



THE EFFECT OF COINS ON SPENDING

Technical Report

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**THINK
FORWARD** INITIATIVE

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Abstract

People worldwide still rely on cash every day. Yet, it is not known whether people spend coins and banknotes of the same value differently. We find that people from both poor and developed countries spend more when they have a unit of money in coins rather than in banknotes. We argue that people spend more coins than notes because coins are more cumbersome than banknotes, which renders coins a pain to hold on to. We find that this pain of holding coins (vs. banknotes) leads people to spend more when shopping, donating to a beggar, and even gambling. That people spend more coins just to get rid of them is important because it appears to affect many different people, including Europeans, Americans, and Indians, and it may be an unacknowledged factor that prevents people from saving as much as they otherwise might. We therefore also hypothesise that giving people the opportunity to deposit their cash onto their bank card should reduce the spending of annoying coins, thereby helping people save money. While we do not find support for this hypothesis in an initial online study, future research is necessary to better test this hypothesis. In the meantime, one potential solution to help people save more of their money is to reduce the number of coins in circulation. This could be achieved by retailers returning change on cash transactions directly to consumers' debit cards or bank accounts.

Keywords: Cash, Coins, Notes, Spending, Saving, Donation, Gambling

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1. Introduction

Cash is a crucial form of payment for people world-wide. Despite the proliferation of new, digital forms of payment, and counter to many peoples' beliefs, cash is actually becoming more common (Bech et al., 2018). Cash in global circulation has increased from 7% to 9% of global gross domestic product (therefore accounting for population and economic growth). In Europe, 79% of point-of-sale transactions were conducted in cash in 2016 (Esselink & Hernandez, 2017). The least cash-reliant country in Europe, the Netherlands, still saw almost half of all transactions in cash. In America, a third of all payments are made in cash, and cash is still the most popular form of money (Kumar et al., 2018).

The most cash reliant people are generally the poorest. In the Eurozone, it is the less developed nations that still rely most heavily on cash (Esselink & Hernandez, 2017), and in the United States it is the poorest people, earning the least per year (Kumar et al., 2018). It is often those countries with limited infrastructure for digital payments that use cash the most (van der Knaap et al., 2018). India, in particular, has been consistently one of the most cash-reliant countries in the world (Shepard, 2016). If the poor – who may be struggling to save any money – are the most cash reliant, then it is very important that we fully understand how people spend cash.

Yet, the academic field knows very little about how peoples' spending might be affected by the physical format of the cash they carry. Cash comes in both banknotes, which are convenient to carry and use, and coins, which are kept because they can withstand regular use (Sargent & Velde, 2003). Does it make a difference to how much people spend if their cash is in coins rather than notes?

While, to the best of our knowledge, no previous research has looked at comparing the spending of

coins and notes of equivalent value, past research suggests that the physical characteristics of cash can affect the way it is spent. For example, Di Muro and Noseworthy (2013) looked at the spending of physically dirty banknotes – which they soiled by putting the notes in dirt – against clean, new bills. They found that consumers preferred clean bills to dirty ones and that they spent dirty ones first. There is therefore precedent to suggest that people might spend coins and banknotes to a different extent because the coins look and feel different than the notes.

The “pain of paying” literature has also compared different forms of money, and cash is especially “painful” for people to spend when compared to credit cards, cheques, debit cards, direct-debit and vouchers (Prelec & Loewenstein, 1998; Raghurir & Srivastava, 2008; Soman, 2003). This research suggests that the pain of paying is good for helping people save because it can be considered to be a kind of affective recognition of opportunity cost: spending money on one thing, precludes it from being spent on something else (Frederick et al., 2009; Spiller, 2011). This literature would suggest, then, that people who carry cash might find it harder to spend this money.

1.1. The Pain of Holding and the Spending of Coins

We argue that not all cash is the same, but rather that people find coins to be a pain to hold on to because these are heftier and bulkier than equivalent banknotes. We base this hypothesis on a number of relevant literatures.

