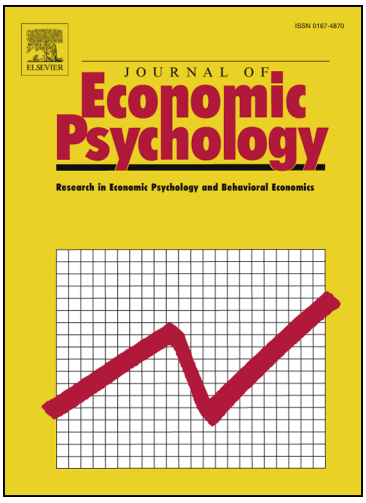

Financial scarcity and cognitive performance: a meta-analysis

Filipa de Almeida, Ian J. Scott, Jerônimo C. Soro, Daniel Fernandes, André R. Amaral, Mafalda L. Catarino, André Arêde, Mário B. Ferreira

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Author Note

Filipa de Almeida and Daniel Fernandes, Católica Lisbon School of Business and Economics, Universidade Católica Portuguesa, Portugal;

Ian J. Scott, Nova Information Management School (NOVA IMS), Universidade Nova de Lisboa;

Jerônimo C. Soro, Lusófona University, HEI-Lab: Digital Human-Environment Interaction Labs, Portugal; CICPSI, Faculdade de Psicologia, Universidade de Lisboa, Lisbon;

Mário B. Ferreira, André R. Amaral, Mafalda L. Catarino, and André Arêde, CICPSI, Faculdade de Psicologia, Universidade de Lisboa, Lisbon.

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Correspondence concerning this article should be addressed to Filipa de Almeida, Palma de Cima 1649-023 Lisboa, and/or filipadealmeida@ucp.pt

ABSTRACT

Whereas several studies find that financial scarcity has a detrimental impact on cognitive functioning, some studies find no relationship and others even report beneficial effects. To shed light on this issue we conducted a meta-analysis on the relationship between financial scarcity and cognitive functioning. We went beyond testing the direct relationship between

these two concepts and looked at potential moderators, namely education, the moment of scarcity, the severity of scarcity, the type of tasks used to assess cognitive functioning, and the type of study. Our findings suggest that scarcity does have a detrimental effect on cognitive functioning. Across 256 effect sizes from 29 datasets involving 111,852 respondents, we found a detrimental total effect of scarcity on cognitive performance of Hedge's g = -0.43. We then estimated a meta-regression model of the drivers of the effect of scarcity on cognition. Education strongly explained this relationship, reducing the effect size by 60% (partial effect of scarcity on cognitive performance is Hedge's g = -0.15, when accounting for education), to a small effect size. The moment and the severity of scarcity also contribute to this relationship, by moderating the effect, such that lifetime and adulthood scarcity have a larger effect than childhood scarcity, and more extreme levels of scarcity lead to higher cognitive dysfunction. The type of task used to assess cognitive functioning did not moderate the effect. And when controlling for education, higher effect sizes were found for non-correlational designs. We discuss these findings and their implications in light of existing research and theories.

Keywords: financial scarcity, poverty, cognitive functioning, procedural processes, working memory, education

1. Introduction

Poverty, 'the state of one who lacks a usual or socially acceptable amount of money or material possessions' (Brittanica, 2023), represents a multifaceted phenomenon that shapes one's identity (Banker et al., 2020). It can manifest in various forms, such as the lack of resources to ensure a sustainable livelihood, poorer health outcomes (Gallo & Mathews, 2003; Pampel et al., 2010), lower levels of well-being (Lachman & Weaver, 1998; Ludwig et al., 2012; Sommet & Spini, 2022), lack of opportunities for autonomous decision-making, and lack of participation in social and cultural life (Lott & Bullock, 2007; United Nations, 1995).

In agreement with this characterization, poverty has been associated with increased mortality (Braveman et al., 2010; Duggan et al., 2007; Lantz et al., 1998), as well as social stigma (Lott & Bullock, 2007) and stereotyping (Fiske, 2012). Furthermore, impoverished people are often more exposed to violence (Sampson et al., 1997) and tend to suffer more from mental disorders (Gallo & Matthews, 2003).

Thus, poverty is a complex phenomenon with numerous adverse consequences for individuals and societies. This paper focuses on the impact of poverty on cognitive functioning, which is itself proposed as a contributing factor to the perpetuation of poverty. Indeed, many studies find that financial scarcity has a detrimental impact on reasoning and decision making, which may lead to choices that contribute to maintain one in poverty (Bertrand et al., 2004; Haushofer & Fehr, 2014; Huijsmans et al., 2019; Mani et al., 2013a; Mullainathan & Shafir, 2013). However, some studies find no relationship (Carvalho et al., 2016; Wicherts & Scholten, 2013) and others even suggest poverty has a beneficial impact in cognitive functioning (Dang et al., 2016; Mehta et al., 2016).

Whether and how scarcity and cognitive functioning are related to one another is not a small matter. Not only do we need to assert that scarcity has a detrimental impact on cognitive functioning, so policy makers have a stronger case to act towards reducing financial scarcity; we also need to know to what extent that might be the case, and which moderating factors might qualify such a relationship. As noted by Frankenhuis and Nettle (2020), focusing on the decreased cognitive functioning of the poor has the potential to lead to stigma, which can ultimately lead to self-fulfilling prophecies (Rubie-Davies, 2014). As such, it is important to understand under which conditions such a relationship actually occurs, if at all.

To shed light on this issue we conducted a meta-analysis on the relationship between financial scarcity and cognitive functioning including the following moderators, a) education; b) the type of tasks used to assess cognitive functioning; c) the moment of scarcity; d) the severity of scarcity; and e) the study design.

Next, we present a brief summary of the findings on the relationship between scarcity and cognitive functioning, followed by a review of the main theories that attempt to account for this relationship, considering the role of each one of the aforesaid potential moderators.

1.1. Brief overview of scarcity's impact on reasoning and decision making

Scarcity significantly affects cognitive functioning. There is evidence that in the professional domain the poor are less productive (Kim et al., 2006), search for jobs in less

effective ways (Gerards & Welters, 2022), and are more likely to be late to work (Neal et al., 2001). Furthermore, at a personal level, they are worse managers of their finances (Barr, 2012; Blank & Barr, 2009), play more lotteries (Callan et al., 2008), and take more debt (Mendel, 2005).

However, there is also evidence that scarcity compels individuals to develop enhanced abilities for addressing challenges pertinent to their financial concerns (Ellis et al., 2017; Frankenhuis & de Weerth, 2013; Mittal et al., 2015). Those facing scarcity have been shown to spend their resources better (Shah et al., 2012), to more carefully consider tradeoffs and opportunity costs of money spending decisions (Spiller, 2011), and to be more likely to notice hidden taxes (Goldin & Homonoff, 2013).

1.1.1. Scarcity theory

Scarcity theory offers a coherent framework to reconcile these seemingly contradictory effects. According to the central tenets of the theory, scarcity leads to a) attentional focus on scarcity pertinent information, b) increased trade-off thinking while c) reducing mental bandwidth (de Bruijn & Antonides, 2022; Mullainathan & Shafir, 2013). The first two aspects account for examples of adaptive cognitive functioning, such as better memory for the information under attentional focus and the development of a more stable frame of values, increasing consumption choices' consistency (Shah et al., 2015; Spiller, 2011).

However, this attentional focus may lead to the neglection of other important information. Zhao and Tomm (2017) showed how participants with a low budget focus more on prices of meals on a menu than participants with a high budget. As a result, they showed decreased attention to a peripheral cue about a discount that would have been especially useful for the low budget group. The authors further observed that attention to internal cues (retrieval and application of relevant information on a task) happens less frequently under conditions of scarcity. Lichand and Mani (2020) reported similar tunneling of attention to scarce-resource tasks in a field study with farmers when dealing with periods of drought.

Scarcity theory further predicts that poverty impedes cognitive function by reducing mental bandwidth. In this regard, Mani et al. (2013) showed that low income participants, when asked to make decisions in hypothetical financially challenging scenarios, displayed lower performance in a subsequent fluid intelligence test, compared to high income participants. The same difference was found within-participants in a longitudinal study, in which sugar cane farmers displayed poorer cognitive performance when evaluated in a period of scarcity than after the end of this period (Mani et al., 2013a; cf. Wicherts & Scholten, 2013; cf. Mani et al., 2013b) or before instead of after payday (Lichand & Mani, 2020). More recently, Ong et al (2019) further tested Mani and collaborators' (2013a, 2013b) proposal that poverty impairs cognitive functioning, showing, in a quasi-experimental study, that reducing debt, and particularly reducing the number of debts, improved the poor's cognitive performance.

In sum, a scarcity mindset is likely to both contribute to and result from impaired cognitive functioning, in a causal loop where the poor often behave in less capable ways because poverty-related concerns create higher levels of stress and constant preoccupation about making ends meet, which depletes mental resources (Cohen et al., 2008; Dohrenwend, 2000; Haushofer & Fehr, 2014; Kelly et al, 1997; Marmot, 2004) reinforcing financial

avoidance (Hilbert et al., 2022a), time discounting (Bartos et al., 2018; Carvalho et al., 2016; cf. Ruggeri et al., 2022; cf. Ruggeri et al., 2023), and other self-defeating actions that further perpetuate poverty (Fehr et al., 2019; Mullainathan & Shafir, 2013; Shah et al., 2012).

1.1.2. Scarcity leads to adaptive responses to the environment

Other authors (Griskevicius et al., 2011; Pepper & Nettle, 2017; Sheehy-Skeffington, 2018; 2020), however, argue that poverty contexts are different from other contexts in important ways, which lead to meaningful changes in focus that are well adapted to reality, leading then to rational decisions for the context they are a part of. In this sense, scarcity may lead to consistently different but not necessarily worse responses than abundance. Some findings support the idea that scarcity does not necessarily have a negative significant impact on cognitive performance, and when it does, it is adaptive. Carvalho et al. (2016) assessed cognitive performance of poor households before and after payday and found no effects in a variety of cognitive measures. The only effect found was a stronger tendency for present-bias in intertemporal choices about monetary rewards before-payday than after-payday, which is not necessarily maladaptive (considering the pressing needs usually before pay-day in a scenario of scarcity; Pepper & Nettle, 2017). And even present bias itself, has been more recently found to not differ based on one's SES (Ruggeri et al., 2022). Moreover, the poor have been shown to be less susceptible to the endowment effect (Fehr et al., 2019). In fact, a recent large study assessed the prevalence of cognitive biases at different SES levels and found the poor to behave similarly to other demographic groups (Ruggeri et al., 2023), further reinforcing the notion that scarcity's impact on cognitive functioning might not be as straightforward as initially thought.

1.1.3. Summary

Taken together, and in line with a recent review on scarcity theory (De Bruijn & Antonides, 2022), the reviewed literature suggests that the relationship between scarcity and cognitive performance may be more complex than initially supposed. In this context, it is important to unveil which variables might qualify such a relationship. The way cognitive functioning is assessed may be an important aspect to consider. Similarly, from a developmental perspective, the moment in life when financial deprivation is experienced may moderate the impact of scarcity on cognition. Likewise, different degrees of scarcity, as well as whether scarcity is naturally occurring or manipulated in the lab (study design) are variables that may qualify a potential relationship between scarcity and cognitive functioning. Next, we briefly address previous research concerning each of these potential moderators: the type of cognitive assessment, the moment in the lifespan, the level of scarcity, and the study design. Finally, as education is a related variable which might or not be taken into consideration by works contributing to this question, we also take it into account.

1.2. Moderators

1.2.1. Education as a moderator

Education correlates with various positive outcomes, ranging from well-being (Lui & Heshmati, 2023) to longevity (Galama et al., 2018; Hong et al., 2020). However, poverty presents significant barriers to educational attainment. Indeed, even though education has a causal and negative effect on poverty (Hofmarcher, 2021), there is a vast body of research suggesting this relationship to be bi-directional, with poverty impacting educational

attainment (Ngepah et al., 2023) through a variety of paths. The limited resources that characterize poverty mean these families are more likely to struggle to provide means that contribute to a positive and effective learning experience (Estefan, 2009), less likely to provide access to higher quality schools (Burgess & Briggs, 2010), teachers (Clotfelter et al., 2006; Rodriguez et al., 2023) or to guarantee adequate nutrition (Patience, 2013), important for the ability to focus and learn. Moreover, the social conditions associated with neighborhoods ridden with poverty have detrimental effects on educational attainment (Noguera, 2011). Furthermore, the higher stress experienced by poorer households has been shown to play a role in contributing to lower educational achievement of children of such households (Morsy & Rothstein, 2019). It seems that poor children have it harder and are more likely to face obstacles with potential to adversely impact their learning, contributing to earlier dropouts, thus affecting education trajectories.

In turn, education is a strong predictor of cognitive functioning (Banks & Mazzonna, 2012; Lövdén et al., 2020; Schneeweis et al., 2014), which has been found to be a protective factor against dementia (Xu et al., 2016). So, naturally, as education is intertwined with both income and cognition, it has been proposed as an explanatory route between scarcity's effects on cognitive functioning. Differences in education and particularly in financial literacy have been put forward as accounting for some of the counterproductive behaviors associated with scarcity (Lusardi & Mitchell 2014; Sirin, 2005; White, 1982). For instance, lower financial literacy makes it harder to understand contract terms, which might lead impoverished people to rely more often on heuristic-based decisions (Sheehy-Skeffington & Rea, 2017), leaving them more vulnerable to predatory loan sellers (Lusardi, 2012). To evaluate such a crucial role often attributed to education as key to cognitive functioning, this factor is carefully considered in the present meta-analysis.

