JUST VENMO ME: Does form of payment affect risk taking and intertemporal choice?

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Abstract
We use an experiment to examine whether form of payment (cash or mobile money) affects estimates of intertemporal choice and risk taking. We find that form of payment does not affect temporal discounting and risk taking. Given that participants prefer payment via mobile money, the results suggest that there are minimal concerns with using mobile money to pay participants in experimental studies.

Keywords Risk taking · Temporal discounting · Mobile money · Form of payment

JEL Classification C91

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1 Introduction

Neo-classical economics assumes that so long as different forms of money are perfectly fungible, form of payment should not affect economic decisions. However, there is extensive evidence that choice architecture influences the measurement of preferences (Thaler et al. 2013; Thaler and Sunstein 2008; Szaszi et al. 2018). We focus on one dimension of the choice architecture: form of payment. The form of payment may influence decisions if forms of payment are not perfectly fungible; for example because of transaction costs or self-control issues. In this paper, we establish participants’ preferences between forms of payment and examine whether payment in mobile money or cash meaningfully affects estimates of intertemporal choice and risk taking.

We measure risk taking and temporal discounting using multiple price lists with undergraduate students in the United States. In the risk task, participants make a series of choices between a gamble and a certain payout. In the time task, participants choose between a sooner and one of several later payments. We vary whether participants are paid in cash or Venmo, a commonly used peer-to-peer electronic transfer platform (mobile money). We also measure preferences between forms of payments using an exchange task in which participants choose between differing amounts of cash and Venmo.

First, we find that participants frequently use Venmo and often prefer to be paid by Venmo. Using survey data, we find that Venmo is commonly used, with 75% of participants saying they use Venmo at least once a week. In addition, participants reveal a preference for payment in Venmo in the exchange task, as 46% of participants are willing to give up income to receive payment by Venmo instead of cash.

Second, we find that estimates of risk taking and temporal discounting do not depend on the form of payment. Specifically, we examine whether form of payment affects the point at which participants switch from choosing the gamble to the certain payment in the risk task and from choosing the sooner payment to the later payment in the time task. The point estimates are small in magnitude, corresponding to a 0.3 row later switch point in the risk task (out of seven choices) and a 0.2 row later switch point in the time task (out of seven choices). Based on the 95% confidence interval, we can rule out effects larger than 0.5 rows and 0.5 rows in the risk and time tasks respectively. Given that participants must have access to a Venmo account to participate in our study, it is noteworthy that the effects are insignificant and qualitatively similar among participants who reveal a preference for Venmo.

Given the proliferation of different options for payments, such as cash, debit/gift cards, and mobile money, experimenters have a number of different options available for payment but may be unsure how behavior is affected by mode of payment. Form of payment is a concern if cash and mobile money are not perfectly fungible. Explanations for the lack of fungibility include: transaction costs, trust and familiarity with mobile money, self-control issues, and anticipatory endowment effects. First, transactions costs could differ between cash and mobile
money for a number of reasons. On the one hand, cash may be less desirable than mobile money because it is simply annoying to use or carry or it is difficult to procure (Vandoros, 2013; Chakravorti, 2014; Mazzotta and Chakravorti, 2014), perhaps because ATMs are less commonly available. On the other hand, mobile money may be less desirable because it is less widely accepted by merchants and there are fees or time costs associated with transferring mobile money into bank accounts. Second, it may be the case that cash is preferred to mobile money due to familiarity and trust in cash. This familiarity could affect processing fluency (Mishra, Mishra, and Nayakankuppam, 2006). If mobile money is viewed as inherently more risky, since the platform could go out of business or take the individual’s money, this could affect estimates of temporal discounting as participants prefer to receive payments sooner rather than later. Third, cash and mobile money may not be viewed as equal due to self-control issues. In particular, people might believe that they are less likely to spend mobile money as opposed to cash or vice versa. This could occur because individuals believe that they are less likely to spend money in a particular form of payment (Raghubir and Srivastava, 2009), because spending in cash is more subject to temptation (Myrseth, Riener, and Wollbrant, 2015), or because cash is harder to monitor (Jonker, 2016; Hernandez, Jonker, and Kosse, 2017). As a result, discounting may differ based on whether payment is offered in cash or mobile money. Finally, endowment effects could explain differences in the results across payment modes if the anticipation of payment in cash induces a different endowment effect than payment in mobile money (Bushong, King, Camerer, and Rangel, 2010; Svirsky, 2014), perhaps because cash is more tangible.1

Our results suggest that form of payment does not affect behavior in the experiment, despite the fact that participants prefer payment via mobile money, indicating that concerns regarding the form of payment in experimental settings with college students are minimal.2 Mobile money is an especially attractive option given the proliferation of experiments implemented online, with both student and non-student populations.3 Transaction costs for payments by mobile money are also very low

1 Since participants do not physically hold the money in this study, any endowment effects would have to occur in anticipation of receiving the money in cash or by mobile money. We would expect that endowment effects are larger when participants can physically hold the money. We believe our results are relevant to most experimental settings since participants make decisions in anticipation of payment at the end of the session.