First, coins and banknotes exist because they fill different niches (Sargent & Velde, 2003): coins are a very sturdy form of money that can be used again and again, while notes are a very convenient form that

can be put away in a wallet or purse. However, these same features make coins bulkier, heavier, and generally more awkward to carry around than notes. In fact, banknotes were invented by merchants so as to deal with the problem of heavy and bulky coins (Bowman, 2000; Davies, 2002; Ebrey, Walthall & Palais, 2006).

Second, people tend to spend money that they dislike, such as when this is dirty (Di Muro and Noseworthy, 2013) or when this money comes from a negative source (Levav & McGraw, 2009). As annoying coins can still be used to purchase goods and services, we argue that people spend them to be rid of their nuisance. We therefore hypothesise that:

- H1. People spend more coins than equivalently-valuable notes (experiment 1).
- H2. People spend more coins than notes because coins are more of a pain to hold (experiments 2 and 3).

Because people are spending coins just to get rid of them, we also want to implement an intervention to help them to save more of this money. If poorer people spend coins just to get rid of them, it is especially important to look for a solution to help them save this form of money instead. For this purpose, we reason that people may only spend their “annoying” coins when there is no convenient option to save

these other than to carry them around. Therefore, if people can easily deposit their coins onto their bank card, they may save their money instead of spending it:

- H3: People spend fewer of their coins when they have the option to easily deposit these onto their bank card (experiment 4)

1.2 Overview of studies

To test our hypotheses, we conducted four experiments in which we endowed participants with either coins, or equally-valuable banknotes (e.g., Indian 10-Rupee coins or 10-Rupee notes) and then allowed them to shop, donate, or gamble, if they so choose. The first experiment was a field study with poor, Indian participants in a rural region and with real money. This was intended to test whether poor people spend more when they have coins than when they have notes (hypothesis 1). The second and third experiments were online studies with American and European people to test if they might donate more to a beggar when they have coins than when they have notes, and if this was caused by the pain of holding onto the coins (hypothesis 2). The fourth experiment was an online study testing if people might also gamble more with their coins than their notes, and whether this might be reduced if people had the option to easily deposit their cash onto their bank card (hypothesis 3).

2. Experiment 1

2.1 Indian Shopping Study

In experiment 1 we set out to test if poor, Indian shoppers in a rural area would spend more coins than notes of the same number and value. We tested this with poorer people because they are generally the most cash-reliant (Esselink & Hernandez, 2017; Kumar et al., 2018). Some of these people earn 400 Rupees (about 5 Euro) in a given day, meaning that we could endow them with a subjectively large amount of cash. Because of their limited financial resources, these people should be the most likely to treat all of their money carefully and not to spend coins just because they're "annoying".

To test poorer people's spending, we partnered with a rural shop in India for this experiment. We approached people entering the shop and paid them 100 Rupees in combinations of coins and notes to mimic what people would normally carry. We then surreptitiously observed how much of that money people spent in the shop. The shop's stock included a variety of items, ranging from chocolates to soap and grain. The shop's customers were generally poor labourers from the surrounding fields.

2.2 Methodology

We approached 101 shoppers as they were entering the shop (see Figure 1) and offered them the opportunity to participate in our research for a payment of 100 Rupees (about 1.25 Euro). The study was presented as a survey about the shop and customer satisfaction so as to cover for the fact that we were really testing shopper spending. This served two purposes. First, we did not want participants to know that we were interested in how much they spent in the store. Second, we chose to have our participants earn their payment because windfalls (free money) are usually spent more readily (Arkes,

et al., 1994). Some participants were illiterate and needed help to complete the survey.

When the survey was finished, shoppers were paid 100 Rupees randomly in either mostly 10-Rupee coins, or mostly 10-Rupee notes (see Figure 2). When the money was predominantly in coins, shoppers received eight *coins* and two notes of 10-Rupees. When the money was predominantly in notes, they received eight *notes* and two coins of 10-Rupees.

