 presents the distribution of risk lottery choices pre- and post-relief, indicating a noticeable shift towards more risky lotteries post-relief (Two-sample Wilcoxon rank-sum test: z=-2.862, p < 0.004).

Table 3 presents results from an interval regression on the CRRA parameters obtained from respondents’ choices. The point estimates suggest debt relief amounts, the number of debt accounts paid off, and improvements in cognitive functioning are positively correlated with increasing risk aversion, while reductions in GAD are negatively correlated. However, no results are statistically significant, indicating that the channels that influence risk aversion due to changes in resource constraints are not captured well by our measures. Our results do not support the hypothesis that cognitive impairment causes decision makers to avoid risk (Shah et al., 2012; Haushofer and Fehr, 2014) – but we caution that our measure of cognitive functioning may not capture the locus of decision making under uncertainty.

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13 We obtained first differences of the change in CRRA based on participant choices between the first and second waves. Because CRRA intervals are bounded by infinity for the extreme choices, this created a particular issue. The difference in CRRA intervals is effectively unbounded (-∞, +∞) when participants choose the same extreme choice between waves. This forces us to omit participants who chose the lottery (SGD28/SG28) or (SGD72/2) in both waves from the analysis. For consistency, we also dropped all participants who kept the exact same lottery choice between waves from the analysis. The results are broadly similar if we include those participants. The results are also similar if we assume that CRRA intervals are bounded at a value less than infinity, which allows us to use the entire sample.
### Table 3. Interval Regression on Changes in CRRA Parameters Pre and Post Debt Relief.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt Relief Amount</td>
<td>0.274 (0.405)</td>
<td>0.253 (0.413)</td>
<td></td>
</tr>
<tr>
<td>Debt Accounts Paid Off</td>
<td>0.275 (0.605)</td>
<td>0.293 (0.630)</td>
<td></td>
</tr>
<tr>
<td>Change in Cognitive Functioning</td>
<td>0.458 (0.329)</td>
<td>0.446 (0.330)</td>
<td></td>
</tr>
<tr>
<td>Lose GAD</td>
<td>-0.49 (1.396)</td>
<td>-0.586 (1.408)</td>
<td></td>
</tr>
<tr>
<td>Gain GAD</td>
<td>-2.293 (2.342)</td>
<td>-2.297 (2.546)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-3.008* (1.729)</td>
<td>-2.330** (0.926)</td>
<td>-3.340* (1.834)</td>
</tr>
</tbody>
</table>

Observations: 139 139 139
Number of id: 139 139 139

Debt Relief Amount is specified as SGD Thousands. Robust standard errors are in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

### 3.2.2 Present bias

Time discounting is measured using two incentivized multiple price lists (Harrison et al., 2002; Meier and Sprenger 2008). Each price list requires participants to trade-off receiving a varying smaller payoff sooner, versus a larger fixed payoff of SGD50 at a later date. The first price list offers a choice between payoffs today versus one month later, while the second offers payoffs six versus seven months later. A participant with a lower individual discount factor (‘impatient’) should prefer smaller, sooner payoffs to waiting for larger fixed payoffs. Present bias is characterized by dynamically inconsistent choices, that is, favouring smaller sooner payoffs only when the payoff is immediate, but not when the payoff occurs in the future.\(^\text{14}\)

In common with earlier studies, a proportion of participants (24%) made inconsistent choices, switching multiple times between a smaller, sooner payoff and the larger fixed payoff. We exclude these participants from this analysis. Of the remaining participants, 95% always chose either a smaller payoff, or the larger fixed payoff, in at least one price list. Thus, the individual discount factor for at least one price list cannot be precisely estimated for a significant proportion of participants.\(^\text{15}\) However, the bounded discount factor is sufficient to

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\(^{14}\) Consider a participant who chooses SGD38 today instead of SGD50 next month, and SGD48 in 6 months instead of SGD 50 in 7 months. This participant has a lower discount factor for the near-term choice compared to the longer-term choice. This means the participant is more ‘impatient’ the closer at hand the payoff is, and exhibits present bias.

\(^{15}\) Individual discount factors can still be bounded even if the participant reports no switches within a price list. For example, a participant who always chooses a smaller sooner payoff, and never switches to the later larger fixed payoff of SGD50, should have a discount factor no larger than that implied by a switch at the lowest smaller payoff of SGD30.
identify present bias, so we restrict our analysis to a binary indicator of whether the participant’s choices reflect present bias.\textsuperscript{16}

We find significantly reduced present bias post-debt relief, as shown in Figure 4. The proportion of participants with present bias fell from 44% pre-debt relief to 32% post-debt relief (Two-sample proportions, two-tailed test: \( z=2.147, p < 0.032 \)).\textsuperscript{17} Table 4 reports fixed effects regressions where the dependent variable is a binary indicator with 1 indicating present bias. The number of debt accounts paid off significantly reduces present bias. The amount of debt relief, on the other hand, is not significantly associated with the change in present bias.