2 The literature that examines whether form of payment affects willingness to spend or save money finds mixed evidence (Bushong, King, Camerer, and Rangel, 2010; Reinstein and Riener, 2012; Runnemark, Hedman, and Xiao, 2015; Spanig, 2021; Luccasen III and Grossman, 2018; Mishra, Mishra, and Nayakankuppam, 2006; Svirsky, 2014). There is also some evidence that there are differences in behavior with payment in cash versus virtual experimental currency in laboratory experiments (Reinstein and Riener, 2012; Shen and Takahashi, 2017; Wadhwa and Zhang, 2015). Our paper differs from this literature in that our participants do not physically handle the cash, thus weakening any endowment effects that may occur. In addition, participants do not face the pain of paying for items; thus, financial flows, mental accounting, and cash-on-hand constraints are irrelevant in our context. Thus the explanations for why form of payment matters are different in our context.

3 Li et al. (2021) and Buso et al. (2021) find that participants behave similarly in the physical lab and in online experiments.
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(Aker et al. 2016), and contactless methods of payment are preferable during times like the COVID-19 pandemic and normal cold and flu seasons. Our finding that the form of payment does not meaningfully affect decisions within the experiment increases the external validity of studies using mobile money. In addition, the finding that students commonly use mobile money and most of them weakly prefer it to cash suggests that mobile money is a preferable form of payment as compared to cash even for in-person experiments. These results also contribute to a larger literature that compares online experimental studies to “traditional” in-person experiments (Clifford and Jerit 2014; Paolacci et al. 2010; Arechar et al. 2018).

The paper is organized as follows: Sect. 2 discusses the background and experimental design; Sect. 3 describes participants’ use of mobile money and preferences for cash vs. mobile money; Sect. 4 presents the results; Sect. 5 concludes.

2 Background and experimental design

2.1 Background of Venmo

Venmo is a peer-to-peer money transfer and social network application that requires the user to be physically located within the United States, at least 18 years of age, and have a US cell phone that can send and receive text messages. Users can connect their account to a credit card, debit card, or checking account. Balances can stay in Venmo or be transferred to a bank for free within one to three business days, or instantaneously for a 1.5% fee. Users initiate transfers in the app by searching for another user’s username or phone number and can create a network of “friends” with whom they send payments to or receive payments from frequently. It is easy to use, fast, and as shown in Sect. 3, widely used among participants in our sample. For researchers, a limitation of Venmo for making payments (at the time of writing) is that there are limits on the amount of money that can be sent. However, the limits are higher with confirmation of your identity and accommodations can be made if the company is contacted in advance.

2.2 Experimental design

We implemented the study with 338 undergraduate students at Colorado College. To recruit participants, advertisements in the form of posters, emails, posts in group chats, and information on campus-wide television screens were shared around the school. A copy of the advertisement flyer is shown in the Online Supplement. Since Colorado College does not have an experimental laboratory, data collection was

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4 Alternative forms of mobile money that are common in the United States include Zelle and Paypal. Venmo is more commonly used among US citizens and younger individuals (Gogol, 2020; Shevlin, 2019).

5 This study was first conceived as a group project with twelve students in a Fall 2018 course entitled “Experimental and Behavioral Economics: Time and Uncertainty”.

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conducted inside the library and the dining hall building during weekend brunch at the end of the term within a three-day period; both are central locations on campus and heavily trafficked areas for students. 78% of the data were collected at the library. Participants gathered outside the designated room (a classroom in the library or study room in the dining hall building) and were invited in every 15 minutes to receive instructions and complete the questionnaire. The experiment was completed on the participant’s own device (laptop or smart phone) using Qualtrics.

The session began with a short questionnaire to determine eligibility: all participants were required to be over 18 years old and have a Venmo account. Anecdotally, students report that Venmo is ubiquitous and frequently used amongst undergraduates at Colorado College. Participants who did not initially have Venmo could use the Venmo account of a friend or set up an account by downloading the app at or before the time of participation if they desired.