We then thanked the shoppers and allowed them to go into the shop if they chose to do so. At this point, shoppers were made to believe that the study was over. Inside the shop, a second research assistant waited to observe how many of their coins and notes these shoppers would spend. This research assistant took the role of a shop-hand and would fetch the goods that shoppers requested. He would then observe and record each shopper's (1) total spending, (2) how many 10-Rupee coins they paid with, and (3) how many 10-Rupee banknotes they paid with. These were our dependent variables.

Figure 1: Outside the Shop



Figure 2: Cash Paid to Indian Shoppers



2.3 Results

We first tested for the number of coins and banknotes that our shoppers spent. Hypothesis 1 was that people spend more coins than equivalently valued notes. However, as the shoppers in our experiment were endowed with coins *and* notes in both conditions, it was necessary to distinguish between how much shoppers spent in total when they had mostly notes versus mostly coins (condition) but also how much they spent of the coins that they carried (unit; 8 coins vs. 2 coins). In this way, we could test not just if people spent more Rupees when they

carried mostly coins, but also whether people in both conditions favoured spending more of their coins than their notes.

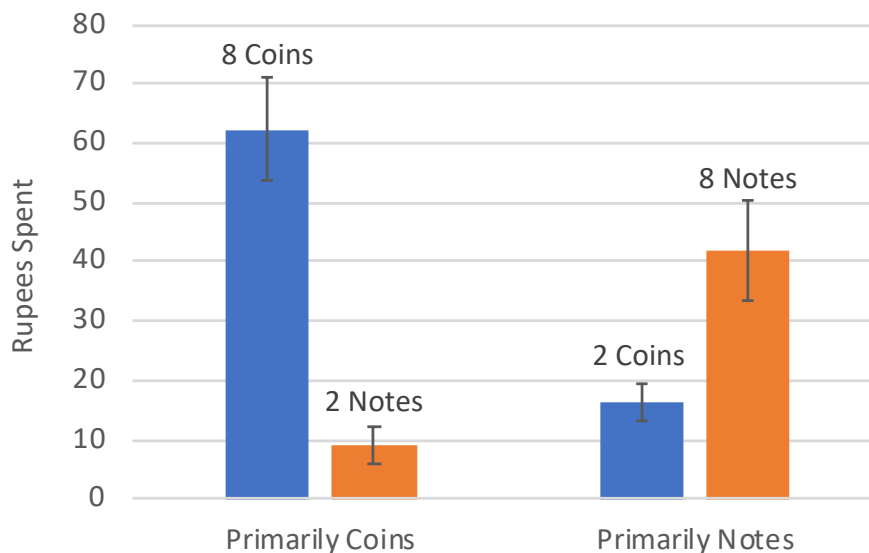
Accordingly, we conducted a mixed ANOVA with “condition” as the between-subject factor (mostly coins vs mostly notes) and the number of “units” (8 vs 2) as the within-subjects variable. Note that shoppers in the “mostly coins” condition were endowed with 8 units of coins and 2 units of notes, while those in the “mostly notes” condition had 8 units of notes and 2 units coins. We found a marginally

significant main effect of experimental condition, $F(1,99) = 3.45$, $p = .066$, which indicated that consumers spent more Rupees in total when they were endowed with mostly coins ($M = 71.4$, $SD = 35.0$) than mostly notes ($M = 58.2$, $SD = 36.2$). We also found a main effect of the “units,” $F(1,99) = 182.98$, $p < .001$, which indicated that shoppers favoured using their coins over their notes. Finally, we found a significant two-way interaction between the “condition” and “units,” $F(1,99) = 23.34$, $p < .001$. As we predicted, shoppers spent more (in Rupees) of their 8-units when these were coins ($M = 62.4$, $SD = 28.5$) than when they were notes ($M = 41.8$, $SD = 32.6$), $F(1,99) = 11.46$, $p = .001$. Shoppers also spent more (in Rupees) of their 2-units when these were coins ($M = 16.5$, $SD = 12.3$) than when in notes ($M = 9.0$, $SD = 9.7$), $F(1,99) = 11.42$, $p = .001$. Our shoppers spent more coins overall and it did not matter if these were more or less common in their wallet (see Figure 3).