1.2.2. Type of task as a moderator

Executive control and working memory are easily impaired by holding online and manipulating several sources of information simultaneously (Baddeley, 2003). The concern with one's finances could then act as a form of cognitive load reducing available working memory processing capacity, which could then mediate the relation between financial scarcity and cognition (e.g., Mullainathan & Shafir, 2013). However, cognition includes other facets beyond working memory which might be impacted differently by scarcity. More autonomous cognitive processes which are largely independent from working memory (e.g., proceduralized skills) may actually be facilitated when working memory is impaired (Beilock & Carr, 2001; DeCaro et al., 2011; Maddox & Ashby, 2004; Waldron & Ashby, 2001). Indeed, Dang et al. (2016) found that poor participants primed with financial demands performed better on procedural tasks than participants that were financially better off. In the same vein, In the meta-analysis here reported, we explore the potential moderator role of the type of cognitive assessment in the relationship between financial scarcity and cognitive functioning by distinguishing between cognitive tasks that are heavily saturated in executive processing requirements and working memory, and tasks largely independent of executive processing.

1.2.3. Moment of financial scarcity as a moderator

Research on financial scarcity focuses on different moments in time: childhood, adulthood, or lifetime, and different theories propose different moments to matter the most. The literature on socioeconomic status (SES) provides evidence supporting a relationship

between childhood SES and adult cognitive performance (Brown, 2010; Brown et al., 2014; Everson-Rose et al., 2003; Fors et al., 2009; Haan et al., 2011; Kaplan et al., 2001; Luo & Waite, 2005; Nguyen et al., 2008; Singh-Manoux et al., 2005). However, the process by which this relationship takes place is not clear.

According to the latency hypothesis (Cohen et al., 2010), any detrimental life circumstances have a stronger impact during childhood, as this is a sensitive period of physical and mental development, which then taints the years to come. This influence is supposedly independent of future adult experiences of scarcity (Ben-Shlomo & Kuh 2002; Kaplan et al., 2001; Kuh et al., 2003).

Similarly, the pathways model proposes that childhood socioeconomic disadvantages have a great impact on later cognitive performance but, differently from the latency hypothesis, this model proposes that childhood SES impacts late life SES rather indirectly, through the influence on subsequent choices and trajectories (Alwin & Wray, 2005; Graham, 2002; Hayward & Gorman, 2004). Specifically, adult SES will mediate the relationship between childhood SES and later cognitive functioning by affecting the cognitive reserve, that is, the neurological capability of counteracting cognitive disruption from neuropathies (Richards & Deary, 2005; see also Stern, 2009).

Finally, the accumulation hypothesis emphasizes the life course as a whole rather than putting an emphasis on childhood (Cohen et al., 2010; Graham, 2002; Kuh et al., 2003). According to this hypothesis, both intensity and duration of exposure to poverty matter more than the specific time period of the financial and socioeconomic difficulties. Thus, cumulative low SES of childhood and adulthood would be more damaging than merely childhood (or adulthood) low SES (see also Graham, 2002).

In this meta-analysis, we explore the potential moderator role of the moment of scarcity in the relationship between financial scarcity and cognitive functioning by distinguishing between childhood scarcity, current scarcity, and lifetime scarcity.

1.2.4. Degree of financial scarcity as a moderator

It is generally accepted that higher levels of scarcity are more detrimental than lower ones. Higher scarcity levels have been consistently associated with lower cognitive performance (Brown et al., 2015; Guiso & Paiella, 2008; Tanaka et al., 2010; Yesuf & Bluffstone, 2008). However, there is also evidence for some of these effects even for scenarios of mild scarcity (Shah et al., 2012) suggesting that the detrimental effects of scarcity in cognitive functioning operate at low scarcity levels as well. As such, we will include the level of scarcity as a potential moderator of the relationship between scarcity and cognitive performance, distinguishing between high, moderate, and low levels of scarcity.

1.2.5. Study design as a moderator

The impact of scarcity on cognitive functioning has been explored in a variety of ways. While some studies take on an experimental approach priming scarcity feelings in the laboratory, others take on a correlational approach, studying individuals across different levels of actual poverty. Arguably, inducing participants to imagine a situation of financial scarcity does not have the same weight as living under actual scarcity. As such, we also look at the potential impact of this variable as a potential moderator of the relationship between scarcity and cognitive functioning.

2. Method

2.1. Search Process and Inclusion Criteria

We included papers written in English only. We did not impose any date limitations to our search, which included works until September 2023.

We searched for articles in Ebsco, Google scholar, and the SSRN databases. We also searched the reference lists of the relevant articles (backward search). In order to deal with the file-drawer issue, and the potential upward bias of published papers (Bozarth & Roberts, 1972; Rothstein et al., 2005), we included papers and studies irrespectively of their publication status, that is, we included published articles, as well as working papers, reports, or dissertations. In addition, we placed requests for unpublished data in social science platforms and forums and contacted recurring authors asking them for unpublished data directly.

As we were interested in assessing the relationship between financial scarcity and cognitive functioning, independently of the source of scarcity and across different measures of cognitive function, we crossed keywords tapping into scarcity with keywords tapping into cognitive functioning, using every possible dyadic combination of our selected search terms. On the scarcity side the keywords included were scarcity, poverty, financial deprivation, SES (socioeconomic status), SEP (socioeconomic position), and debt. On the cognitive functioning side, we included: cognition, attention, memory, executive function, decision, bias(ed), heuristic, choice, and rationality (with variations "rational", "irrational", "irrationality"). Attention, memory, and executive function were chosen as pillars of cognition with relevance to the scarcity literature (Dean et al., 2017), cognition was chosen as the overarching term encompassing cognitive processes, and the remaining words (decision, rationality) were chosen in order to tap into the consequences of cognitive functioning often found in the literature on scarcity.

We screened the resulting works by title and abstract. To pass this initial stage, the sources needed to indicate having (experimental, quasi-experimental, or correlational) data on the relationship between scarcity and cognitive functioning, with cognitive function measured on adults[1]. All articles were coded by two coders. All disagreements were resolved by discussion or by a third judge.

When screening by title and abstract did not yield definite information, the articles were passed to the next stage of inspection. After careful inspection of the final list of papers, we excluded sources which, a) did not have data (e.g., review papers); b) only reported qualitative data; c) did not include measures or manipulations of financial scarcity and/or responses related to cognitive functioning; d) did not yield sufficient data for the computation of the effect size; and e) looked at the effect of scarcity in combination with other specific conditions which might trigger depletion of cognitive resources by themselves (above and beyond scarcity). To illustrate the latter exclusion criterion, homeless individuals often live under other socially challenging factors linked to living on the streets (e.g.,

[1] We focused on studies which collected data with adults, as we considered including studies involving children would introduce too high of a heterogeneity. The different nature of the impact of scarcity on cognition of this specific population, who are likely to perceive scarcity differently from adults, and whose performance on cognitive tests is expected to differ to those of adults, would render the comparison of effect sizes less meaningful. We believe the impact on children's cognition is also interesting, yet, it should constitute a distinct work.

physical threats, insecurity) that may impact cognition in ways that go above and beyond scarcity effects. As such, since it was not possible to separate the cognitive effects resulting from scarcity from those resulting from other aspects of homelessness, we did not include scarcity studies involving homeless individuals. Similarly, sub-nutrition, although often associated with scarcity, is likely to directly impact cognition above and beyond scarcity effects. The same reasoning applies to cognitive impairment situations, such as dementia. Thus, studies with undernourished or cognitively impaired individuals clearly identified as such were left out of the current meta-analysis. Finally, we also excluded studies in which the interpretation of the impact of scarcity on cognition was ambiguous. To illustrate, whereas a better performance in the Stroop task is clearly a sign of better cognitive functioning, the same is not as clear cut for tasks revealing individuals' time preferences. Usually, opting for present shorter gains instead of future higher gains, is taken as an instance of the present bias, which is seen as a maladaptive response. However, under scarcity settings that create emergent needs, the rational option may be to choose a smaller gain in the present (sometimes the only option for all practical purposes). Indeed, it has been argued that the specific needs and limitations involved in situations of scarcity may characterize the present bias as adaptive (Griskevicius et al., 2011; Pepper & Nettle, 2017; Sheehy-Skeffington, 2018). In the same vein, financial reasoning and decisions involving risk are difficult to analyze from a normative point of view because the risk level that would be rational to take varies with how much money one has in the first place (e.g., Bosch-Domènech & Silvestre, 2006). Therefore, we excluded effect sizes based on variables such as time preferences (Brown et al., 2015; Hilbert et al., 2022b; Yesuf & Bluffstone, 2008) and risk aversion (Guiso & Paiella, 2008; Tanaka et al., 2010), and focused only on studies in which the dependent variable involved clear markers of better or worse cognitive functioning.

2.2. Moderators

2.2.1. Education

To understand education's impact on the relationship between scarcity and cognitive functioning, we coded whether effect sizes reported in the underlying studies control for education[2]. That is, whether education is treated as a mediator in the studies considered here and the effect size reported excludes the effect through education. We can then examine the "effect of scarcity on cognition" and the "effect of scarcity on cognition, controlling for the effect on education" separately, and question whether and by how much scarcity impacts cognitive functioning above and beyond its effects through education.

2.2.2. Task type

Cognitive functioning was measured by tasks categorized as relying on the engagement of working memory or tasks largely independent of working memory (e.g., procedural tasks).[3]

2.2.3. Moment of scarcity

[2] Education Control indicates that the method that generated the effect size controls for education. This can be through experimental design, the nature of the quasi-experiment, or an approach such as adding "Education" as a control variable to a regression or only comparing groups with the same level of education.

[3] For further details on how we categorized each dependent variable please see the Web Appendix F.

For the moment of scarcity, we coded results based on three levels: childhood, adulthood, or lifetime scarcity.

2.2.4. Degree of scarcity

Degree of scarcity was categorized into high, medium, and low levels of scarcity. As different measures of scarcity are used across studies, and in some cases within studies, comparing their relative levels can be difficult. In the case where the distribution of the measure of scarcity over the population is provided (for example, income, or parental employment) the following classification was used: for groups in the bottom 20% of the distribution, scarcity was considered high, for groups in the 21st-35th percentile of the distribution, scarcity was considered medium, and for groups in the 35th-50th percentile of the distribution, scarcity was considered low. Any sample where the scarcity measure would place that group into the upper 50% of the distribution was considered to not include scarcity and would be part of the control group where differences in means were calculated.

2.2.5. Study design

Finally, study design was categorized as correlational, quasi-experimental, or experimental.

2.3. Statistical Method

The broad measures of scarcity and cognitive functioning included in this study are selected to facilitate a general understanding of how the former impacts the latter. As argued by Webb et al. (1999, p. 3): "If a proposition can survive the onslaught of a series of imperfect measures, with all their irrelevant errors, confidence should be placed in it". The advantage of this approach is that we can draw from evidence from a broad range of literature, including effects that were not directly relevant to the original study. This can help to reduce publication bias as the value of the study did not directly relate to the result of interest for this meta-analysis. This approach means that rather than deriving an effect size for a very specific situation we can explore a robust but broad effect of scarcity on cognitive functioning (Cooper et al., 2019). However, it is still important to ensure that the studies included relate to the concept we are trying to measure (Cooper et al., 2019).

One implication of this approach is that we often derive multiple results from a single published study. Including all such results in the common random-effects meta-analysis model would violate the assumption that each effect in our meta-analysis is independent. Here we face all three types of effect size dependence described in Cooper et al. (2019): we find examples where the same individuals are assessed with different measures of cognition, cases where the same individuals are measured at different points in time (longitudinal studies), and cases where we have different levels of scarcity (different treatment groups) compared to the same control group. All these sources of dependence can occur within the same study.

One approach traditionally used in this situation is to use only a single effect per study (either through selection of one effect or aggregation of all effects). This approach, while simple, can affect the statistical power of the tests (as some information is lost) and reduces the questions possible to ask in the meta-analysis (Cheung, 2015). Instead, we use a modern multilevel modeling approach to deal with statistical dependence of effect sizes (Cheung, 2019). In this approach we group effect sizes within studies in a three-level model

that only requires that they are conditionally independent. This relatively recent and advanced approach to meta-analysis allows us to make the most of the wide range of individual effects we find reported in studies by explicitly including all effects sizes and accounting for their potential dependence. Fernández-Castilla et al. (2019) argue that in many situations where there are multiple sources of dependence between effects, as here, additional levels should be added to the meta-analysis over the more common three. As such, we tested a four level meta-analysis structure for its ability to add explanatory power and address sources of dependence in our meta-analysis.

We additionally checked for outliers by calculating a measure of Cooks' distance and reviewing any results with a Cooks' distance greater than 0.5. As the results are expected to differ based on moderators, we calculated the Cooks' distance on a version of the model with a subset of moderators selected by backwards elimination. Because some extreme outliers were affecting the selection of moderators (in effect forcing the model to select moderators to account for extreme values), this process was conducted iteratively. This ensured that values were not detected as outliers when they differed from the overall result in a way explained by moderators.

Finally, as we included broad definitions of scarcity and cognitive functioning, derived from a wide literature, we found source examples of a number of different types of effect size measures including difference in means, correlations, regressions, and odds ratios. As our aim was to include as wide a number of sources as possible, we attempted to include as many of these different effect sizes as possible by converting them to hedges g. There are, however, a number of limitations to our ability to include results in this way. Firstly, we only allowed for correlation results where one variable is dichotomous, due to the complexity of interpreting the effect size where both variables are continuous (Mathur & VanderWeele, 2020). For regression coefficients, we allowed multiple regressions that control for age or demographics, as the majority of studies control for these in some way.