The experiment then continued with a risk task, a time task, and a Venmo-cash exchange task. Participants were randomly assigned to have their payment offered in cash or by Venmo in the risk task, and re-randomized into payment type in the time task; therefore form of payment is randomized between subject in a particular task and within subjects across tasks. Throughout the tasks, the screens listed the form of payment for the relevant series of choices that participants were about to make. While this presentation likely increases the salience of the form of payment for participants, this should bias us towards finding significant effects between the cash and mobile money treatments due to experimenter demand effects. Participants were told that one choice from one task would be selected at random for payment. The experiment concluded with questions about Venmo use and demographics. A copy of the instructions and screenshots of a representative experimental survey are shown in Online Supplement 6.

Participants took approximately ten minutes to complete the survey at the study site. Since payments were determined on the hour, participants could leave the site of data collection and return on the hour to learn which task paid out and how much they earned. Irrespective of whether participants were paid by Venmo or cash as well as whether they were paid at that time or later for the time task, participants were required to return to receive payment in person in order to equalize transaction costs for all participants. We operationalized this by requiring that participants sign a receipt for their payment.

**Eliciting risk taking**

Risk taking is captured using multiple price lists (Holt and Laury, 2002), offering respondents five menus of seven choices each between a 50-50 gamble and a certain payment. In addition to randomizing form of payment across participants, all participants were presented with five menus in random order that differed in how payments were denominated. Thus, denomination was varied within-subject. In the “Whole-Whole” menu, both the gamble and certain amount were denominated in multiples of $0.25. In the “Exact-Exact” menu, both the gamble and the certain amount were denominated in multiples of $0.01 or $0.05. The “Whole-Exact” and “Exact-Whole” menu mixed the payment denominations. The “High Stakes Exact-Exact” menu was equivalent to the “Exact-Exact” menu but with stakes approximately five times
larger. Specific amounts were chosen such that choices in each task bracketed the same coefficient of relative risk aversion parameter, $r$. The amounts offered in each choice for each menu are shown in Table 1. Since the variation across denominations is not of interest to this paper, our analysis will pool across all menus and control for denomination as well as the order in which the menus were seen.$^6$

**Eliciting temporal discounting**

Temporal discounting is also elicited using multiple price lists (Harrison, Lau, and Williams, 2002; Coller and Williams, 1999), offering respondents four menus of seven choices each between a sooner and later payment. In addition to re-randomizing form of payment, all participants were presented with four menus in random order that differed in how payments were denominated. The dates chosen for the sooner and later payments were selected to take advantage of students’ understanding of the flows of the academic calendar.$^7$ The sooner option was chosen to be 39–42 days from the date of the experiment (the third day of classes after winter break); the later option was 28 days after the sooner option (one month later based on the academic calendar).

As in the risk task, we use menus that differ in denomination: Whole-Whole, Whole-Exact, Exact-Whole, and Exact-Exact. For the Whole-Exact, Exact-Whole, and Exact-Exact menus, the amounts chosen for sooner and later payouts were selected to bracket the same discount rates ($\delta$). Despite doubling the payments in the Whole-Whole menu, we could not select payment amounts in multiples of $0.25 that bracketed the same discount rate as the other menus. Payouts were higher for the time task than for the risk task due to the length of time participants would have to wait to receive either payment. The amounts offered in each choice for each menu are shown in Table 2.

**Eliciting cash-Venmo exchange rate**

Lastly, to examine the fungibility and preferences for money paid in cash versus mobile money, we directly elicit whether participants preferred to receive payment in cash or by Venmo. Participants were presented with a list of choices for varying payments in cash or Venmo. We offer choices in which the cash payout was greater than the Venmo payout, followed by one choice in which the payouts are equal, and finally choices in which the Venmo payout was greater than the cash payout. The choices are shown in Table 3.

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$^6$ We included treatments that varied in denomination to test whether cash and mobile money have different effects due to self-control issues (i.e. because participants are more or less tempted to spend cash compared to mobile money), transactions costs (for example because coins are annoying to carry or ATMs are uncommon and so participants prefer mobile money), left-digit bias (Lacetera, Pope, and Sydnor, 2012; Ashton, 2014; Strulov-Shlain, 2019), or processing fluency (Mishra, Mishra, and Nayakankuppam, 2006; Alter and Oppenheimer, 2008; King and Janiszewski, 2011). We find that denomination does matter; specifically, we find that participants are more likely to choose options that are denominated in whole denominations rather than exact denominations for those paid in both Venmo and cash. Since these results are not of primary interest, they are available upon request.