Some shoppers also spent some of their own money in addition to what we gave them. These people spent 153 Rupees when they had been endowed with mostly coins ($SD = 148$) but 111 Rupees when they had been endowed with mostly notes ($SD = 83.96$), $t(1,99) = 1.729$, $p = .097$.

In a post-test, we asked people in the area about how they would feel if they received coins or notes to determine how much of a nuisance they found this money to be. We asked 80 people to tell us how much of a pain, irritation, bother, annoyance, or inconvenience the coins or the notes would be from 1 to 7 scale (Not at all to Very much). These items were highly related ($\alpha = .89$) and indexed into one measure: the pain of holding. A t-test showed that these people thought the coins to be much more of a pain to hold on to ($M = 4.07$, $SD = 1.90$) than the banknotes ($M = 2.30$, $SD = 1.38$), $t(1,79) = 4.67$, $p < .001$. For a factor analysis of the pain of holding, please see Appendix A.

Figure 3: Indian Shopper Coin and Note Spending by Condition



3. Experiment 2

3.1 Pain of Holding and Donation Study

Experiment 1 showed that people can spend more coins than notes. It did not, however, show if this spending was specifically due to the coins being more of a pain to hold on to. To determine if the coins were more of a pain to hold on to and whether this nuisance statistically explained the greater spending of coins over banknotes (hypothesis 2), we conducted an online experiment. We changed the dependent variable to donation, so as to test if other kinds of spending might be affected by coins and their pain of holding. We also accessed European people to extent our findings to other (non-Indian) people.

As with the Indian field experiment, we opted for a currency that features equivalently-valued coins and notes: the Hong Kong dollar. In this instance we chose to use \$10 HK coins and notes (about 1.10 Euro). The “denomination effect” literature has established that people spend more with broken down money (e.g., five \$20 banknotes) than larger denominations (e.g., one \$100 banknote; Mishra et al., 2006; Raghubir and Srivastava, 2009). Equivalently-valued coins and notes allow us to rule out the denomination effect as a driver of spending as we can keep the number of units of money consistent between conditions while varying their physical form (coins versus notes).

3.2 Methodology

We accessed 741 European participants from Prolific Academic in exchange for 20 pence. We asked these people to imagine going on holiday to Hong Kong and receiving \$100HK (about 11 Euro) in change from a taxi ride. We showed them an image of this money featuring either eight coins and two notes of \$10HK, or two coins and eight notes. We then asked them to describe holding the money, and measured the pain of holding (a pain, irritation, bother, annoyance, or

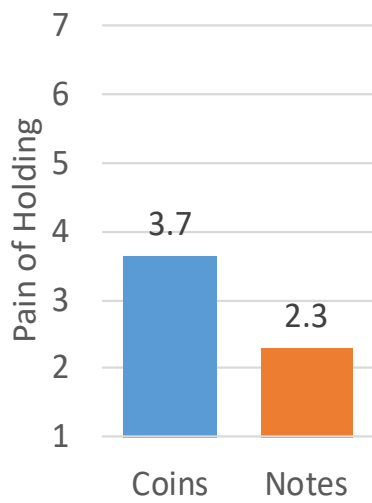
inconvenience; 1 to 7, Not at all to Very much). These items were again highly related ($\alpha = .96$) and so we created an index of pain of holding by averaging the items. Finally, we showed these people a picture of a beggar, and asked how many of their coins and/or notes they would donate to this person.