Effect sizes controlling for education are less straightforward. The treatment of education in the studies we extract data from is an especially important consideration. As seen in the literature, it is clearly the case that scarcity can affect education and that lower education may affect both cognitive functioning and be a risk factor for scarcity itself. As such, there is potential for joint determination. One can attempt to control for this by considering only effects from studies that control for education. The result that measures the effect of scarcity on cognitive functioning, given education, will understandably be lower than the overall effect of scarcity on cognitive functioning. We believe both of these effects, "the effect of scarcity on cognition" and the "effect of scarcity on cognition controlling for education", are of interest, and address this in two ways. Firstly, we undertake a meta-analysis that contains all effects found and use moderators to control for the fact that some of these effects are measuring the effect controlling for education and some are not. This has the benefit of allowing us to explore the role of education as a channel through which scarcity affects cognition. Then, to ensure this approach is appropriate we undertake a meta-analysis limited to only effects that do not control for education, where we find similar results (see Web Appendix G).

Effect sizes were converted in R using the approaches described in Harrer et al. (2019)[4]. In cases not covered by these approaches we made use of the effect size calculator by Wilson (2001).

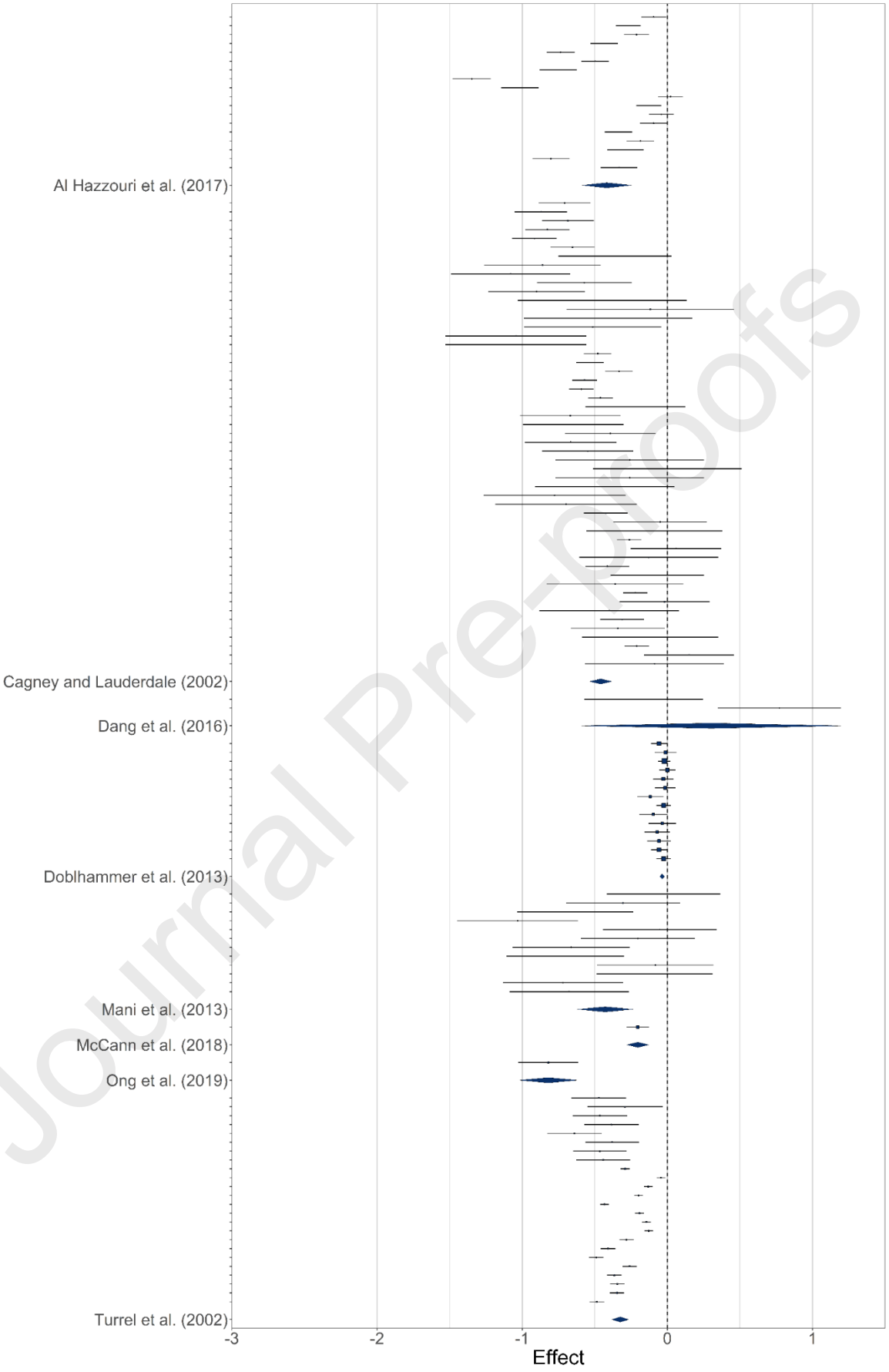
3. Results

3.1. Overview

The research synthesis resulted in a total of 29 studies that provide 256 effect sizes that summarize the results of a total sample of 111852 participants[5]. We present the forest plot in Figure 1. For an expanded version of the forest plot with confidence intervals, see Web Appendix A.

[4] Regression coefficients are converted using the esc_B or esc_b functions, t statistics using esc_t, means and standard deviations with esc_mean_sd from the "esc" R package specifying the output effect to be hedges g. Odds ratios and cases where multiple groups were combined (in either treatment or control) were converted with the online effect size calculator Wilson (2001) then converted to hedges g with the hedges_g function from the "esc" R package.

[5] The final coding of included studies can be found in Web Appendix F.



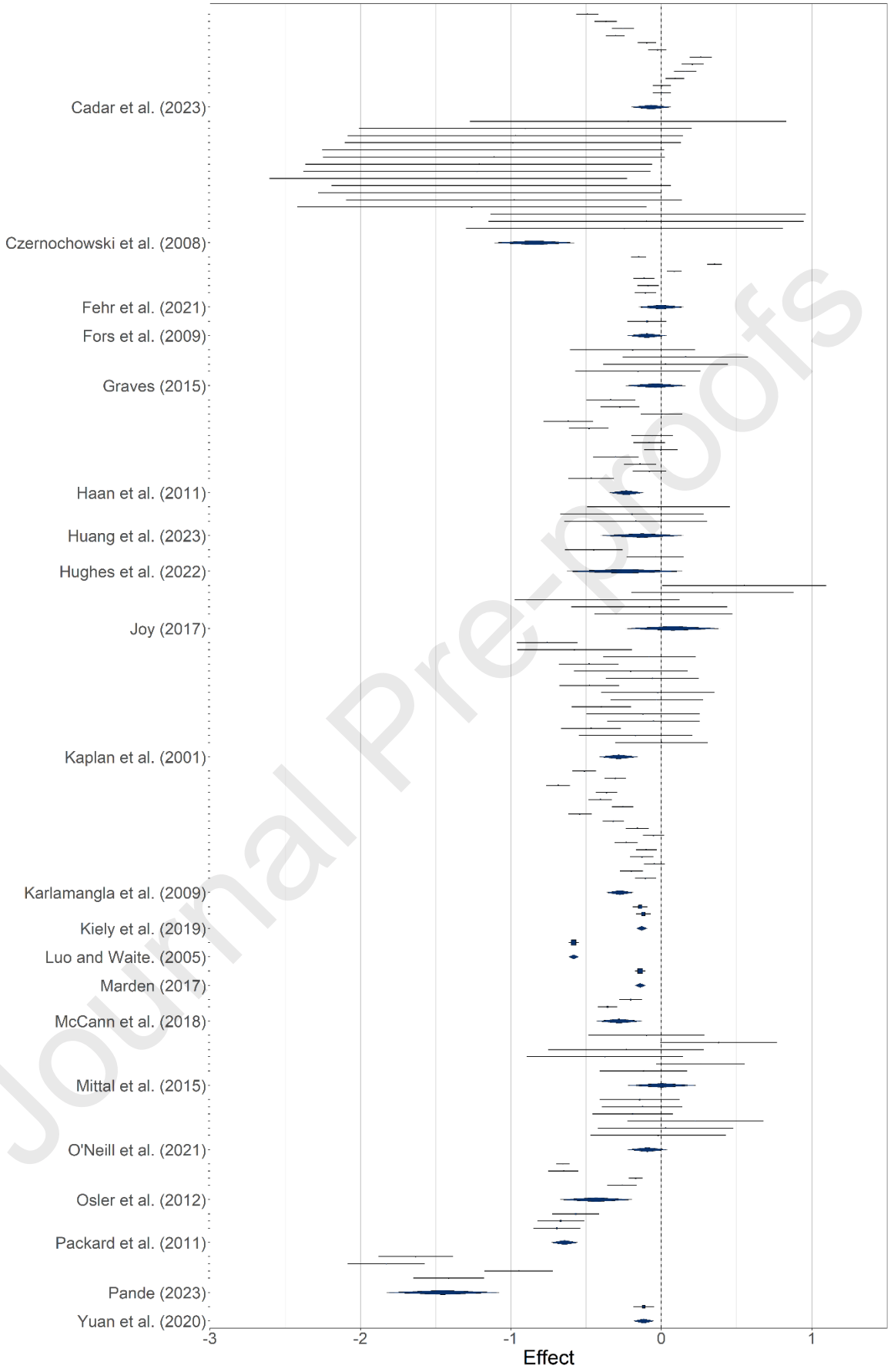


Figure 1. Forest plot of effect sizes organized by study

3.2. Meta-analysis

In this meta-analysis, we include effect sizes that explicitly control for education and also that do not. We include a moderator variable "Education Control" to assess whether the effect-size resulting from studies controlling for education is lower than in studies that do not have such controls. Additionally, we test if this variable interacts with any of the theoretical moderators. As aforementioned, in a meta-analysis without such control for education we obtained similar results (see Web Appendix G).

3.2.1. Test of meta-analytical model

We followed the process of outlier detection described in section 2.3 which resulted in the removal of 10 effect sizes based on Cook's distance, Figure 2 provides the Cook's distance of remaining effect sizes. Next, we tested the proposed three-level structure of the meta-analysis (level 1: sampling variance, level 2: variance between measured effect sizes within studies, level 3: variance between studies) and compared it to a number of alternative structures following the process of Harrer et al. (2019). A high and significant Q statistic of 6335 ($p < .001$) was found, indicating that there is significant heterogeneity in the results[6], which would not be well described in a fixed effects model that ignored the grouping of effects. We then tested the removal of the different levels of the model (by restricting the variance at the given level) and compared the results of these restricted two-level models. Removing either levels 2 or 3 significantly increased the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) ($p < .001$) allowing us to reject the hypothesis that the three-level model did not provide an improvement in model fit.

Next, we tested alternative model structures to reflect the sources of statistical dependence found in our data, as recommended by Fernández-Castilla et al. (2019). We examined whether multiple results taken from the same samples could add to the explanatory power of the model in a four-level structure (L1: sampling variance, L2: 246 effect sizes, L3:35 samples, L4: 28 studies). While a small amount of variance could be attributed to this variable, the inclusion reduced the fit by AIC and BIC measures and we found no evidence to include the additional layer ($p = .975$).

[6] See Web Appendix B for additional measures of heterogeneity.