$^7$ Colorado College operates on the Block Plan: professors teach one class at a time and students take one class at a time. Each class lasts for 3.5 weeks, followed by a 4-day break. The dates of the sooner and later payments were chosen to match the rhythm of the Block Plan.
| Menu: whole-whole | Menu: whole-exact | Menu: exact-whole | Menu: exact-exact |
|------------------|------------------|------------------|------------------|
| **Choice**       | **Option A**     | **Option B**     | **Implied r**    | **Option A**     | **Option B**     | **Implied r**    | **Option A**     | **Option B**     | **Implied r**    |
|                  | 50% chance      | 50% chance      |                  | 50% chance      | 50% chance      |                  | 50% chance      | 50% chance      |                  |
| 1                | $1.00           | $6.00           | or $2.50         | 0.94            | $2.00           | $7.00           | or $3.79         | 0.94            |
| 2                | $1.00           | $6.00           | or $2.75         | 0.71            | $2.00           | $7.00           | or $3.96         | 0.70            |
| 3                | $1.00           | $6.00           | or $3.00         | 0.47            | $2.00           | $7.00           | or $4.14         | 0.47            |
| 4                | $1.00           | $6.00           | or $3.25         | 0.25            | $2.00           | $7.00           | or $4.31         | 0.25            |
| 5                | $1.00           | $6.00           | or $3.50         | 0.00            | $2.00           | $7.00           | or $4.49         | 0.01            |
| 6                | $1.00           | $6.00           | or $3.75         | −0.26           | $2.00           | $7.00           | or $4.68         | −0.26           |
| 7                | $1.00           | $6.00           | or $4.00         | −0.55           | $2.00           | $7.00           | or $4.88         | −0.55           |
| **Choice**       | **Option A**     | **Option B**     | **Implied r**    | **Option A**     | **Option B**     | **Implied r**    | **Option A**     | **Option B**     | **Implied r**    |
|                  | 50% chance      | 50% chance      |                  | 50% chance      | 50% chance      |                  | 50% chance      | 50% chance      |                  |
| 1                | $0.87           | $5.55           | or $2.25         | 0.94            | $0.68           | $6.27           | or $2.13         | 0.95            |
| 2                | $0.87           | $5.55           | or $2.50         | 0.69            | $0.68           | $6.27           | or $2.46         | 0.71            |
| 3                | $0.87           | $5.55           | or $2.75         | 0.45            | $0.68           | $6.27           | or $2.81         | 0.47            |
| 4                | $0.87           | $5.55           | or $3.00         | 0.22            | $0.68           | $6.27           | or $3.14         | 0.24            |
| 5                | $0.87           | $5.55           | or $3.25         | −0.04           | $0.68           | $6.27           | or $3.47         | 0.00            |
| 6                | $0.87           | $5.55           | or $3.50         | −0.30           | $0.68           | $6.27           | or $3.79         | −0.26           |
| 7                | $0.87           | $5.55           | or $3.75         | −0.66           | $0.68           | $6.27           | or $4.09         | −0.55           |
Table 1 (continued)

Menu: high stakes exact-exact

| Choice | Option A | Option B | Implied r |
|--------|----------|----------|-----------|
|        | 50% chance | 50% chance |          |
| 1      | $3.41 | $31.36 or $10.73 | 0.954 |
| 2      | $3.41 | $31.36 or $12.32 | 0.71    |
| 3      | $3.41 | $31.36 or $14.08 | 0.47    |
| 4      | $3.41 | $31.36 or $15.68 | 0.25    |
| 5      | $3.41 | $31.36 or $17.39 | 0.00    |
| 6      | $3.41 | $31.36 or $18.96 | −0.26   |
| 7      | $3.41 | $31.36 or $20.47 | −0.55   |