3.3 Results

We first tested whether our online participants spent more coins than notes on donation (as per hypothesis 1). We therefore again tested for the spending of coins and notes using a mixed ANOVA with condition (coins vs notes) as the between-subject factor, and units (8 vs 2) as the within-subject factor. We found a main effect of condition, $F(1,739) = 16.18, p < .001$, indicating that people intended to donate more when they had primarily coins. We also found a main effect of units, $F(1,739) = 92.64, p < .001$, indicating that people did not use their coins and notes equally for donation. Finally, we found an interaction between condition and units, $F(1,739) = 307.51, p < .001$. As we predicted, people intended to give more when their money was primarily in coins: \$25HK with coins ($SD = 26$), and \$18HK when they had notes ($SD = 20$). People therefore generally favoured giving away their coins and keeping their notes.

Subsequently, we tested whether people found the coins to be more of a pain to hold on to than the notes (hypothesis 2). A t-test supported that having more coins was seen to be a greater annoyance ($M = 2.88, SD = 1.66$) than having more notes ($M = 2.29, SD = 1.49$), $t(1,739) = 5.10, p < .001$. This is illustrated in Figure 4.

Figure 4: Pain of Holding of Coins and Notes



Finally, to test if coins were a pain to hold on to and if it was this nuisance that caused people to spend more (Hypothesis 2) we ran a mediation analysis. We did this using Hayes' PROCESS macro (2018; Model 4), where condition (coins vs notes) was the independent variable, the pain of holding the mediator, and the intended donation the dependent variable. This analysis supported that the coins lead to a greater pain of holding ($B = .59, p < .001, F(1, 739) = 25.97, R^2 = .03$), which lead to a greater intended donation in turn ($B = .13, p = .186, F(1, 739) = 10.92, R^2 = .03; a \times b = .07, LLCI = .002, ULCI = .16$). We note, however, that this is not full mediation, as the effect of condition on donation was still significant after the inclusion of the pain of holding ($B = .61, p < .001$).

Figure 5: 10 Hong Kong Dollars (Conditions)



4. Experiment 3

4.1 Only Coins or Notes Study

Experiment 2 showed that coins were seen to be more annoying to keep and that this led consumers to intend to donate more of their money. However, mediation via the pain of holding was not full and therefore allowed for the possibility that other factors might also be mediating the effect of coins on spending. One possible explanation for this is that both conditions featured combinations of coins and notes. Participants might therefore have spent more coins as a result of some feature of these combinations in addition to the pain of holding of the coins. Alternatively, participants might even have been annoyed by the coins because they were made aware of more desirable banknotes. To ensure that spending was not the result of some property of this combination, we therefore set out to test hypothesis 2 by endowing participants with only coins or only notes. We also accessed American people to extent our findings to other populations.

4.2 Methodology

We accessed 801 American participants from Amazon's Mechanical Turk in exchange for 30 cents. We followed the same procedure set out in experiment 2. However, when participants were shown their \$100HK, this was either in the form of solely \$10 coins, or solely \$10 notes (see Figure 5).

4.3 Results

We predicted that people would still donate more when they held coins than when they held notes. A t-test confirmed that participants donated \$34HK in

coins ($SD = 29$) but only \$29 in notes ($SD = 2.87$), $t(1,799) = 2.58, p = .009$.

We also predicted that people would expect coins to be more of a pain to keep than notes. A t-test confirmed that the pain of holding ($\alpha = .98$, indexed) was higher for the coins ($M = 3.65, SD = 1.96$) than the notes ($M = 2.30, SD = 1.58$), $t(1,799) = 10.76, p < .001$.