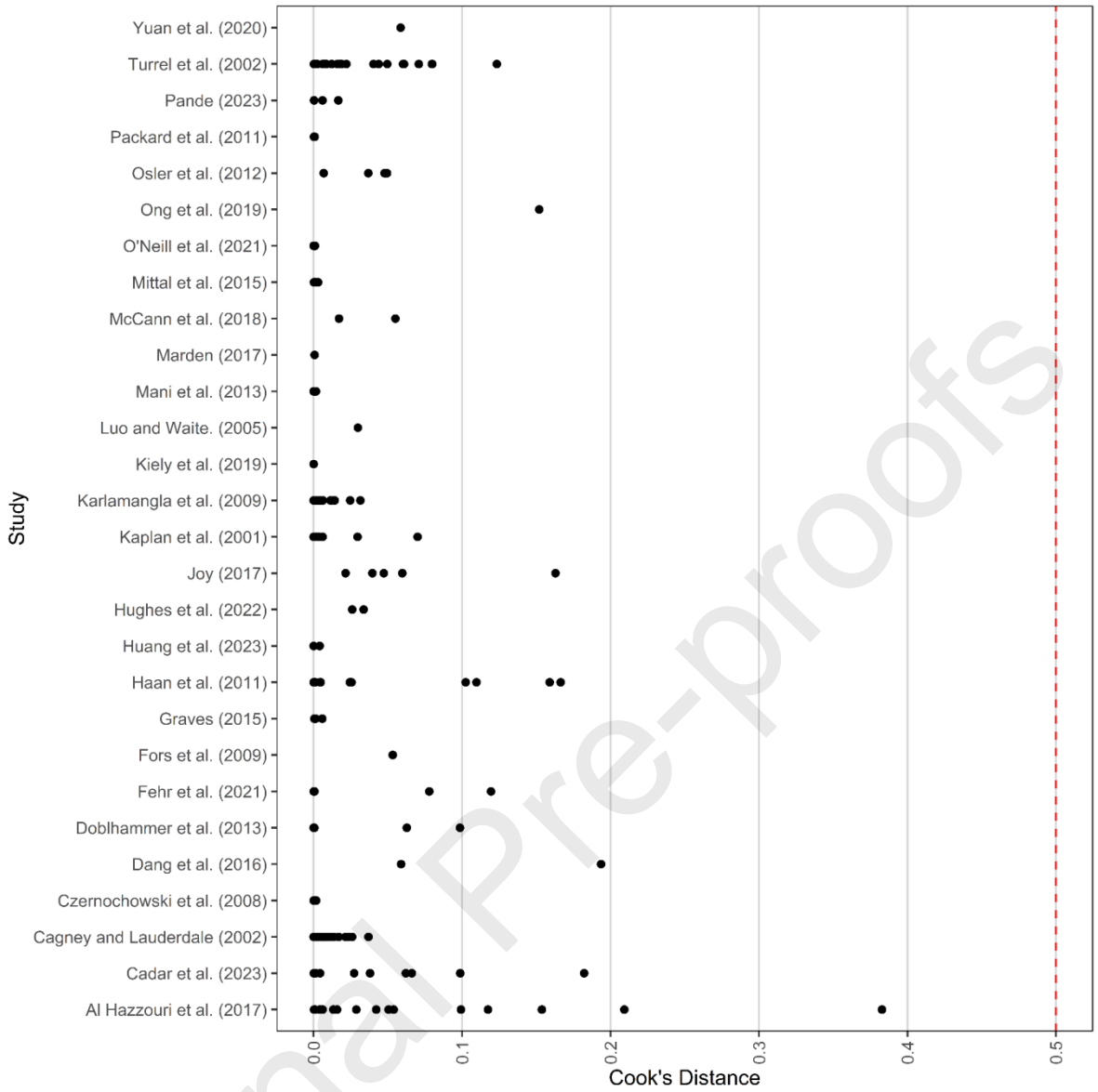


Figure 2. Influence analysis results

Next, we tested the results for publication bias. The typical approach of examining a funnel plot does not account for the structure of the three-level model used here. Instead, we implemented the Egger's regression (Egger et al., 1997) directly by adding N (as in Suurmond et al. 2020) to the three-level model. The resulting coefficient on N/1000 of b = 0.01, CI [-0.01, 0.03], was not significant (p = .380), meaning that we do not find evidence for a relationship between study size and effect size that would be suggestive of publication bias. In Appendices C, D, and E, we include the p-curve, alternative methods for controlling for publication bias (PET-PEESE, selection models, and RoBMA-PSMA; Bartos et al., 2022). The results essentially replicate the findings of the Egger's regression analysis of no evidence for publication bias. In addition, we test to see if any of the effect sizes extracted (regression coefficients, sample means, odds ratios, and t statistics) results in a different effect size. We find this not to be the case as reported in Table 1 (e.g., no difference in effect sizes derived from regression coefficients, b = 0.11, CI [-0.05, 0.26], p = .181) providing justification for our approach of trying to include as wide a possible a range of studies and reporting methods.

3.2.2. Main effect

We found an overall medium effect size of scarcity on cognitive functioning of g = -0.29, CI [-0.42, -0.17], $p < .001$. However, we caution against interpreting this result without consideration of the moderator analysis to follow.

3.2.3. Moderator Analysis

Next, we report results for the moderator analysis. This model includes whether effect sizes control for education, "Education Control". We also look at whether "Education Control" interacts with the other moderators. The full results are displayed in Table 1 and the results excluding those that control for education can be found in Web Appendix G.

3.2.3.1. Controlling for the effect of education

We find that the effect of scarcity on cognitive performance is g = -0.43, CI [-0.58, -0.29], $p < .001$, when examining effects without educational control. However, a meta-regression controlling for education strongly reduces the effect, b = 0.28, CI [0.22, 0.35], $p < .001$, to g = -0.15, CI [-0.30, -0.00], p = .048. Education, therefore, accounts for about 60% of the effect of scarcity on cognition. These results show that education explains a majority of the effect of scarcity, but not fully, as a statistically significant portion remains unexplained.

3.2.3.2. Type of task

Looking at the moderator type of task, we do not find significant differences for measures relying more, b = 0.01 CI [-0.07, 0.09], p = .807, or less on working memory, b = 0.03 CI [-0.12, 0.07], p = .599.

3.2.3.3. Moment of scarcity

When exploring the moment of scarcity we find that lifetime scarcity has a higher effect size g = -0.52, CI [-0.69, -0.35], $p < .001$, and that controlling for education reduces the effect of lifetime scarcity on cognitive functioning, b = 0.4 CI [0.29, 0.5], $p < .001$. We find that adulthood scarcity is not statistically significantly different from lifetime scarcity (b = 0.08 CI [-0.03, 0.19], p = .171), whereas childhood scarcity reduces the effect of scarcity, b = 0.22 CI [0.06, 0.38], p = .007.

We find that the interaction with education is significant and the effect of education is lower in the cases of adulthood scarcity, b = -0.16 CI [-0.3, -0.01], p = .036, and childhood scarcity, b = -0.26 CI [-0.44, -0.09], p = .003. These results suggest that education plays the highest effect when scarcity has the highest effect, which is when it occurs over a lifetime.

3.2.3.4. Degree of scarcity

When we look at the degree of scarcity, we find that high levels of scarcity significantly increase the effect of scarcity on cognitive functioning, leading to lower cognitive functioning, b = -0.27 CI [-0.37, -0.16], $p < .01$ than other levels. However, the effect of controlling for education is particularly strong in this case, leading to almost entirely canceling out this effect, b = 0.22, CI [0.09, 0.35], $p < .001$.

3.2.3.5. Study design

When looking at the moderator study design, we find that experimental, b = -0.35, CI [-0.62, -0.07], p = .013, and quasi-experimental designs, b = -0.22, CI [-0.41, -0.02], p = .026, both increase the effect size.

Table 1: *Moderators of the Effect size Results for the Meta-analysis including Effect Sizes that Control for Education*

	Effect Size (hedges g)	95%CI LL	95%CI UL	*Q*	Variance	Sampling Variance (%)	L2 Variance (%)	L3 Variance (%)
Three-level Model Without Moderators								
Intercept	-0.29 ***	-0.42	-0.17	6335 ***	0.144	1.4%	33.1%	65.5%
Three-level Model With Education Moderator								
Intercept	-0.43 ***	-0.58	-0.29	5923 ***	0.167	1.2%	18.9%	79.9%
Education Control	0.28 ***	0.22	0.35					
Scarcity Degree								
Intercept	-0.31 ***	-0.47	-0.15	4831 ***	0.152	1.3%	17.3%	81.4%
Education Control	0.15 **	0.04	0.26					
High	-0.27 ***	-0.37	-0.16					

High * Education Control	0.22 ***	0.09	0.35					
Low	0.04	-0.28	0.36					
Low * Education Control	-0.13	-0.38	0.13					
Scarcity Moment								
Intercept	-0.52 ***	-0.69	-0.35	4939 ***	0.144	1.4%	21.4%	77.3%
Education Control	0.4 ***	0.29	0.5					
Adulthood Only	0.08	-0.03	0.19					
Adulthood * Education Control	-0.16 *	-0.3	-0.01					
Childhood Only	0.22 **	0.06	0.38					
Childhood * Education Control	-0.26 **	-0.44	-0.09					
Study Design								
Intercept	-0.33 ***	-0.49	-0.17	5554 ***	0.147	1.4%	20.8%	77.9%
Education Control	0.32 ***	0.25	0.39					

Experimental	-0.35 *	-0.62	-0.07
Quasi-Experimental	-0.22 *	-0.41	-0.03

Effect Size Type

Intercept	-0.47 ***	-0.63	-0.32
Education Control	0.27 ***	0.2	0.34
Regression coefficient	0.11	-0.05	0.26
Intercept	-0.39 ***	-0.55	-0.23
Education Control	0.27 ***	0.2	0.34
Difference in means	-0.09	-0.25	0.06
Intercept	-0.46 ***	-0.61	-0.31
Education Control	0.29	0.22	0.35
Odds Ratio	0.37	-0.19	0.92
Intercept	-0.41 ***	-0.55	-0.26

Education Control	0.29 ***	0.22	0.35					
t statistic	-0.32	-0.76	0.12					
Task Type								
Intercept	-0.43 ***	-0.58			-0.29			
Education Control	0.3 ***	0.22			0.37			
Procedural	-0.03	-0.12			0.07			
Procedural * Education Control	-0.03	-0.17			0.11			
Intercept	-0.44 ***	-0.6	-0.29					
Education Control	0.26 ***	0.16	0.36					
Working Memory	0.01	-0.07	0.09					
Working Memory * Education Control	0.04	-0.09	0.17					
Combined								
Intercept	-0.37 ***	-0.52	-0.22	5190 ***	0.145	1.4%	17%	81.6%

Education Control	0.16 **	0.06	0.25
High Scarcity	-0.33 ***	-0.44	-0.23
Childhood Scarcity	0.21 ***	0.09	0.33
High Scarcity * Education Control	0.2 ***	0.08	0.32

Note. *** p < 0.001 ** p < 0.01 * p < 0.05. For the variables task type and effect size type, each level is included in a separate model.

3.2.4. Combined moderator model

Finally, applying an iterative elimination approach to finding the best combination of moderators, we find an estimated effect size of g = -0.37, CI [-0.52, -0.15], p < .001, which broadly corresponds to the application of a medium or low level of scarcity either throughout the lifetime or in adulthood, without controlling for education. Controlling for education reduces this effect by b = 0.16, CI [0.06,0.25], p < .001, to a value of g = -0.22, CI [-0.36, -0.07], p = .003. This effect size can be increased by high levels of scarcity, b = -0.33, CI [-0.44, -0.23], p < .001. However, this effect is, again, reduced by controlling for education, b = 0.2, CI [0.08, 0.32], p < .001, such that when education is controlled for, the effect of high scarcity is reduced to b = -0.13, CI [-0.24, -0.01], p = .027. This confirms that the effect of high scarcity is partially attenuated by controlling for education, but not fully, as a significant effect of b = -0.13 remains. The effect of scarcity on cognitive function is also reduced when scarcity occurs during childhood, by b = 0.21, CI [0.09,0.33], p = .001, to g = -0.16 CI [-0.35, 0.04], p = .110, which is not significantly different from zero. Table 2 further depicts this finding.

Table 2: *Effect size of scarcity on cognition depending on moderator values (Hedge's g)*

	High scarcity		Medium or low scarcity	
	Childhood Only	Adulthood or lifetime	Childhood Only	Adulthood or lifetime

Controls for education	-0.2*	-0.35***	-0.01	-0.23**
Does not control for education	-0.42***	-0.73***	-0.15	-0.37***

*** p < 0.001 ** p < 0.01 * p < 0.05

4. Discussion

4.1. Results discussion

We meta-analyzed 256 effect sizes, from 29 research papers, which focus on the relationship between scarcity (both measured and manipulated), and cognitive function, defined in terms of performance in cognitive tasks that allowed for clear markers of better or worse cognitive functioning.

Results clearly indicate that scarcity has a detrimental effect on cognitive functioning (g = -0.43). A substantial part of this effect is explained by scarcity's association with education. As such, the effect-size of scarcity after controlling for education is significantly smaller (g = -0.15). This shows that much of the effect of scarcity on cognition can be explained by impoverished education under scarcity.

Previous research shows that education is indeed a strong driver of cognitive performance. For instance, Ritchie and Tucker-Drob (2018) conducted a meta-analysis of the effect of schooling on cognitive abilities and found that one additional year of education is associated with a 0.2 *SD* increase in IQ. The studies of policy changes, such as increases in compulsory schooling, arguably the strongest evidence, produce an average weighted effect size of 0.14 *SD* per year of education, an effect of about the same size as the effect of scarcity controlling for education. Trahan et al. (2014) performed a meta-analysis of the Flynn effect. IQ has increased over time at a rate of 0.015 *SD* per year, an effect attributed to improved nutrition, education, among other drivers. The detrimental impact of scarcity reported in the present meta-analysis has an effect-size with a magnitude equivalent to approximately 29 years of gains in IQ, if we consider the effect of scarcity through education and other channels, or 10 years if we exclude the effect through education. As such, policies that aim at enabling students living under scarcity to have access and conditions for high quality education may provide better outcomes (Cheung et al., 2018; Kenworthy, 1999; Rodrigues, 2009).

Beyond the role of education, our meta-regression also shows that the effect of scarcity is moderated by additional variables. As aforementioned, the highest level of scarcity is the most detrimental. Such a finding suggests that poverty alleviation policies that focus on fighting extreme poverty are particularly important (Roser & Ortiz-Ospina, 2020).

Concerning the moment of scarcity, it is noteworthy that scarcity in adult life (and during lifetime) has a stronger effect in present cognitive functioning than scarcity during

childhood. This finding may call for a revision of the notion that early-life interventions should have primacy (over later-life interventions) and therefore have an accumulated greater impact (e.g., Cunha & Heckman, 2007; Cunha et al., 2006; Everson-Rose et al., 2003; Fors et al., 2009; Kaplan et al., 2001) as they affect outcomes at every stage of the lifecycle. In particular, when the level of scarcity is not high, controlling for education entirely removes the effect of childhood scarcity on cognition. Our results are compatible with those arguing that adult SES has a significant effect on cognitive performance that is independent of childhood SES (Leist et al., 2014; Marengoni et al., 2011; Nguyen et al., 2008; Singh-Manoux et al., 2005). This is not to say that one should neglect the effects of childhood scarcity on cognitive development. Childhood scarcity may affect cognitive functioning during childhood (Duncan et al., 1994; Roberts et al., 1999) and later in life, by influencing one's path in education attainment and adult SES. Indeed, Singh-Manoux et al. (2005) contended that adult SES mediates the childhood SES effect on cognitive function (see also Kaplan et al., 2001), while finding direct effects of adult SES on cognitive functioning to be stronger than childhood SES. In sum, our results are perhaps better aligned with the view that better financial conditions later in life can attenuate or counterbalance any detrimental effect childhood scarcity may have, whereas a worse financial condition may accentuate its negative effects considerably (González et al., 2013; Luo & Waite, 2005). Interestingly, we find that education plays an increased role in these later life experiences of scarcity, compared to childhood.