There is no evidence of a link between changes in psychological functioning and present bias. Changes in cognitive functioning and GAD are not significantly related to changes in present bias. Thus, while our results clearly show a generalized effect of debt relief on reducing present bias, there is no direct support for one hypothesized mechanism: that scarcity-impaired cognitive functioning generates an excessive focus on immediate payoffs (Shah et al., 2012; Haushofer and Fehr, 2014). The improvement in cognitive functioning amongst our participants does not appear to drive the reduction in present bias.

\textsuperscript{16} Present bias can be imputed reliably even if a participant reports no switches within a price list. For example, a participant who switches at SGD38 today versus SGD50 in one month, but who always chooses SGD50 in 7 months instead of a smaller sum at 6 months, is clearly present biased. The implied discount factor from the first price list, when an immediate payoff is possible, is obviously lower than that implied from the future price list.

\textsuperscript{17} Including the 24% of participants who made inconsistent choices provides similar results. Assuming that inconsistent participants’ ‘real’ discount factors are captured by their first switching point, we find that the proportion of present biased respondents fell from 47% to 34% post-debt relief (Two-sample proportions, two-tailed test: \( z=2.394, p < 0.016 \)).
4 Comparison with previous studies

This section compares our results to the two closest studies of the effects of poverty on psychological functioning and decision making: Mani et al. (2014) and Carvalho et al. (2016). We restrict the comparison to measures that are directly comparable across the studies.

Table 5 shows that our study’s estimate of the change in cognitive functioning caused by debt relief is larger in magnitude than Mani et al. (2014), and similar in precision. Although we use the Flanker task, while Mani et al. (2014) use the Stroop task, we believe this confirms that significant changes in resource constraints can improve cognitive functioning across different contexts of poverty. Our estimates of changes in cognitive functioning are more than ten times larger in magnitude than Carvalho et al (2016). These differences are not caused by model specification, as they persist regardless of whether we analyse our results using Carvalho et al.’s specification, or vice versa.

Debt relief also significantly reduces CRRA, making participants less risk-averse. In contrast, Carvalho et al. (2016) find no payday effect on risk aversion. The CRRA results are particularly comparable because we use the same elicitation method as Carvalho et al. (2016), down to the same value of lottery payments in nominal terms.18

Together, these results suggest the timing, magnitude, and delivery mode of resource shocks matter for impacts on psychological functioning and economic decision making. In our study,

\footnote{The values provided in the risk elicitation lottery were identical between Carvalho et. al (2016) and our study in nominal terms. That is, while we used SGD 28, Carvalho et al (2016) used USD 28, following Eckel and Grossman (2002). While the USD was worth about 1.4 SGD at the time of study, the value of the incentive is comparable as price levels for domestically oriented goods and services are lower in Singapore. A basic purchased cooked meal costs, for example, about SGD 3.}

### Table 4. Fixed Effects Regression on Present Bias

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt Relief Amount</td>
<td>0.0123</td>
<td>0.0106</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.020)</td>
<td></td>
</tr>
<tr>
<td>Debt Accounts Paid Off</td>
<td>-0.0878**</td>
<td>-0.0932**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td></td>
<td>(0.041)</td>
</tr>
<tr>
<td>Cognitive Functioning</td>
<td>-0.0163</td>
<td>0.00685</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.028)</td>
<td></td>
</tr>
<tr>
<td>GAD</td>
<td>0.0912</td>
<td>-0.0179</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.093)</td>
<td>(0.102)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.437***</td>
<td>0.433**</td>
<td>0.408**</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.175)</td>
<td>(0.189)</td>
</tr>
<tr>
<td>Observations</td>
<td>266</td>
<td>266</td>
<td>266</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.05</td>
<td>0.013</td>
<td>0.051</td>
</tr>
<tr>
<td>Number of id</td>
<td>133</td>
<td>133</td>
<td>133</td>
</tr>
</tbody>
</table>

Debt Relief Amount is specified as SGD Thousands. The dependent variable is (1 = present bias; 0 = no present bias). Robust standard errors are in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%. 

18 The values provided in the risk elicitation lottery were identical between Carvalho et. al (2016) and our study in nominal terms. That is, while we used SGD 28, Carvalho et al (2016) used USD 28, following Eckel and Grossman (2002). While the USD was worth about 1.4 SGD at the time of study, the value of the incentive is comparable as price levels for domestically oriented goods and services are lower in Singapore. A basic purchased cooked meal costs, for example, about SGD 3.
participants received a one-off wealth shock in the form of debt relief equivalent on average to several months’ of household income. While the magnitude of the shock in Mani et al. (2014) is in relative terms greater – as their subjects receive an entire year’s income all at once – our shock is unanticipated. The magnitude of Carvalho et al.’s (2016) shock is both anticipated, and relatively small, at the value of a monthly pay cycle.