Note: $r$ refers to the implied coefficient of relative risk aversion parameter for which an agent would be indifferent between the two options for each choice.
### Table 2  Choices across menus in the time task

| Menu: whole-whole | Implied interest rate | Menu: exact-whole |
|-------------------|-----------------------|-------------------|
| Choice | Sooner | Later | $\delta$ | Sooner | Later | $\delta$ | Implied interest rate |
| 1 | $40.00$ | $40.25$ | 0.9220 | 8.46% | 1 | $19.95$ | $20.00$ | 0.9679 | 3.32% |
| 2 | $30.00$ | $30.25$ | 0.8975 | 11.42% | 2 | $19.89$ | $20.00$ | 0.9306 | 7.46% |
| 3 | $21.00$ | $21.50$ | 0.7358 | 35.90% | 3 | $19.79$ | $20.00$ | 0.8714 | 14.76% |
| 4 | $18.00$ | $19.00$ | 0.4942 | 102.35% | 4 | $19.47$ | $20.00$ | 0.7046 | 41.92% |
| 5 | $16.00$ | $17.50$ | 0.3109 | 221.61% | 5 | $19.08$ | $20.00$ | 0.5413 | 84.74% |
| 6 | $13.75$ | $17.00$ | 0.0629 | 1489.25% | 6 | $18.81$ | $20.00$ | 0.4495 | 122.48% |
| 7 | $12.00$ | $16.50$ | 0.0157 | 6251.47% | 7 | $18.36$ | $20.00$ | 0.3278 | 205.05% |
| Menu: whole-exact | Implied interest rate | Menu: exact-exact |
|-------------------|-----------------------|-------------------|
| Choice | Sooner | Later | $\delta$ | Sooner | Later | $\delta$ | Implied interest rate |
| 1 | $20.00$ | $20.05$ | 0.9679 | 3.32% | 1 | $19.67$ | $19.72$ | 0.9674 | 3.37% |
| 2 | $20.00$ | $20.11$ | 0.9306 | 7.46% | 2 | $19.42$ | $19.53$ | 0.9290 | 7.64% |
| 3 | $20.00$ | $20.22$ | 0.8714 | 14.76% | 3 | $19.11$ | $19.31$ | 0.8731 | 14.52.5% |
| 4 | $20.00$ | $20.54$ | 0.7066 | 41.52% | 4 | $18.77$ | $19.28$ | 0.7046 | 41.92% |
| 5 | $20.00$ | $20.97$ | 0.5413 | 84.74% | 5 | $18.38$ | $19.26$ | 0.5435 | 83.99% |
| 6 | $20.00$ | $21.27$ | 0.4482 | 123.12% | 6 | $17.98$ | $19.12$ | 0.4487 | 122.86% |
| 7 | $20.00$ | $21.78$ | 0.3291 | 203.87% | 7 | $17.53$ | $19.09$ | 0.3291 | 203.82.5% |

Note: $\delta$ refers to the implied discount rate for which an agent would be indifferent between the two options for each choice.

### Table 3  Choices in the cash-Venmo exchange task

| Choice | (+Cash) | Cash | Venmo | (+Venmo) |
|--------|---------|------|-------|---------|
| 1      | (+$1.03) | $11.00 | $9.97 |
| 2      | (+$0.78) | $10.75 | $9.97 |
| 3      | (+$0.28) | $10.25 | $9.97 |
| 4      | (+$0.19) | $10.16 | $9.97 |
| 5      | (+$0.06) | $10.03 | $9.97 |
| 6      | (+$0.01) | $9.98  | $9.97 |
| 7      | $9.97   | $9.97 |
| 8      | $9.97   | $9.98  | (+$0.01) |
| 9      | $9.97   | $10.03 | (+$0.06) |
| 10     | $9.97   | $10.16 | (+$0.19) |
| 11     | $9.97   | $10.25 | (+$0.28) |
| 12     | $9.97   | $10.75 | (+$0.78) |
| 13     | $9.97   | $11.00 | (+$1.03) |
3 Descriptive statistics

We begin by describing the demographic characteristics of the 338 participants in our sample and then document participants’ preference for payment in cash versus Venmo and their self-reported usage of Venmo.

Table 4 describes participants in the sample: 40% are male, they are evenly spread across expected graduation years, and 22% are Economics and Business Majors. Table A.1 in the Online Supplement shows the fraction of the sample choosing Venmo over cash by question in the exchange task. While 45% of the sample are willing to give up at least one cent of money in cash to receive Venmo instead, giving up an average $0.39 to receive their payment in the form of Venmo, only 25% are willing to give up six cents or more. A smaller sample prefers payment in cash. 18% of the sample are willing to give up at least one cent of money in Venmo to receive payment instead in cash, giving up an average of $0.43 to receive their payment in cash. 37% of participants simply chose the form of payment that results in the highest amount of money.\(^8\) When the choice is costless, i.e. participants do not give up any money to have their preferred form

\(^8\) The sample of participants that always choose cash or always choose Venmo are 6% and 14% respectively, giving up to $1.03 of money for their preferred form of payment.
of payment, 66% of the sample chose to have their payment in Venmo rather than cash. The fact that 80% of participants switch their choice from payment in cash to payment in Venmo suggests that cash and Venmo are to some degree fungible. However, the fact that 45% of the sample are willing to give up money to receive...
payment in Venmo and 37% choose to receive payment in whichever form offers the highest amount of money suggest that the majority of the sample weakly prefers payment by Venmo to payment in cash.