Finally, there seems to be no attenuation of the negative effect of scarcity on tasks where performance is largely independent of working memory and perhaps more dependent on proceduralized processes (e.g., information-integration categorization task). This can hardly be accounted for by Mani et al. (2013a)'s proposal that scarcity impairs cognition through cognitive load. Indeed, if scarcity effects run through a two-step mediation process from financial stress (Cohen et al., 2008; Dohrenwend, 2000; Kelly et al., 1997; Marmot, 2004) to reduced working memory, via cognitive load (Mani et al., 2013a; Shah et al., 2012) then, as argued by Dang et al. (2016), tasks requiring less working memory and relying more on procedural processes should not be affected (or be significantly less affected), which is not what we find. Therefore, our results raise the question of which processes (besides cognitive depletion) mediate the effects of scarcity on cognitive performance. As motivation is key to performance, and scarcity encompasses a constellation of behaviors, which might decrease motivation to persist on a task (Haushofer, 2013; Pepper & Nettle, 2017; Sharafi, 2003), this might be a possible explanatory route. Another alternative could be that stress, which is higher among the poor (Haushofer, 2011) impairs both simple and more complex cognitive tasks. Indeed, just like there is plenty of evidence that stress impairs working memory (Oei et al., 2006; Schoofs et al., 2008; for a review see LeBlanc, 2009), stress effects have been shown to impair declarative memory (Lupien et al., 2007; Roozendaal et al., 2006; Wolf, 2006, 2008) and procedural tasks as well (Moorthy et al., 2003, but see Lighthall et al., 2013).

It is also relevant to note that the effect of scarcity is not reduced when accounting for publication bias. Recent meta-analyses in psychology show a strong reduction in effect-sizes by publication bias, such as the effect of nudges (Maier et al., 2022), of the growth mindset (Macnamara & Burgoyne, 2023), and of prejudice reduction interventions (Paluck et al., 2021) in light of the replication crisis.

The present meta-analysis suggests that education has an important explanatory role in the relationship between scarcity and cognitive functioning, both when looking at

moderation of the main effect and at interactions with several moderators. This finding is perhaps not surprising, as there seems to be a bi-directional relationship between poverty and education (e.g., Gewirtz, 2017) and a clear connection between education and cognitive functioning (Banks & Mazzonna, 2012; Lövdén et al., 2020; Schneeweis et al., 2014). Furthermore, the interaction of education with several other moderators reinforces the importance of this factor. For instance, we find that education significantly interacts with the moment of scarcity, such that its effect is higher when scarcity occurs over a lifetime. Broadly, all these results should be taken together to indicate that the effect of education is relative (potentially proportional) to the effect of scarcity. This provides evidence that the effectiveness of education as an intervention may increase with magnitude of detrimental effects seen from scarcity, in particular in cases of extreme scarcity or long duration scarcity. It is interesting to note that the type of study design emerged as a significant moderator when controlling for education but not when not doing so.

These results impel us to add to the voices asking for more investment in education (e.g., Psacharopoulos & Patrinos, 2018; Smyth & McCoy, 2009) as the main mechanism for upwards social mobility and a crucial protective factor in favor of empowerment of unprivileged individuals (Lipman, 2004) and against impaired cognitive functioning. Education may thus be a crucial instrument to reduce poverty and its related problems from the roots (Vân, 2017).

Often funds obtained to facilitate access to education are not fully used leaving seats at schools and universities empty. This likely occurs due to lack of awareness and lack of transparency of the available opportunities (Choudhury, 2014). The important role that education plays in the findings of the present meta-analysis supports claims for the development of policies that promote awareness of opportunities and the access of the disadvantaged and deprived to formal education.

However, and importantly, as education does not suffice to explain the impact of scarcity on cognitive functioning, our results urge decision makers to act to reduce poverty through education and through all other possible means.

4.2. Limitations

Despite our effort to shed light on the important question of the impact of scarcity on cognitive functioning, our approach has some limitations, which must be considered when interpreting the results.

First, there is a fundamental limitation to interpreting measured effects of scarcity on cognitive functioning, particularly those derived from non-experimental data. In the literature review we find evidence both for scarcity resulting in a detrimental effect on cognition, and for poorer cognition contributing positively to scarcity. This can lead to issues of joint determination in the measured effect sizes we extract from the source data for this meta-analysis. Potentially, we may be overestimating this effect size as we are not solely measuring the effect of scarcity, but also its feedback loop. This may particularly be an issue in the results that do not control for education, as reduced education may lead to higher scarcity, not just through lower cognition, but also through other channels (such as lower earnings potential, for instance). By examining whether controls are included for education in the measured effect size as a moderator, we contribute to better understand how much of the overall effect is likely to run through education.

It should be noted that certain studies in our analysis may not provide strong evidence for a causal relationship due to the limitations inherent in their research designs, particularly those that merely observe effect sizes. To address this issue, we incorporate evidence from a wide range of research designs, including experimental and quasi-experimental studies, that provide higher quality evidence for this link.

Second, the categorization of cognitive tasks in a) heavily saturated in executive processing requirements and working memory; and b) largely independent of executive processing, was not always straightforward. Such difficulty was mainly due to the fact that the tasks surveyed were usually not originally designed having this distinction in mind. As such, we cannot discard the possibility that other theoretical driven categorizations would lead to different results.

Third, while with our keywords we intended to grasp cognitive functioning broadly, including purely cognitive processes such as attention and memory but also performance on decision making and reasoning, research focusing on the present bias, temporal discounting and risk-taking were not included in the current meta-analysis, as it was not possible to clearly categorize this research as reflecting better or worse cognitive functioning (see Section 2). As a result, these important areas of investigation were not included in the current meta-analysis.

5. Conclusion

While there has been marked progress in reducing poverty over the past decades (Serajuddin & Yoshida, 2018), as of 2022, the percentage of people living in extreme poverty was still estimated to be around 8.5%, according to the World Bank (2023). More robust evidence concerning the effects of financial scarcity on people's cognitive functioning and the underlying psychological mechanisms is thus of crucial importance for both fundamental and applied reasons. In this vein, we believe that the meta-analysis here reported assessing this relationship and various of its moderators is timely and important.

Specifically, we provide an accurate estimate of the effect size of the relationship between scarcity and cognitive functioning while exploring the moderating role of relevant variables. By doing so, our goal was to contribute to an organized view of the growing body of research on the effects of scarcity on cognitive functioning that could be useful to researchers and practitioners alike.

Scarcity seems to have detrimental effects on cognitive functioning. The severity and moment in the lifetime of financial scarcity play relevant moderating roles. In addition, the psychological mechanisms put forward, namely by the cognitive depletion account, provide an incomplete explanation for the detrimental effects of scarcity in tasks that do not rely on working memory (e.g., Beilock et al., 2004; Markman et al., 2006), and education emerges as a key variable to explain scarcity's impact on cognitive functioning, however, one that does not fully explain this effect. In this regard, our findings suggest that investing in formal education is a promising route to improve cognitive functioning, and consequently, social mobility.

Future research should focus on completing this picture by a) providing clearer evidence of causality and clarifying the potential mediator role of factors such as education; b) better identifying and studying other psychological routes for the impact of scarcity on cognition; b) exploring other individual and contextual factors that moderate the effects of

scarcity. New findings along these research lines will likely contribute to the formulation of a more encompassing, evidence-based, scarcity theory.

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References

* Al Hazzouri, A. Z., Elfassy, T., Sidney, S., Jacobs, D., & Yaffe, K. (2017). Sustained economic hardship and cognitive function: The coronary artery risk development in young adults study. *American Journal of Preventive Medicine, 52*(1), 1-9. https://10.1016/j.amepre.2016.08.009

Alwin, D. F., & Wray, L. A. (2005). A Life-Span Developmental Perspective on Social Status and Health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(Special_Issue_2), S7-S14. https://doi.org/10.1093/geronb/60.special_issue_2.s7

Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature Review Neuroscience 4***,** 829–839. https://doi.org/10.1038/nrn1201

Banerjee, A. V., & Duflo, E. (2007). The economic lives of the poor. Journal of Economic Perspectives, 21(1), 141-168. https://doi.org/ 10.1257/jep.21.1.141

Banker, S., Bhanot, S. P., & Deshpande, A. (2020). Poverty identity and preference for challenge: Evidence from the US and India. *Journal of Economic Psychology, 76*, 102214. https://doi.org/10.1016/j.joep.2019.102214

Banks, J., & Mazzonna, F. (2012). The effect of education on old age cognitive abilities: evidence from a regression discontinuity design. *The Economic Journal, 122*(560), 418-448. https://doi.org/10.1111/j.1468-0297.2012.02499.x

Barr, M. S. (2012). No Slack: The Financial Lives of Low-Income Americans. Washington, DC: Brookings Institution Press.

Bartos, V., Bauer, M., Chytilová, J., & Levely, I. (2018). Effects of poverty on impatience: Preferences or inattention? (Working Paper No. 108). Ludwig-Maximilians-Universität München und Humboldt-Universität zu Berlin, Collaborative Research Center Transregio 190 - Rationality and Competition, München und Berlin. Retrieved from: http://hdl.handle.net/10419/185778

Bartoš F, Maier M, Quintana DS, Wagenmakers E-J. (2022). Adjusting for Publication Bias in JASP and R: Selection Models, PET-PEESE, and Robust Bayesian Meta-Analysis. *Advances in Methods and Practices in Psychological Science. 5*(3), 1-19. https://doi.org/10.1177/25152459221109259

Beilock, S. L., & Carr, T. H. (2001). On the Fragility of Skilled Performance: What Governs Choking Under Pressure? *Journal of Experimental Psychology: General*, *130*(4), 701-725. http://doi.org/10.1037/0096-3445.130.4.701

Beilock, S. L., Kulp, C. A., Holt, L. E., & Carr, T. H. (2004). More on the Fragility of Performance: Choking Under Pressure in Mathematical Problem Solving. *Journal of Experimental Psychology: General, 133*(4), 584–600. https://doi.org/10.1037/0096-3445.133.4.584

Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: Conceptual models, empirical challenges and interdisciplinary

perspectives. *International Journal of Epidemiology*, *31*, 285-293. https://doi.org/10.1093/ije/31.2.285

Bertrand, M., Mullainathan, S., & Shafir, E. (2004). A behavioral-economics view of poverty. *American Economic Review*, *94*(2), 419-423. https://doi.org/10.1257/0002828041302019

Blank, R.M. & Barr, M. S. (2009). *Insufficient Funds: Savings, Assets, Credit, and Banking Among Low-Income Households*. New York, NY: Russel Sage Foundation Publications.

Bosch-Domènech, A., Silvestre, J. (2006). Do the Wealthy Risk More Money? An Experimental Comparison. In: Schultz, C., Vind, K. (Eds.) *Institutions, Equilibria and Efficiency. Studies in Economic Theory*, vol 25. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-28161-4_6

Bozarth, J. D., & Roberts, R. R. (1972). Signifying significant significance. *American Psychologist, 27*(8), 774–775. https://doi.org/10.1037/h0038034

Braveman, P. A., Cubbin, C., Egerter, S., Williams, D. R., & Pamuk, E. (2010). Socioeconomic disparities in health in the United States: what the patterns tell us. *American Journal of Public Health, 100*(S1), S186-S196. https://doi.org/10.2105/AJPH.2009.166082

Bricker, J., Kennickell, A. B., Moore, K. B., & Sabelhaus, J. (2012). Changes in US family finances from 2007 to 2010: evidence from the Survey of Consumer Finances. *Federal Reserve Bulletin, 100*(4), 1-80. Retrieved from https://www.federalreserve.gov/pubs/bulletin/2014/pdf/scf14.pdf

Brown, M. T. (2010). Early-life characteristics, psychiatric history, and cognition trajectories in later life. *The Gerontologist*, *50*, 646-656. https://doi.org/10.1093/geront/gnq049

Brown, J. R., Ivković, Z., & Weisbenner, S. (2015). Empirical determinants of intertemporal choice. *Journal of Financial Economics*, *116,* 473–486. https://doi.org/10.1016/j.jfineco.2015.04.004

Brown, M. T., Wilmoth, J. M., & London, A. S. (2014). Veteran status and men's later-life cognitive trajectories: Evidence from the Health and Retirement Study. *Journal of Aging and Health*, *26*, 924-951. https://doi.org/10.1177/0898264314534893

Burgess, S., & Briggs, A. (2010). School assignment, school choice and social mobility. *Economics of Education Review, 29*(4), 639-649. https://doi.org/10.1016/j.econedurev.2009.10.011

* Cadar, D., Brocklebank, L., Yan, L., Zhao, Y., & Steptoe, A. (2021, October). *Socioeconomic Inequalities in Healthy Cognitive Ageing: A Coordinated Cross-Country Investigation between England and China* (Working paper). http://dx.doi.org/10.2139/ssrn.3945459

* Cagney, K. A., & Lauderdale, D. S. (2002). Education, wealth, and cognitive function in later life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(2), 163-172. https://doi.org/10.1093/geronb/57.2.P163

Callan, M. J., Ellard, J. H., Will Shead, N., & Hodgins, D. C. (2008). Gambling as a search for justice: Examining the role of personal relative deprivation in gambling urges and gambling behavior. *Personality and Social Psychology Bulletin*, *34*(11), 1514-1529. https://doi.org/10.1177/0146167208322956

Carvalho, L. S., Meier, S., & Wang, S. W. (2016). Poverty and economic decision-making: Evidence from changes in financial resources at payday. *American Economic Review*, *106*(2), 260-284. https://doi.org/10.1257/aer.20140481

Cheung, K. C., Chan, W., Chou, K., & Lau, M. K. (2018). Evaluating the Effectiveness and Efficiency of Hong Kong Welfare Programmes in Reducing Child Poverty. *Children & Society, 32*(6), 481–491. https://doi.org/10.1111/chso.12290

Cheung, M. W. L. (2015). *Meta-analysis: A structural equation modeling approach*. United Kingdom: John Wiley & Sons.