Finally, we ran a mediation analysis using Hayes' PROCESS macro (2018; Model 4) to test if the coins were perceived to be more of a nuisance to keep, and if this led to greater intended donation in turn. The mediation analysis confirmed this to be the case ($a \times b = .19, LLCI = .03, ULCI = .35$). Importantly, this time the mediation was full, as the effect of condition on donation disappeared ($B = .34, p = .12$) when the pain of holding was included in the model. Full mediation does not rule out that other factors may also be causing people to spend more with coins than notes, but does suggest that these factors are likely to be highly correlated to the pain of holding. One such possible factor is that people may not appreciate the monetary value of coins as much as they do the value of notes. If coins don't feel as valuable as notes, this could contribute to them being annoying to carry and being spent as a result. While we cannot rule out all other possible causes in just two experiments, experiments 2 and 3 provide evidence that the pain of holding is a likely cause for the greater spending of coins over notes.

5. Experiment 4

5.1 Digital

To test if people might save their cash when they have a convenient way to deposit this money onto their bank card (hypothesis 3), we conducted an online experiment. We changed our dependent variable to a lottery, so as to determine if coins might lead to more gambling than notes.

5.2 Methodology

We accessed 879 European participants from Prolific Academic in exchange for 30 pence. We asked these participants to imagine travelling to Hong Kong and receiving \$100HK randomly in either just coins or just notes as per experiment 3. However, in this procedure, we also randomly assigned some participants to read that they can easily deposit their cash onto their bank card at any shop or ATM, and that this is normal practice in Hong Kong. This is true of Hong Kong's "Octopus" public transport and stored-value card.

We then asked participants to imagine that they'd spotted a Hong Kong National Lottery kiosk, selling

tickets for a one-billion-dollar jackpot (about 115-million Euro). Finally, we asked participants how many tickets they would buy for \$10HK each (one coin/note).

5.3 Results

To test whether people spent more coins than notes on gambling (hypothesis 1), and whether our intervention was successful in reducing the spending of those who saw it (hypothesis 3), we conducted an ANOVA. This ANOVA included two between-subject factors: condition (coins vs notes) and intervention (easy depositing vs no depositing), and the interaction between the two. This ANOVA revealed a significant main effect of coins, $F(1,878) = 6.84$, $p = .009$, such that people intended to gamble more of their money when they had coins ($M = 2.91$, $SD = 3.29$) than when they had notes ($M = 2.39$, $SD = 2.67$). The effect of the intervention was not significant ($p = .690$), and neither was the interaction ($p = .792$). The intervention was ineffective at reducing the spending of coins ($p = .640$) or notes ($p = .924$) relative to when it was not applied.

6. Conclusion

6.1 Key Outcomes

We set out to test three hypotheses in our experiments: (1) whether people would spend more coins than equivalently-valuable banknotes; (2) whether people do this because coins are more of a pain to hold on to; and (3) whether people spend fewer of their coins when they have the option to easily deposit these onto their bank card. In the process we're found that:

(1) People spend, donate, and gamble more when they have coins instead of banknotes.

Real, poor consumers in India spent more money, which they'd earned, when this was in the form of 10-Rupee coins rather than 10-Rupee banknotes. Despite the fact that many of these people had a low, daily income of about 400 Rupees (about 5 Euros), they spent the equivalent of 10% of their daily income more when they had coins instead of notes. The well-being of poor people may therefore be negatively affected if they spend more coins just to be rid of them, and these people in particular cannot afford to be frivolous with their spending.

We also found that European and American people would donate, and even gamble more with coins in our hypothetical studies. This suggests that people spend their coins in at least several different ways. Gambling in particular is problematic because it places further financial strain on individuals and their families (Verdejo-García et al., 2008), beyond even the reduced saving from greater spending.

(2) Coins are more of a pain to hold on to and this drives spending

Across two experiments, we provided evidence that people are likely to be spending more coins than equivalently-valuable banknotes specifically because

they find coins a pain to hold on to. People found coins generally to be a greater inconvenience and bother, and therefore spent them. This finding suggests that the greater spending of coins over notes is inherently frivolous, because people were spending more just to get rid of the money.