Next, we examine responses on survey questions regarding participants’ use of Venmo. Figure 1 shows the descriptive statistics. We find that 68% of participants signed up for Venmo more than a year ago (Fig. 1A) and they overwhelmingly use Venmo for interactions with friends (1B). 75% of the sample use Venmo at least once a week (1C). It is reassuring that the participants’ reported usage of Venmo (1C) is qualitatively similar to students’ perceptions of their friends’ usage of Venmo (1E), with reported friends’ usage a bit higher on average. Unsurprisingly, participants who use Venmo more often also give up more cash to receive payment by Venmo in the exchange task (1D). The use of Venmo among students is perceived to be nearly ubiquitous, as the majority of participants believe that 75–100% of their friends use Venmo, with 87% believing that more than half their friends use Venmo (1F).

Therefore, we find that students frequently use Venmo and often prefer to be paid by Venmo. Since students needed to have access to Venmo to participate in the study, it is possible that our measures of usage and preference for Venmo are upward biased relative to the general population of students at Colorado College.

4 Results

The main specification testing the effect of form of payment on estimates of risk taking and temporal discounting are ordered logit regressions:

\[
Switch_{Pointit} = \beta_0 + \beta_1 Venmo_i + \theta order_i + \psi Venmo_{Other Task_i} \\
+ \alpha X_i + \gamma denomination_i + \epsilon_{it}
\]  

where the dependent variable is \(Switch_{Pointit}\), the last choice that respondent \(i\) switched from choosing the gamble (sooner payment) to the certain payment (later payment) of menu \(t\) in the risk (time) task as the certain payment increases (gap between the sooner and later payment increases). \(Venmo_i\) is a dummy variable indicating that the participant was paid by Venmo in the task; therefore \(\beta_1\) is the coefficient of interest. We also include the following controls, depending on the specification: (1) \(order_i\) is a vector of menu order indicators since we randomize the order in which the menus are presented within a task, (2) \(Venmo_{Other Task_i}\) controls for the form of payment in the other (risk or time) task, (3) \(X_i\) refers to demographic controls, specifically gender and graduation year, and (4) \(denomination_i\) is a vector of denomination indicators since we also vary the denomination of the payments across menus within each task. Standard errors are clustered at the participant level. We report marginal effects for ease of interpretation.

Menus in which a respondent only switched in the theoretically “wrong” direction are excluded from the analysis, thus the number of observations included is not
exactly equal to the number of respondents multiplied by the number of menus.\(^9\),\(^{10}\)

Multiple switchers (individuals that switch from choosing the gamble (sooner payment) to the certain payment (later payment) more than once within a menu in the risk (time) task) are included in the analysis; robustness checks that exclude multiple switchers are shown in Tables A.8 and A.15.\(^{11}\) The rate of multiple switching is not different across treatments, as shown in Tables A.13 and A.20.\(^{12}\)

Subjects who never switch from choosing the gamble (sooner payment) to the certain payment (later payment) within a menu in the risk (time) task are included in the analysis and are coded as switching one choice after the menu ended.\(^{13}\),\(^{14}\) Robustness checks that exclude never switchers are shown in Tables A.9 and A.16.\(^{15}\) The rate of never switching is not different across treatments, as shown in Tables A.14 and A.21. We used an ordered logit of the switch point rather than convert the switch point to a coefficient of relative risk aversion parameter or discount rate because it is not clear how to code respondents who multiple switched or never switched, and we wanted to include as many respondents as possible to increase statistical power and bias the analysis towards finding a statistically significant effect.

We implement the regressions separately for the risk and time tasks and report effects in Tables 5 and 6. In Table 5 we find that payment by Venmo does not significantly affect the switch point in the risk task, irrespective of the controls included in the regression. The effects are also small, corresponding to a 0.219 row later switch point in our preferred specification in Column (4), in which we control for order effects, form of payment in the time task, denomination effects, and demographic characteristics. Reassuringly, the effect sizes are similar across specifications. We report the corresponding 95% confidence interval to find that we can reject effects larger than approximately 0.5 rows.