Cheung, M. W. L. (2019). A guide to conducting a meta-analysis with non-independent effect sizes. *Neuropsychology Review*, 29, 387–396. https://doi.org/10.1037/bul0000147

Choudhury, P. (2014). The Myth of Right to Education. *IOSR Journal Of Humanities And Social Science, 19*(12), 37-41. https://doi.org/10.9790/0837-191213741

Clotfelter, C., Ladd, H. F., Vigdor, J., & Wheeler, J. (2006). High-poverty schools and the distribution of teachers and principals. *North Carolina Law Review, 85*, 1345-1380. https://doi.org/10.1037/e722752011-001

Cohen, S., Alper, C. M., Doyle, W. J., Adler, N., Treanor, J. J., & Turner, R. B. (2008). Objective and subjective socioeconomic status and susceptibility to the common cold. *Health Psychology*, *27*(2), 268-274. https://doi.org/10.1037/0278-6133.27.2.268

Cohen, S., Janicki-Deverts, D., Chen, E., & Matthews, K. A. (2010). Childhood socioeconomic status and adult health. *Annals of The New York Academy of Sciences*, *1186*(1), 37-55. https://doi.org/10.1111/j.1749-6632.2009.05334.x

Cooper, H., Hedges, L. V. & Valentine, J. C. (2019). *The handbook of research synthesis and meta-analysis*. New York, NY: Russell Sage Foundation.

Cuñado, J., & de Gracia, F. P. (2012). Does education affect happiness? Evidence for Spain. *Social Indicators Research, 108*(1), 185–96 https://doi.org/10.1007/s11205-011-9874-x

Cunha, F., & Heckman, J. (2007). The technology of skill formation. *American Economic Review*, *97*(2), 31-47. https://doi.org/10.1257/aer.97.2.31

Cunha, F., Heckman, J. J., Lochner, L., & Masterov, D. V. (2006). Interpreting the evidence on life cycle skill formation. In E. Hanushek & F. Welch (eds.), *Handbook of the*

Economics of Education (pp 697-812). Amsterdam: Elsevier. https://doi.org/10.1016/S1574-0692(06)01012-9

* Czernochowski, D., Fabiani, M., & Friedman, D. (2008). Use it or lose it? SES mitigates age-related decline in a recency/recognition task. *Neurobiology of Aging, 29*(6), 945-958. https://doi.org/10.1016/j.neurobiolaging.2006.12.017

* Dang, J., Xiao, S., Zhang, T., Liu, Y., Jiang, B., & Mao, L. (2016). When the poor excel: Poverty facilitates procedural learning. *Scandinavian Journal of Psychology*, *57*(4), 288-291. https://doi.org/10.1111/sjop.12292

Dean, E. B., Schilbach, F., & Schofield, H. (2017). Poverty and cognitive function. In The economics of poverty traps (pp. 57-118). University of Chicago Press.

De Bruijn, E. J., & Antonides, G. (2022). Poverty and economic decision making: a review of scarcity theory. *Theory and Decision, 92*(1), 5-37. https://doi.org/10.1007/s11238-021-09802-7

DeCaro, M. S., Thomas, R. D., Albert, N. B., & Beilock, S. L. (2011). Choking under pressure: Multiple routes to skill failure. *Journal of Experimental Psychology: General*, *140*(3), 390-406. https://doi.org/10.1037/a0023466

DeCaro, M. S., Thomas, R. D., & Beilock, S. L. (2008). Individual differences in category learning: Sometimes less working memory capacity is better than more. *Cognition*, *107*(1), 284-294. https://doi.org/10.1016/j.cognition.2007.07.001

DiMatteo, M. R., Giordani, P. J., Lepper, H. S., & Croghan, T. W. (2002). Patient adherence and medical treatment outcomes a meta-analysis. *Medical Care*, *40*(9), 794-811. https://doi.org/10.1097/00005650-200209000-00009

* Doblhammer, G., Van den Berg, G. J., & Fritze, T. (2013). Economic conditions at the time of birth and cognitive abilities late in life: evidence from ten European countries. *PloS One, 8*(9), 1-12. https://doi.org/10.1371/journal.pone.0074915

Dohrenwend, B. (2000). The Role of Adversity and Stress in Psychopathology: Some Evidence and Its Implications for Theory and Research. *Journal of Health and Social Behavior, 41*(1), 1-19. Retrieved from: www.jstor.org/stable/2676357

Duggan, J. E., Gillingham, R., & Greenlees, J. S. (2007). Mortality and lifetime income:

evidence from US social security records (Working paper No. 7/15). International Monetary Fund. Retrieved from: https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/wp/2007/_wp0715.ashx

Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development*, *65*(2), 296-318. https://doi.org/10.1111/j.1467-8624.1994.tb00752.x

Encyclopædia Britannica Editors (2023, October 13). Poverty | Definition, Causes, Types, & Facts. Encyclopedia Britannica. https://www.britannica.com/topic/poverty

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629-634. https://doi.org/10.1136/bmj.315.7109.629

Ellis, B. J., Bianchi, J., Griskevicius, V., & Frankenhuis, W. E. (2017). Beyond risk and protective factors: An adaptation-based approach to resilience. *Perspectives on Psychological Science, 12*(4), 561-587. https://doi.org/10.1177/1745691617693054

Estevan, F. (2009, December). When being out of school can be bad for the school: a case for conditional cash transfers (Working paper #0915E). Department of Economics, Faculty of Social Sciences, University of Ottawa. https://ruor.uottawa.ca/handle/10393/41352

Everson-Rose, S. A., Mendes de Leon, C. F., Bienias, J. L., Wilson, R. S., & Evans, D. A. (2003). Early life conditions and cognitive functioning in later life. *American Journal* of Epidemiology, 158(11), 1083-1089. https://doi.org/10.1093/aje/kwg263

Fafchamps, M., & Quisumbing, A. R. (1999). Human capital, productivity, and labor allocation in rural Pakistan. *Journal of Human Resources, 34*, 369-406. https://doi.org/10.2139/ssrn.68988

Fehr, D., Fink, G., & Jack, K. (2019). Poverty, seasonal scarcity and exchange asymmetries (No. w26357). National Bureau of Economic Research.

* Fehr, D., Fink, G., & Jack, B. K. (2022). Poor and rational: Decision-making under scarcity. *Journal of Political Economy, 130*(11), 2862-2897. https://doi.org/10.1086/720466

Fernandes, D., Lynch Jr, J. G., & Netemeyer, R. G. (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science*, *60*(8), 1861-1883. https://doi.org/10.1287/mnsc.2013.1849

Fernández-Castilla, B., Beretvas, S. N., Onghena, P., & Van Den Noortgate, W. (2019, May 31). *Multilevel Models in Meta-Analysis: A Systematic Review of Their Application and Suggestions*. ZPID (Leibniz Institute for Psychology Information). https://doi.org/10.23668/psycharchives.2478

Fiske, S. T. (2012). Managing ambivalent prejudices: smart-but-cold and warm-but-dumb stereotypes. *The Annals of the American Academy of Political and Social Science,*

639(1), 33-48. https://doi.org/10.1177/0002716211418444

* Fors, S., Lennartsson, C., & Lundberg, O. (2009). Childhood living conditions, socioeconomic position in adulthood, and cognition in later life: exploring the associations. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *64*(6), 750-757. https://doi.org/10.1093/geronb/gbp029

Frankenhuis, W. E., & de Weerth, C. (2013). Does early-life exposure to stress shape or impair cognition? *Current Directions in Psychological Science, 22*(5), 407-412. https://doi.org/10.1177/0963721413484324

Frankenhuis, W. E., & Nettle, D. (2020). The strengths of people in poverty. *Current Directions in Psychological Science, 29*(1), 16-21. https://doi.org/10.1177/09637214198811

Fry, C. E., Langley, K., & Shelton, K. H. (2017). A systematic review of cognitive functioning among young people who have experienced homelessness, foster care, or poverty. *Child Neuropsychology, 23*(8), 907–934. https://doi.org/10.1080/09297049.2016.1207758

Galama, T., Lleras-Muney, A., & Kippersluis, H. (2018, May 24). The Effect of Education on Health and Mortality: A Review of Experimental and Quasi-Experimental Evidence. *Oxford Research Encyclopedia of Economics and Finance.* https://oxfordre.com/economics/view/10.1093/acrefore/9780190625979.001.0001/acrefore-9780190625979-e-7.

Gallo, L. C., & Matthews, K. A. (2003). Understanding the association between socioeconomic status and physical health: do negative emotions play a role? *Psychological Bulletin, 129*(1), 10-51. https://doi.org/10.1037/0033-2909.129.1.10

Gerards, R., & Welters, R. (2022). Job search in the presence of a stressor: Does financial hardship change the effectiveness of job search? *Journal of Economic Psychology, 90*, 102508. https://doi.org/10.1016/j.joep.2022.102508

Gereke, J., Schaub, M., & Baldassarri, D. (2022). Immigration, integration and cooperation: experimental evidence from a public goods game in Italy. *Journal of Ethnic and Migration Studies, 48*(15), 3761-3788. https://doi.org/10.1080/1369183X.2021.1949269

Sharon Gewirtz (2017) Rethinking education and poverty. *British Journal of Sociology of Education, 38*(7), 1081-1088. https://doi.org/10.1080/01425692.2017.1349654

Goldin, J., & Homoff, T. (2013). Smoke gets in your eyes: Cigarette tax salience and regressivity. *American Economic Journal: Economic Policy, 5*(1), 302-336. https://doi.org/10.1257/pol.5.1.302

González, H. M., Tarraf, W., Bowen, M. E., Johnson-Jennings, M. D., & Fisher, G. G. (2013). What do parents have to do with my cognitive reserve? Life course perspectives on twelve-year cognitive decline. *Neuroepidemiology, 41*, 101–109. https://doi.org/10.1159/000350723

Graham, H. (2002). Building an inter-disciplinary science of health inequalities: the example of lifecourse research. *Social Science & Medicine*, *55*(11), 2005-2016. https://doi.org/10.1016/s0277-9536(01)00343-4

* Graves, V. (2015). *Does poverty really impede cognitive function? Experimental evidence from Tanzanian Fishers.* (Master's thesis, The University of San Francisco, San Francisco, USA). Retrieved from https://repository.usfca.edu/cgi/viewcontent.cgi?article=1148&context=thes.

Griskevicius, V., Tybur, J. M., Delton, A.W., & Robertson, T. E. (2011). The influence of mortality and socioeconomic status on risk and delayed rewards: a life history theory

approach. *Journal of Personality and Social Psychology, 100*, 1015–1026 https://doi.org/10.1037%2Fa0022403

Guiso, L., & Paiella, M. (2008). Risk aversion, wealth, and background risk. *Journal of the European Economic Association*, *6*(6), 1109-1150. https://doi.org/10.1162/JEEA.2008.6.6.1109

* Haan, M. N., Zeki Al-Hazzouri, A., & Aiello, A. E. (2011). Life-span socioeconomic trajectory, nativity, and cognitive aging in Mexican Americans: the Sacramento Area Latino Study on Aging. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *66*(supplement_1), i102-i110. https://doi.org/10.1093/geronb/gbq071

Hagenaars, A., & De Vos, K. (1988). The definition and measurement of poverty. *Journal of Human Resources, 23*, 211-221. https://doi.org/10.2307/145776

Harrer, M., Cuijpers, P., Furukawa, T.A, & Ebert, D. D. (2019). *Doing Meta-Analysis In R: A Hands-On Guide*. Retrieved from https://bookdown.org/MathiasHarrer/Doing_Meta_Analysis_in_R/. https://doi.org/10.5281/zenodo.2551803

Haushofer, J. (2011). *Neurobiological poverty traps.* Working paper. Princeton University. Retrieved from https://pdfs.semanticscholar.org/27f5/62bc74d4e871439d2a73a8bf88884875ee1f.pdf

Haushofer, J. (2013). *The psychology of poverty: Evidence from 43 countries* (Working paper). Retrieved from https://www.princeton.edu/haushofer/publications/Haushofer_2013.pdf

Haushofer, J., & Fehr, E. (2014). On the psychology of poverty. *Science*, *344*(6186), 862-867. https://doi.org/10.1126/science.1232491

Haushofer, J., & Shapiro, J. (2016). The short-term impact of unconditional cash transfers to the poor: experimental evidence from Kenya. *The Quarterly Journal of Economics, 131*(4), 1973-2042. https://doi.org/10.1093/qje/qjw025

Hayward, M. D., & Gorman, B. K. (2004). The long arm of childhood: The influence of early-life social conditions on men's mortality. *Demography*, *41*(1), 87-107. https://doi.org/10.1353/dem.2004.0005

Hilbert, L. P., Noordewier, M. K., & van Dijk, W. W. (2022a). The prospective associations between financial scarcity and financial avoidance. *Journal of Economic Psychology, 88*, 102459. https://doi.org/10.1016/j.joep.2021.102459

Hilbert, L. P., Noordewier, M. K., & van Dijk, W. W. (2022b). Financial scarcity increases discounting of gains and losses: Experimental evidence from a household task. *Journal of Economic Psychology, 92*, 102546. https://doi.org/10.1016/j.joep.2022.102546

