**How payment innovations impact charitable giving. A field experiment in Denmark**

**– PAP: Statistical analysis on the blinded data –**

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October 31, 2017

**Abstract**

This document describes the statistical portion of the Pre-Analysis Plan (PAP) of the study (Fosgaard and Soetevent, 2016), based on the blinded outcome data.

# 1 Statistical Analysis

A total of 712 donations were received via MobilePay. The vast majority of all MobilePay donations (687) is made at the day of the fund raising drive. Only 25 donations arrive at a later day, with the final donation coming in after fourteen days. Figures 1*a*-*b* show this arrival process.

A total of 343 MobilePay transactions could be one-to-one matched with a record in the Donation Data (before application of the exclusion rules). The average MobilePay donation is about DKK 70 (≈€9.40), with virtually no difference between matched and unmatched payment: For the matched payments, the average is DKK 68.86 (s.d. 44.81) and for the unmatched payments DKK 71.35 (s.d. 56.82). Table 1 summarizes which keys (addresss, time stamp, other) have been used to link the matched observations. In 37% of all cases, a match between the address associated with the sending cell phone and the address in the Donation Data leads to identification. In half of the cases, a match is accomplished based on the receiving phone number in both the MobilePay and Donation Data combined with the time stamp of the cell phone payment. In 30% of the cases, a match is possible using information in the solicitor's record sheet.[1]

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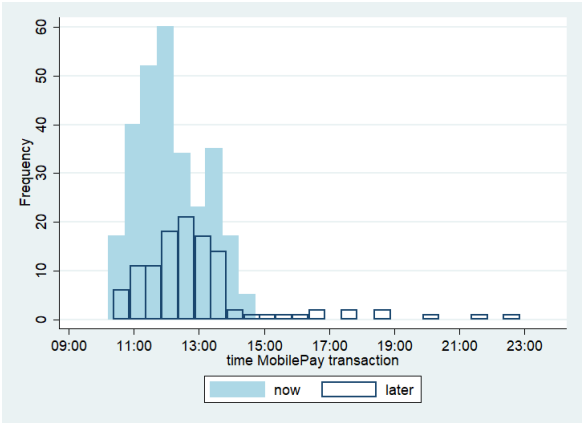
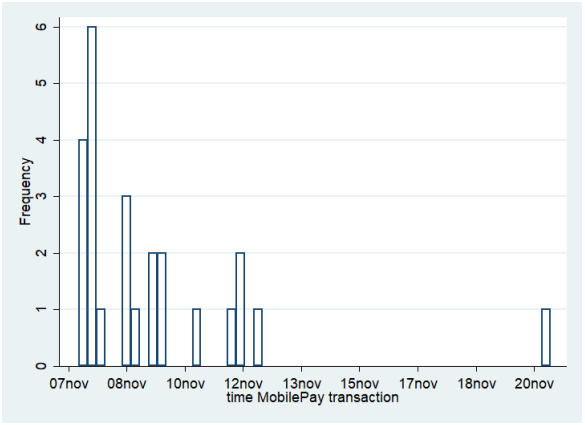
[1]The percentages add up to > 100% because in a number of cases, the observation matched on address and time stamp.

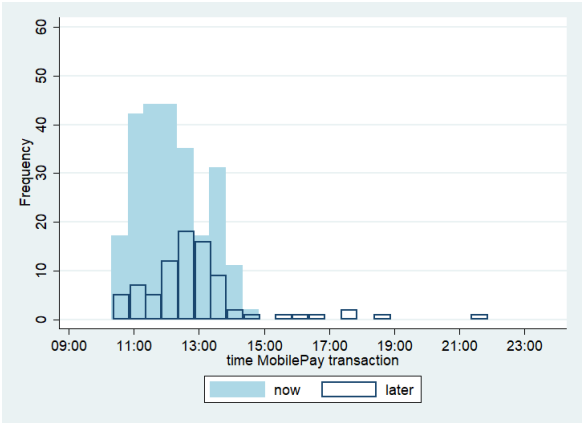
Figure 1: Arrival of MobilePay donations over time