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9 By theoretically “wrong” direction, we mean switching from choosing the safe option when the payout to the safe option is small relative to the expected value of the gamble, to choosing the gamble when the value of the safe option is relatively large.

10 18% of respondents switched in the “wrong” direction in at least one risk menu, while 9% switched in the “wrong” direction in any given risk menu. 14% of respondents switched in the “wrong” direction in at least one time menu, while 7% switched in the “wrong” direction in any given menu.

11 These tables show results excluding the menus in which a respondent multiple switched. Results excluding respondents who multiple switched in any menu are similar and available on request.

12 12% of respondents multiple switched in at least one of the risk menus, while 5% multiple switched in any given menu. 11% of respondents multiple switched in at least one of the time menus, while 5% multiple switched in any given menu.

13 People who never switch are expressing a preference that is not captured by the parameters bracketed in the menus offered. Thus they are coded as having a preference parameter somewhere beyond the menu. Because we use an ordered logit, all of these individuals are essentially grouped into a single category.

14 25% of respondents did not switch in at least one of the risk menus, while 4% of participants did not switch in any given risk menu. 50 percent of respondents did not switch in at least one of the time menus, while 26% of respondents did not switch in any given time menu.

15 Tables A.2-4 and A.5-7 show the distribution of choices by question in the risk and time tasks respectively. Together they show that while there are a notable minority of respondents who never switch, there is substantial variation in choices across options overall.
JUST VENMO ME: Does form of payment affect risk taking and...

Similarly, Table 6 shows that payment in Venmo does not significantly affect the

Table 6 Switch point in the time task

|            | (1)    | (2)     | (3)     | (4)     |
|------------|--------|---------|---------|---------|
| Venmo      | 0.173  | 0.157   | 0.154   | 0.160   |
|            | (0.151)| (0.154)| (0.157)| (0.163)|
| 95% Confidence interval | [− 0.124, 0.470] | [− 0.145, 0.459] | [− 0.155, 0.463] | [− 0.160, 0.480] |
| Cash mean  | 6.356  | 6.356   | 6.356   | 6.356   |
|            | (1.800)| (1.800)| (1.800)| (1.800)|
| Order controls | Yes   | Yes     | Yes     | Yes     |
| Payment other task | Yes   | Yes     | Yes     | Yes     |
| Demographic controls | Yes   | Yes     | Yes     | Yes     |
| Denomination controls | Yes   | Yes     | Yes     | Yes     |
| Number of observations | 1345  | 1345    | 1345    | 1345    |
| Number of subjects   | 338    | 338     | 338     | 338     |
| Pseudo R²            | .000727| .00141  | .00198  | .0154   |

Notes: We use ordered logit regressions of the switch point in each time menu. The dependent variable is the last choice that the respondent switches from choosing the sooner payment to the later payment in a particular menu in the time task as difference in payments increases. “Venmo” captures the effect of form of payment on the switch point in the time task. “Order” controls for order in which the menus are presented. “Payment Other Task” controls for form of payment in the risk task. “Demographic” controls include controls for the respondent’s gender and planned graduation year. “Denomination” controls for the denomination of the payments in the menu. We report marginal effects, with standard errors clustered at the participant level in parentheses. “Cash Mean” refers to the average question in which participants paid in cash switch from choosing the sooner payment to the later payment.
switch point in the time task, irrespective of the controls included in the regression. The effect sizes are smaller, corresponding to a 0.160 row effect in Column (4). The corresponding 95% confidence interval suggests that we can rule out effects larger than approximately 0.5 rows.

Given that our main result is a null finding, we implemented ex-post power analysis to better understand what sample size would have been required to detect effects in an OLS regression, if our estimates of the mean and standard deviation of the effect were equal to the true parameters. In the analysis of the risk task, assuming an alpha of 0.05 and power of 0.80, we would need a sample size of 1156 subjects to detect a statistically significant effect. Given our sample size, the minimal detectable effect is 0.378, while our estimated treatment effect is 0.220. In the analysis of the time task, we would need a sample size of 3712 subjects to detect a statistically significant effect. Given our sample size, the minimal detectable effect is 0.439, while our estimated treatment effect is 0.174. This analysis confirms that we would have needed an unusually large sample to detect statistically significant effects given the magnitudes of the effects we find. Since our sample size is similar to those used in many experimental studies, this analysis and our main result suggest that any effects of paying subjects in cash versus mobile money are small enough to not be of concern.