Hofmarcher, T. (2021). The effect of education on poverty: A European perspective. *Economics of Education Review, 83*, 102124. https://doi.org/10.1016/j.econedurev.2021.102124

Hong, K., Savelyev, P. A., & Tan, K. T. (2020). Understanding the mechanisms linking college education with longevity. *Journal of Human Capital, 14*(3), 371-400. https://doi.org/10.1086/710221

* Huang, L., Li, X., Xu, F., & Li, F. (2023). Consequences of scarcity: the impact of perceived scarcity on executive functioning and its neural basis. *Frontiers in Neuroscience, 17*, 1158544. https://doi.org/10.3389/fnins.2023.1158544

* Hughes, B. T., Ludwig, R. M., & Berkman, E. (2022, November 2). *The Effect of Financial Stress on Inhibitory Control and Economic Decisions.* PsyArXiv. https://doi.org/10.31234/osf.io/ra7n6

Huijsmans, I., Ma, I., Micheli, L., Civai, C., Stallen, M., & Sanfey, A. G. (2019). A scarcity mindset alters neural processing underlying consumer decision making. *Proceedings of the National Academy of Sciences*, *116*(24), 11699-11704. https://doi.org/10.1073/pnas.1818572116

* Joy, E. E. (2017). *For the Poor, Does Attentional Bias or Worry Explain the Relationship between Financial Stressors and Poor Cognitive Performance?* (Master's thesis, Washburn University, Topeka, Kansas, USA). https://wuir.washburn.edu/items/acd66177-e32c-4a67-b76d-3f48b74493fb

Judge, T. A., Hurst, C., & Simon, L. S. (2009). Does it pay to be smart, attractive, or confident (or all three)? Relationships among general mental ability, physical attractiveness, core self-evaluations, and income. *Journal of Applied Psychology, 94*(3), 742-755. https://doi.org/10.1037/a0015497

* Kaplan, G. A., Turrell, G., Lynch, J. W., Everson, S. A., Helkala, E. L., & Salonen, J. T. (2001). Childhood socioeconomic position and cognitive function in adulthood. *International Journal of Epidemiology*, *30*(2), 256-263. https://doi.org/10.1093/ije/30.2.256

* Karlamangla, A. S., Miller-Martinez, D., Aneshensel, C. S., Seeman, T. E., Wight, R. G., & Chodosh, J. (2009). Trajectories of cognitive function in late life in the United States: demographic and socioeconomic predictors. *American Journal of Epidemiology, 170*(3), 331-342. https://doi.org/10.1093/aje/kwp154

Katz, S. J., & Hofer, T. P. (1994). Socioeconomic disparities in preventive care persist despite universal coverage: breast and cervical cancer screening in Ontario and the United States. *Journal of the American Medical Association, 272*(7), 530-534. https://doi.org/10.1001/jama.1994.03520070050037

Kelly, S., Hertzman, C., & Daniels, M. (1997). Searching for the biological pathways between stress and health. *Annual Review of Public Health*, *18*(1), 437-462. https://doi.org/10.1146/annurev.publhealth.18.1.437

Kenworthy, L. (1999). Do social-welfare policies reduce poverty? A cross-national assessment. *Social Forces*, *77*(3), 1119-1139. https://doi.org/10.1093/sf/77.3.1119

* Kiely, K. M., Anstey, K. J., & Butterworth, P. (2019). Within-person associations between financial hardship and cognitive performance in the PATH through life study. *American Journal of Epidemiology, 188*(6), 1076-1083. https://doi.org/10.1093/aje/kwz051

Kim, J., Sorhaindo, B., & Garman, E. T. (2006). Relationship between financial stress and workplace absenteeism of credit counseling clients. *Journal of Family and Economic Issues, 27*(3), 458-478. https://doi.org/10.1007/s10834-006-9024-9

Kishiyama, M. M., Boyce, W. T., Jimenez, A. M., Perry, L. M., & Knight, R. T. (2009). Socioeconomic disparities affect prefrontal function in children. *Journal of Cognitive Neuroscience*, *21*(6), 1106-1115. https://doi.org/10.1162/jocn.2009.21101

Kuh, D., Ben-Shlomo, Y., Lynch, J., Hallqvist, J., & Power, C. (2003). Life course epidemiology. *Journal of Epidemiology and Community Health*, *57*(10), 778-783. http://doi.org/10.1136/jech.57.10.778

Lachman, M. E., & Weaver, S. L. (1998). The sense of control as a moderator of social class differences in health and well-being. *Journal of Personality and Social Psychology, 74*(3), 763-773. https://doi.org/10.1037/0022-3514.74.3.763

Lantz, P. M., House, J. S., Lepkowski, J. M., Williams, D. R., Mero, R. P., & Chen, J. (1998). Socioeconomic factors, health behaviors, and mortality: results from a national representative prospective study of US adults. *Journal of The American Medical Association, 279*(21), 1703-1708. https://doi.org/10.1001/jama.279.21.1703

LeBlanc, V. R. (2009). The effects of acute stress on performance: implications for health professions education. *Academic Medicine, 84*(10), S25-S33. https://doi.org/10.1097/acm.0b013e3181b37b8f

Leist, A. K., Hessel, P., & Avendano, M. (2014). Do economic recessions during early and mid-adulthood influence cognitive function in older age? *Journal of Epidemiology & Community Health, 68*, 151–158. doi:10.1136/jech-2013-202843

* Lichand, G., & Mani, A. (2020, February). Cognitive droughts (Working Paper No. 341). University of Zurich, Department of Economics. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3540149

Lighthall, N. R., Gorlick, M. A., Schoeke, A., Frank, M. J. & Mather, M. (2013). Stress modulates reinforcement learning in younger and older adults. Psychology and Aging, 28, 35–46.

Lipman, P. (2004). *High Stakes Education: Inequality, Globalization, and Urban School Reform*. Routledge.

Liu, S., & Heshmati, A. (2023). Relationship between education and well-being in China. *Journal of Social and Economic Development, 25*(1), 123-151. https://doi.org/10.1007/s40847-022-00193-1

Lott, B., & Bullock, H. E. (2007). *Psychology and economic injustice: Personal, professional, and political intersections*. Washington, DC: American Psychological Association Press.

Lövdén, M., Fratiglioni, L., Glymour, M. M., Lindenberger, U., & Tucker-Drob, E. M. (2020). Education and cognitive functioning across the life span. *Psychological Science in the Public Interest, 21*(1), 6-41. https://doi.org/10.1177/1529100620920576

Ludwig, J., Duncan, G. J., Gennetian, L. A., Katz, L. F., Kessler, R. C., Kling, J. R., & Sanbonmatsu, L. (2012). Neighborhood effects on the long-term well-being of low-income adults. *Science, 337*(6101), 1505-1510. https://doi.org/10.1126%2Fscience.1224648

* Luo, Y., & Waite, L. J. (2005). The impact of childhood and adult SES on physical, mental, and cognitive well-being in later life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(2), S93-S101. https://doi.org/10.1093%2Fgeronb%2F60.2.s93

Lupien, S. J., Maheu, F., Tu, M., Fiocco, A., & Schramek, T. E. (2007). The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition. *Brain and cognition*, *65*(3), 209-237. https://doi.org/10.1016/j.bandc.2007.02.007

Lusardi, A. (2012). Numeracy, Financial Literacy, and Financial Decision-Making. *Numeracy*, *5*(1), 1-14. http://doi.org/ 10.5038/1936-4660.5.1.2

Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *American Economic Journal: Journal of Economic Literature, 52*(1), 5-44. https://10.1257/jel.52.1.5

Macnamara, B. N., & Burgoyne, A. P. (2023). Do growth mindset interventions impact students' academic achievement? A systematic review and meta-analysis with recommendations for best practices. *Psychological Bulletin, 0*(0). https://doi.org/10.1037/bul0000352.

Maddox, W. T., & Ashby, F. G. (2004). Dissociating explicit and procedural-learning based systems of perceptual category learning. *Behavioural Processes*, *66*(3), 309-332. https://doi.org/10.1016/j.beproc.2004.03.011

Maier, M., Bartoš, F., Stanley, T. D., Shanks, D. R., Harris, A. J., & Wagenmakers, E. J. (2022). No evidence for nudging after adjusting for publication bias. *Proceedings of the National Academy of Sciences, 119*(31), e2200300119. https://doi.org/ https://doi.org/10.1073/pnas.2200300119

* Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013a). Poverty impedes cognitive function. *Science, 341*(6149), 976-980. https://doi.org/10.1126/science.1238041

Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013b). Response to comment on "Poverty impedes cognitive function". *Science, 342*(6163), 1169-1169. https://doi.org/10.1126/science.124679

* Marden, J. (2016). *Predictors of Dementia and Memory Decline: Lifecourse Socioeconomic Status and Diabetes* (Doctoral dissertation, Harvard T.H. Chan School of Public Health). http://nrs.harvard.edu/urn-3:HUL.InstRepos:25757886

Marengoni, A., Fratiglioni, L., Bandinelli, S., & Ferrucci, L. (2011). Socioeconomic status during lifetime and cognitive impairment no-dementia in late life: The population-based aging in the Chianti Area (InCHIANTI) Study. *Journal of Alzheimer's Disease: JAD, 24*, 559–568. https://doi.org/10.3233/JAD-2011-101863

Markman, A. B., Maddox, W. T., & Worthy, D. A. (2006). Choking and Excelling Under Pressure. *Psychological Science, 17*(11), 944–948. https://doi.org/10.1111/j.1467-9280.2006.01809.x

Marmot, M. (2004). *The Status Syndrome: How Social Standing Affects our Health And Longevity*. London: Bloomsbury.

Mathur, M. B., & VanderWeele, T. J. (2020). A Simple, Interpretable Conversion from Pearson's Correlation to Cohen's for d Continuous Exposures. *Epidemiology*, *31*(2), e16-e18. https://doi.org/10.1097/EDE.0000000000001105

* McCann, A., McNulty, H., Rigby, J., Hughes, C. F., Hoey, L., Molloy, A. M., ... & McCarroll, K. (2018). Effect of area-level socioeconomic deprivation on risk of cognitive dysfunction in older adults. *Journal of the American Geriatrics Society, 66*(7), 1269-1275. https://doi.org/10.1111/jgs.15258

Medeiros-Ward, N., Cooper, J. M., & Strayer, D. L. (2014). Hierarchical control and driving. *Journal of Experimental Psychology: General, 143*(3), 953–958. https://doi.org/10.1037/a0035097

Mehta, R., & Zhu, M. (2016). Creating when you have less: The impact of resource scarcity on product use creativity. *Journal of Consumer Research, 42*(5), 767-782. https://doi.org/10.1093/jcr/ucv051

Mendel, D. (2005). Double Jeopardy: Why the Poor Pay More. Baltimore, Md.: Annie E. Casey Foundation.

* Mittal, C., Griskevicius, V., Simpson, J. A., Sung, S., & Young, E. S. (2015). Cognitive adaptations to stressful environments: When childhood adversity enhances adult executive function. *Journal of Personality and Social Psychology, 109*(4), 604. https://doi.org/10.1037/pspi0000028

Moorthy, K., Munz, Y., Dosis, A., Bann, S., & Darzi, A. (2003). The effect of stress-inducing conditions on the performance of a laparoscopic task. *Surgical Endoscopy and Other Interventional Techniques*, *17*(9), 1481-1484. https://doi.org/10.1007/s00464-002-9224-9

Morsy, L., & Rothstein, R. (2019). Toxic stress and children's outcomes. Retrieved from: https://files.eric.ed.gov/fulltext/ED598149.pdf

Mullainathan, S., & Shafir, E. (2013). *Scarcity: Why having too little means so much*. New York, NY: Times Books.