Given the breadth of people (Europeans, Americans, and Indians) that appear to be spending more coins just to be rid of them, this spending could be inhibiting many people globally from saving more of their money. This is an even greater problem for the poor, who rely on cash and are therefore likely to carry more coins, and who can likely not afford to engage in any frivolous spending. We therefore believe that it is imperative to help people, and especially the poor, to save more of their coins.

(3) Reminding people that they can deposit their cash onto their card is not an effective way to help them to save this money

We expected that people would save more of their coins if they knew that they could deposit them easily onto their bankcard. However, we did not find evidence in support of this hypothesis. This does not imply that no "digital" solutions to this problem may exist, but only that this particular intervention in an online setting is ineffective. This may have been ineffective, for example, because we surveyed people online who may not have taken the possibility to deposit their cash seriously. Alternatively, people may have not considered depositing their money onto their bank card because we asked them to imagine being on holiday in Hong Kong: they may have wanted to spend all of the coins and notes over the course of their trip.

6.2 Future Research

We have two main goals for this research project going forward:

1. To establish how poor consumers might spend coins and banknotes beyond the single spending moment, and over the course of several weeks; and
2. To develop an effective intervention to help people to save more of their coins.

This is important so that we can assess the balance of “positive” and “negative” ways in which people spend their coins. Coins could be more readily spent on goods and services that are not necessary (e.g., indulgences) or even outright problematic (e.g., gambling). This kind of spending could have a detrimental effect on consumer well-being and is particularly worrisome for consumers in developing countries who have limited income and are cash-reliant. To illustrate, in India, we observed a participant purchasing two coconuts that he said he did not want, simply to be rid of his last coins.

Understanding how people spend coins may also help us to determine better ways to help them save this. While our online intervention was ineffective in reducing the spending of coins, this does not mean that helping people save their coins is impossible. We foresee that there may be other ways in which we can achieve this, such as focusing people on the real value of their money. Given the number of people – include many poor people – that are likely to be spending their coins to get rid of them, this is imperative.

6.3 Managerial Implications

The spending of more coins than banknotes in our experiments appears inherently frivolous given that it seems to be driven in part by the desire to get rid of coins. While our individual intervention was not sufficient to help people save their coins, it is still possible to prevent this spending by preventing people from receiving coins in the first place. At the government level, one practical solution may therefore be to simply remove coins from circulation, as South Korea is planning to do (Harris, 2016). Organisations may also assist people to save more of their coins by returning any change from peoples’ cash transactions back onto their debit card, credit card, or other forms of digital wallets. If individuals don’t carry coins, they won’t be tempted to dispose of them.

However, while removing or limiting coins in circulation may be practical in many developed nations, where the infrastructure for digital payments and change is in place for, the most heavily cash-reliant countries are likely to lack this infrastructure altogether (van der Knaap et al., 2018). In these countries, it may be beneficial to replace coins with banknotes to help people save a little bit more. It may also be beneficial to teach individuals in these places about the pain of holding and that this may lead to greater spending, as part of their financial education. If people are made aware of the fact that coins are usually more annoying than notes, and disposed of as a result, they may choose more productive uses for this money (such as saving or donating to others).

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8. Appendix

Pain of Holding Factor Analysis

We conducted a factor analysis of the pain of holding data (items: a pain, annoying, bothersome, inconvenient, irritating) gathered in India using principal axis factoring. We set an eigenvalue criterion of 1 for extracted factors, and implemented an oblimin oblique rotation as the items were highly correlated. The Kaiser-Meyer-Olkin measure proved adequate at .81, and Bartlett's Test of Sphericity was significant ($p < .001$). The analysis subsequently extracted a single factor with an eigenvalue of 3.5 containing all of the items constituting the pain of holding (and explaining 63% of the variance). Therefore, our items appear to consistently capture the pain of holding. This result is robust to other methods of extraction and is also consistent in the pain of holding data gathered in experiments 2 and 3

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