Since a limitation of this study is that we restrict participation to individuals that have access to Venmo, we consider whether the results are similar among individuals that exhibit a preference for Venmo versus cash in the exchange task. Specifically, we define an individual as preferring Venmo over cash if they choose to be paid $9.97 by Venmo over $9.98 in cash in the exchange task. Tables A.22, A.23, A.30, and A.31 implement the analysis separately for individuals who do and do not prefer Venmo over cash in the risk and time tasks respectively. The effect of offering payment by Venmo on risk taking and temporal discounting is not statistically significant for both subgroups. These results suggest that lack of trust or familiarity with Venmo nor a preference for payment via Venmo contribute to the main results.

Next, we confirm the robustness of our results in Tables A10–A.12 and A.17–A.19. We confirm the results are robust to the use of logit regressions of the likelihood of choosing the gamble (sooner payment), as well as the use of the linear probability model (OLS) instead of the ordered logit model. We also consider alternative methods to analyze the preferences data by aggregating across choices and using the total number of risky (impatient) choices in each menu as outcomes of interest. The estimated effects in each of these specifications are not statistically significantly and are small in magnitude.

We also confirm that the null result is not specific to a particular subgroup of our sample. To investigate income effects, we split the sample into those who do and do not receive financial aid in Tables A.24, A.25, A.32, and A.33 to find that form of payment does not affect estimates of risk taking and temporal discounting for both subgroups. We also explore whether those who had more recent familiarity

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16 The estimated coefficients were nearly identical in the ordered logit and an OLS regression.

17 Subgroup identifiers were pulled from administrative data.
with numerical tasks would behave differently than those with less recent or no exposure. We measured the time since the participant last took a science, technology, engineering, or mathematics (STEM) class, and split the sample into those with above and below or equal to median times since last exposure in Tables A.26, A.27, A.34, and A.35. We largely find null results in the risk and time tasks for both subgroups; an exception is that payment by Venmo significantly affects temporal discounting for those who took a STEM class more recently, but the effect continues to be small in magnitude (0.5 rows). Lastly, we split the sample by above or equal to and below median GPA, and again find null results in the risk and time tasks for both subgroups (seen in Tables A.28, A.29, A.36, and A.37).

We implemented a follow-up study with 300 residents of informal settlements in Nairobi, Kenya in collaboration with the Busara Center for Behavioral Economics in Fall 2019 to test whether the effects are similar across contexts (described in AEA RCT Registry 0004795). We also found that form of payment did not have a statistically significant effect on estimates of risk taking and temporal discounting in Kenya. However, we do not report the results from these data due to concerns about data quality based on the high rates of multiple switches, never switching, and choosing a dominated option.

In sum, we find broad support for the hypothesis that form of payment does not have statistically significant or sizable meaningful effects on estimates of risk taking and temporal discounting.

5 Conclusion

We use an experiment to examine whether form of payment (cash versus mobile money) affects estimates of temporal discounting and risk taking. While participants frequently use and often prefer to be paid in mobile money, we find that form of payment does not affect behavior in the experiment.

A limitation of this study is that we include only participants who had access to Venmo, since we needed to be able to pay participants via mobile money. As a result, we cannot fully rule out selection issues as it is possible that students with access to Venmo respond differently to form of payment than participants without access to Venmo. However, these results are relevant for our population of interest, that is college students in the United States as they are frequently the participants of laboratory experiments and because students report that Venmo is ubiquitous and frequently used amongst undergraduates at Colorado College. Finally, the finding that the results are similar based on a preference for Venmo within our sample suggests that the non-fungibility and lack of trust in or familiarity with Venmo are not relevant concerns.

Our results are relevant for experimental economists considering payments using mobile money. While Venmo is the most popular form of mobile money among students in our sample, we believe our results speak to experiments that pay using the

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18 Those who had not taken a STEM class were classified as above median.
dominant mobile money platform in contexts in which mobile money is widespread. Given that student participants prefer to be paid using mobile money and that mobile money is often easier for the experimenter to use, as it involves low transactions costs (Aker, Boumnijel, McClelland, and Tierney, 2016), is relatively easy to sign up for and use, and reduces health concerns through contactless transfers, the results support the use of mobile money for payment.

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**Availability of data and materials** The replication material for this study is available at https://doi.org/10.3886/E171061V1. The experimental scripts are provided in the corresponding Online Supplement to this manuscript.

**Declarations**

**Conflicts of interest/Competing interests** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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