**Table 5. Comparison of Results Across Studies**

<table>
<thead>
<tr>
<th></th>
<th>Cognitive Functioning Response Time</th>
<th>CRRA Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Our study</td>
<td>Mani et al.</td>
</tr>
<tr>
<td>Before Debt Relief</td>
<td>0.256***</td>
<td>(0.046)</td>
</tr>
<tr>
<td>Before Harvest</td>
<td>0.19***</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Before Payday</td>
<td>0.020</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.399***</td>
<td>(0.023)</td>
</tr>
</tbody>
</table>

Observations | 350 | 902 | 20,206 | 350 | 1064 |
Number of id   | 175 | 451 | 1056 | 175 | 532 |

For log median response time, our study specifies the dependent variable as the log of Flanker task total response time and uses a fixed effects model with no control variables. Mani et al. specifies the dependent variable as the log of numerical Stroop Task total response time, uses Carvalho et al.’s re-analysis with a fixed effects model with controls for calendar month. Carvalho et al. specifies the dependent variable as log of individual Flanker task trial response time from “Study 1”, and uses an OLS model with controls for trial order. For CRRA parameter, our study and Carvalho et al. use an interval regression model with no control variables.

**5 Discussion**

Our study makes three contributions to the active discourse on whether poverty may be self-perpetuating through impairing cognitive resources. First, we reconcile contrasting evidence in the literature by showing that the psychological costs of scarcity are derived in part from the overhead costs of managing complex personal finances on low incomes. In our study, and in Mani et al. (2014), the deprivation endured is substantial and the positive shock to

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19 Our study’s model omits time-based controls because our participants should not be affected by weather-related seasonal effects. Singapore is a city with no agricultural sector and as an equatorial city the weather is fairly constant year-round. While religious and cultural holidays might affect participants, our surveys were always conducted outside significant holiday periods in Singapore.
financial resources sharp, giving affected households the chance to ‘reset’ their finances, improving psychological functioning. However, the payday income shock studied in Carvalho et al. (2016) is anticipated, modest, and frequent, providing little opportunity for households to effect a meaningful change in household finances. In common with Carvalho et al. (2016), we study the urban poor in highly developed countries, who are relatively but not absolutely poor: they enjoy access to housing, healthcare, and public resources greatly exceeding that of the rural poor in a developing country. But our evidence suggests that the presence of formal social safety nets that support minimum standards of living may not effectively shield the urban poor from the cognitive impairments associated with managing the complex constraints of poverty.

Second, we show that commonly hypothesized psychological and economic mechanisms appear only weakly connected to how scarcity affects economic decision making. Both laboratory and observational evidence suggests that scarcity increases risk aversion and present bias, and potential channels operate through changes in psychological functioning (Dohmen et al. 2010; Benjamin et al. 2013). However, although our study population exhibits general reductions in risk aversion and present bias post-relief, as well as significant improvements in cognitive functioning, we find no evidence of a strong statistical link between the two sets of changes. More work in field settings is needed to determine how scarcity-induced changes psychological functioning actually affect economic decision making.

Third, our study suggests policies to alleviate chronic poverty could be more cost effective if they directly targeted easing the complex decision constraints faced by the poor. The debt relief program we studied helped many beneficiaries unload the burden of managing multiple creditors on little income. Our point estimates suggest clearing one debt account has equivalent benefits for cognitive functioning as providing SGD1238 of general debt relief. Eliminating debt accounts, moreover, is directly linked to improvements in GAD, and reductions in present bias. Our findings that targeted debt account elimination has functional benefits contrasts with the neoclassical economic view that debt mental accounting behaviours are counterproductive because they tend to increase overall economic costs (Amar et al. 2011). Moreover, they suggest that cash transfer policies, which are theoretically efficient from a neoclassical viewpoint, should be compared in the field to similarly resource-intensive targeted assistance that aims to resolve specific cognitive ‘pain points’.

Overall, we view our work as contributing to the growing literature attempting to uncover the exact mechanisms through which scarcity affects human functioning – both psychological and economic. We find strong evidence that significant unanticipated shocks to wealth, even in an urban poverty context, significantly improve measures of human functioning. Poverty does indeed impact cognitive functioning across a range of economic and cultural contexts. Yet we find no evidence that shock-driven improvements in psychological functioning explain changes in risk attitudes and present bias. Perhaps this is not too surprising, given that the poor have typically endured the cognitive burdens of poverty for years, and may have developed strategies for decision making that rely less on conventional cognitive channels. Future work should explore whether these changes in cognitive functioning and economic decision making are persistent, and whether they meaningfully contribute to behaviours that allow upward mobility.
References:


Raghunathan, R., & Pham, M. T. (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational behavior and human decision processes, 79*(1), 56-77.