Neal, R.D., Lawlor, D.A., Allgar, V., Colledge, M.A., Ali, S., Hassey, A., Portz, C., & Wilson, A. (2001). Missed appointments in general practice: retrospective data analysis from four practices. *The British Journal of General Practice, 51*(471), 830-832. Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1314130/pdf/11677708.pdf

Ngepah, N., Makgalemele, T., & Saba, C. S. (2023). The relationship between education and vulnerability to poverty in South Africa. *Economic Change and Restructuring, 56*(1), 633-656. https://doi.org/10.1007/s10644-022-09439-8

Nguyen, C. T., Couture, M., Alvarado, B. E., & Zunzunegui, M. (2008). Life course socioeconomic disadvantage and cognitive function among the elderly population of seven capitals in Latin America and the Caribbean. *Journal of Aging and Health*, *20*, 347-362. https://doi.org/10.1177/0898264308315430

Nikolaev, B. (2018). Does higher education increase hedonic and eudaimonic happiness? *Journal of Happiness Studies, 19*, 483–504. https://doi.org/10.1007/s10902-016-9833-y

Noble, K. G., McCandliss, B. D., & Farah, M. J. (2007). Socioeconomic gradients predict individual differences in neurocognitive abilities. *Developmental Science*, *10*(4), 464-480. https://doi.org/10.1111/j.1467-7687.2007.00600.x

Noble, K. G., Norman, M. F., & Farah, M. J. (2005). Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science*, *8(*1), 74-87. https://doi.org/10.1111/j.1467-7687.2005.00394.x

Noguera, P. A. (2011). A broader and bolder approach uses education to break the cycle of poverty. *Phi Delta Kappan, 93*(3), 8-14. https://doi.org/10.1177/003172171109300303

Oei, N. Y., Everaerd, W. T., Elzinga, B. M., van Well, S., & Bermond, B. (2006). Psychosocial stress impairs working memory at high loads: an association with cortisol levels and memory retrieval. *Stress, 9*(3), 133-141. https://doi.org/10.1080/10253890600965773

* O'Neill, J., Cameron, C. E., Leone, L. A., & Orom, H. (2021). Financial scarcity is indirectly related to multiple aspects of executive function through stress and the strength of association depends on childhood poverty. *Journal of Theoretical Social Psychology, 5*(4), 464-477. https://doi.org/10.1002/jts5.111

* Ong, Q., Theseira, W., & Ng, I. Y. (2019). Reducing debt improves psychological functioning and changes decision-making in the poor. *Proceedings of the National Academy of Sciences*, *116*(15), 7244-7249. https://doi.org/10.1073/pnas.1810901116

* Osler, M., Avlund, K., & Mortensen, E. L. (2013). Socio-economic position early in life, cognitive development and cognitive change from young adulthood to middle age. *The European Journal of Public Health, 23*(6), 974-980. https://10.1093/eurpub/cks140

* Packard, C. J., Bezlyak, V., McLean, J. S., Batty, G. D., Ford, I., Burns, H., ... & Millar, K. (2011). Early life socioeconomic adversity is associated in adult life with chronic inflammation, carotid atherosclerosis, poorer lung function and decreased cognitive performance: a cross-sectional, population-based study. *BMC Public Health, 11*(1), 42. https://doi.org/10.1186/1471-2458-11-42

Paluck, E. L., Porat, R., Clark, C. S., & Green, D. P. (2021). Prejudice reduction: Progress and challenges. *Annual Review of Psychology, 72*, 533-560. https://doi.org/10.1146/annurev-psych-071620-030619

Pampel, F. C., Krueger, P. M., & Denney, J. T. (2010). Socioeconomic disparities in health behaviors. *Annual Review of Sociology, 36*, 349-370. https://doi.org/10.1146/annurev.soc.012809.102529

* Pande, S. (2023). *Decision Making Under Scarcity: An Inquiry into The Effects of Cognitive Load* (Doctoral dissertation, University of East Anglia). Retrieved from https://ueaeprints.uea.ac.uk/id/eprint/93000/

Panter-Brick, C. (2002). Street children, human rights, and public health: A critique and future directions. *Annual Review of Anthropology*, *31*(1), 147-171. https://doi.org/10.1146/annurev.anthro.31.040402.085359

Patience, S. (2013). Supporting low-income families with nutrition. *Journal of Health Visiting, 1*(6), 336-341. https://doi.org/10.12968/johv.2013.1.6.336

Pepper, G. V., & Nettle, D. (2017). The behavioural constellation of deprivation: Causes and consequences. *Behavioral and Brain Sciences, 40*, 1-46. https://doi.org/10.1017/S0140525X1600234X

Prelec, D., & Loewenstein, G. (1998). The red and the black: Mental accounting of savings and debt. Marketing Science, 17(1), 4-28. https://doi.org/10.1287/mksc.17.1.4

Psacharopoulos, G., & Patrinos, H. A. (2018). Returns to Investment in Education: A Decennial Review of the Global Literature. *Education Economics, 26*, 445-458. https://doi.org/10.1080/09645292.2018.1484426

Richards, M., & Deary, I. J. (2005). A life course approach to cognitive reserve: a model for cognitive aging and development? *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society*, *58*(4), 617-622. https://doi.org/10.1002/ana.20637

Roberts, E., Bornstein, M. H., Slater, A. M., & Barrett, J. (1999). Early cognitive development and parental education. *Infant and Child Development: An International Journal of Research and Practice*, *8*(1), 49-62. https://doi.org/10.1002/(SICI)1522-7219(199903)8:1%3C49::AID-ICD188%3E3.0.CO;2-1

Rodrigues, C. F. (2009). *Efficacy of Anti-poverty and Welfare Programs in Portugal: the Joint Impact of the CSI and RSI*. (Working Paper nº 42-2009/DE). Retrieved from https://www.repository.utl.pt/handle/10400.5/1734

Rodriguez, L. A., Nguyen, T. D., & Springer, M. G. (2023). Revisiting Teaching Quality Gaps: Urbanicity and Disparities in Access to High-Quality Teachers Across Tennessee. *Urban Education, 0*(0). https://doi.org/10.1177/00420859231153409

Rodríguez-Pose, A., & von Berlepsch, V. (2014). Social capital and individual happiness in Europe. *Journal of Happiness Studies, 15*, 357–386. https://10.1007/s10902-013-9426-y

Roozendaal, B., Okuda, S., De Quervain, D. F., & McGaugh, J. L. (2006). Glucocorticoids interact with emotion-induced noradrenergic activation in influencing different memory functions. *Neuroscience, 138*(3), 901-910.

Roser M. and Ortiz-Ospina E. (2020). *Global Extreme Poverty*. Published online at OurWorldInData.org. Retrieved from https://ourworldindata.org/extreme-poverty

Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). *Publication bias in meta-analysis: Prevention, assessment and adjustments*. Chichester, England; Hoboken, NJ: Wiley. https://doi.org/10.1002/0470870168

Ruggeri, K., Panin, A., Vdovic, M., Većkalov, B., Abdul-Salaam, N., Achterberg, J., ... & Toscano, F. (2022). The globalizability of temporal discounting. *Nature Human Behaviour, 6*(10), 1386-1397. https://https://doi.org/10.1038/s41598-023-36339-2

Ruggeri, K., Ashcroft-Jones, S., Abate Romero Landini, G., Al-Zahli, N., Alexander, N., Andersen, M. H., ... & Stock, F. (2023). The persistence of cognitive biases in financial decisions across economic groups. *Scientific Reports, 13*(1), 10329. https://https://doi.org/10.1038/s41562-022-01392-w

Schaub, M., Gereke, J., & Baldassarri, D. (2019). Does Poverty Undermine Cooperation in Multiethnic Settings? Evidence from a Cooperative Investment Experiment. Journal of Experimental Political Science, 7, 27 - 40. https://doi.org/10.1017/XPS.2019.19.

Schaub, M. (2020). Does poverty reduce turnout? Causal evidence from the sequencing of bank working days. https://maxschaub.eu/documents/schaub2020poverty.pdf

Schoofs, D., Preuß, D., & Wolf, O. T. (2008). Psychosocial stress induces working memory impairments in an n-back paradigm. *Psychoneuroendocrinology, 33*(5), 643-653. https://doi.org/10.1016/j.psyneuen.2008.02.004

Schneeweis, N., Skirbekk, V., & Winter-Ebmer, R. (2014). Does education improve cognitive performance four decades after school completion? *Demography, 51*(2), 619-643. https://doi.org&10.1 007/s 1 3 524-0 1 4-028 1 - 1

Serajuddin, U. & Yoshida, N. (2018). The world is aiming to halve extreme poverty by 2030 – but what does that actually mean? Retrieved from https://www.weforum.org/agenda/2016/07/the-world-is-aiming-to-halve-extreme-poverty-by-2030-but-what-does-that-actually-mean/

Shah, A. K., Mullainathan, S., & Shafir, E. (2012). Some consequences of having too little. *Science*, *338*(6107), 682-685. https://doi.org/10.1126/science.1222426

Shah, A. K., Shafir, E., & Mullainathan, S. (2015). Scarcity frames value. *Psychological Science*, 26(4), 402-412. https://10.1177/0956797614563958

Sharafi, Z. (2023). Poverty and perseverance: The detrimental effect of poverty on effort provision. Journal of Development Economics, 162, 103040. https://doi.org/10.1016/j.jdeveco.2022.103040

Sheehy-Skeffington, J. (2018). Decision-making up against the wall: A framework for understanding the behavioural dimension of low socioeconomic status. In S. Oishi and A. Uskul (eds), *The Socioeconomic Environment and Human Psychology*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780190492908.001.0001

Sheehy-Skeffington, J. (2020). The effects of low socioeconomic status on decision-making processes. *Current Opinion in Psychology, 33*, 183-188. https://doi.org/10.1016/j.copsyc.2019.07.043

Sheehy-Skeffington, J., & Rea, J. (2017). *How poverty affects People's decision-making processes*. York: Joseph Rowntree Foundation. Retrieved from http://www.lse.ac.uk/PBS/assets/documents/2017-sheehy-and-rea-findings-3235-final.pdf

Singh-Manoux, A., Richards, M., & Marmot, M. (2005). Socioeconomic position across the lifecourse: how does it relate to cognitive function in mid-life? *Annals of Epidemiology*, *15*(8), 572-578. https://doi.org/10.1016/j.annepidem.2004.10.007

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*(3), 417-453. https://doi.org/10.3102%2F00346543075003417

Smyth, E. and S. McCoy (2009). Investing in Education, ESRI Research Bulletin 2009/3/3, Dublin: ESRI. Retrieved from https://www.esri.ie/publications/investing-in-education

Sommet, N., & Spini, D. (2022). Financial scarcity undermines health across the globe and the life course. Social Science & Medicine, 292, 114607. https://doi.org/10.1016/j.socscimed.2021.114607

Spiller, S. A. (2011). Opportunity cost consideration. *Journal of Consumer Research, 38*, 595–610. https://10.1086/660045

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, *47*(10), 2015-2028. https://doi.org/10.1016/j.neuropsychologia.2009.03.004

Suurmond, R., Wynstra, F., & Dul, J. (2020). Unraveling the dimensions of supplier involvement and their effects on NPD performance: a meta-analysis. *Journal of Supply Chain Management*, 1-21. https://doi.org/10.1111/jscm.12221

Tanaka, T., Camerer, C. F., & Nguyen, Q. (2010). Risk and time preferences: Linking experimental and household survey data from Vietnam. *American Economic Review*, *100*(1), 557-571. https://doi.org/10.1007/978-4-431-55402-8_1

Thaler, R. H. (1999). Mental accounting matters. *Journal of Behavioral Decision Making*, *12*(3), 183-206. https://doi.org/10.1002/(SICI)1099-0771(199909)12:3%3C183::AID-BDM318%3E3.0.CO;2-F

Trahan, L. H., Stuebing, K. K., Fletcher, J. M., & Hiscock, M. (2014). The Flynn effect: a meta-analysis. *Psychological bulletin*, *140*(5), 1332–1360. https://doi.org/10.1037/a0037173

* Turrell, G., Lynch, J. W., Kaplan, G. A., Everson, S. A., Helkala, E. L., Kauhanen, J., & Salonen, J. T. (2002). Socioeconomic position across the lifecourse and cognitive function in late middle age. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(1), S43-S51. https://doi.org/10.1093/geronb/57.1.s43

United Nations (1995). *Report of the World Summit for Social Development.* Retrieved from https://undocs.org/A/CONF.166/9

Vân, P. T. T. (2017). Education as a breaker of poverty: a critical perspective. *Papers of Social Pedagogy, 07*, 30-41. https://doi.org/604/01.3001.0010.8049

van Osselaer, S. M. J., and Janiszewski, C. (2001). Two ways of learning brand associations. *Journal of Consumer Research, 28*(2), 202-223. https://doi.org/10.1086/322898

Vogl, T. S. (2014). Height, Skills, and Labor Market Outcomes in Mexico. *Journal of Development Economics, 107*, 84–96. https://doi.org/10.1016/j.jdeveco.2013.11.007

Waldron, E. M., & Ashby, F. G. (2001). The effects of concurrent task interference on category learning: Evidence for multiple category learning systems. *Psychonomic Bulletin & Review*, *8*(1), 168-176. https://doi.org/10.3758/BF03196154

Webb, E. J., Campbell, D. T., Schwartz, R. D., & Sechrest, L. (1999). *Unobtrusive measures*. California: Sage Publications.

Wee, L. E., Yeo, W. X., Yang, G. R., Hannan, N., Lim, K., Chua, C., ... & Koh, G. C. H. (2012). Individual and area level socioeconomic status and its association with cognitive function and cognitive impairment (low MMSE) among community-dwelling elderly in Singapore. *Dementia and Geriatric Cognitive Disorders Extra*, *2*(1), 529-542. https://doi.org/10.1159%2F000345036

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*(3), 461–481. https://doi.org/10.1037/0033-2909.91.3.461

Wicherts, J. M., & Scholten, A. Z. (2013). Comment on "Poverty impedes cognitive function". *Science*, *342*(6163), 1169-1169. https://doi.org/10.1126/science.1246680

Wilson, D. B. (2001). Practical meta-analysis effect size calculator.

Wolf, O. T. (2006). Effects of stress hormones on the structure and function of the human brain. *Expert Review of Endocrinology & Metabolism*, *1*(5), 623-632. https://doi.org/10.1586/17446651.1.5.623

Wolf, O. T. (2008). The influence of stress hormones on emotional memory: relevance for psychopathology. *Acta Psychologica*, *127*(3), 513-531. https://doi.org/10.1016/j.actpsy.2007.08.002

World Bank (2023). Poverty and Inequality Platform (version 20230919_2017_01_02_PROD) [data set]. pip.worldbank.org. Accessed on 2023-10-22

Xu, W., Tan, L., Wang, H. F., Tan, M. S., Tan, L., Li, J. Q., ... & Yu, J. T. (2016). Education and risk of dementia: dose-response meta-analysis of prospective cohort studies. *Molecular Neurobiology, 53*, 3113-3123. https://doi.org/10.1007/s12035-015-9211-5

Yesuf, M., & Bluffstone, R. (2008). *Wealth and time preference in rural Ethiopia* (Working paper no. 08-16-efd). Retrieved from https://www.researchgate.net/publication/241766831_Wealth_and_Time_Preference_in_Rural_Ethiopia

* Yuan, M., Fu, H., Han, Y., Chen, J., & Fang, Y. (2020). Mediation and moderated mediation in the relationships among income condition, depression, cognition and residence among older adults in China. *Geriatrics & Gerontology International, 20*(10), 860-866. https://doi.org/10.1111/ggi.13987