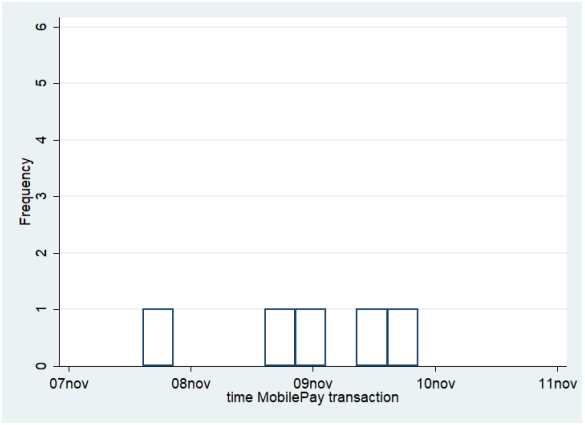

(a) All MobilePay transactions: November 6 (30m interval)




(b) All MobilePay transactions: November 7-21 (6h interval)




(c) Analysis set: November 6 (30m interval)




(d) Analysis set: November 7-21 (6h interval)

Notes: Panels *a* and *b* show the arrival of all 712 MobilePay donations in the initial sample. Panels *c* and *d* give the distribution of the 361 MobilePay donations included in the analysis set.

The analysis set, i.e. the data set after the exclusion rules have been applied, contains a total of 361 MobilePay transactions, 281 of which are matched exactly with one of the 6,973 records (addresses) in the solicitor data. The remaining 80 are matched to a solicitor but not to a specific address/respondent. See Table2 for a summary. Figures 1*c-d* show the timing of these 361 transaction in the analysis set.

## 1.1 Timing of MobilePay donations

The PAP to this project stated that: *"to identify whether individual MobilePay transactions originate from donors who have indicated to donate"now" or from a donor who indicated to donate "later" we rely on matching the time stamp of the transaction with the times written down by solicitors on their record sheet. This identification may not be 100% in case many donors who select "later" donate right*

Table 1: MobilePay donations [matched observations]

| | obs. | mean | s.d. | min. | max. |
|---|---|---|---|---|---|
| amount | 343 | 68.86 | 44.81 | 5 | 250 |
| address match | 343 | 0.37 | 0.48 | 0 | 1 |
| time stamp match | 343 | 0.50 | 0.50 | 0 | 1 |
| other match | 343 | 0.29 | 0.46 | 0 | 1 |

Table 2: Timing of mobile payments [MobilePay records]

| | Matched | Unmatched |
|---|---|---|
| now | 239 | 4 |
| later | 42 | 45 |
| unidentified | 0 | 31 |
| total | 281 | 80 |

*after they have closed the door again. Of course, MobilePay transactions arriving after the solicitor has returned to the distribution center always originate from 'later'-donors but for the transactions at November 6th, identification may pose some problems, especially if the time stamps made by solicitors are not precise. One of the PIs (Fosgaard) will first consider whether matching poses an issue. If so, the other PI (Soetevent) will determine based on the blinded data according to which rules individual MobilePay transactions will be categorized as "now", "later" or "undetermined"."*

In this vein, the summary and classification below has been done by Soetevent on the blinded data. For a important number of sending phones we could exactly identify the sending address.[2] This importantly increased the precision with which we could classify actual donations as immediate or later.

### 1.2 Brief data summary

Table 3 provides a brief overview of the solicitor records included in the analysis set. Of the 6,973 records, 3,197 households have been reported home. Of these households, 2,409 (75.4%) made or promised a donation. 1,806 donations (75% of the total number of donations) were immediate cash donations, for 10 donations (<1%) the payment method is unknown.[3] The remaining 593 donations were made by mobile phone: 263 (44.3% of all mobile phone donations) were immediate and 327 were promises to make a mobile phone payment at a later point in time. In three cases, information on whether a mobile phone payment is an immediate donation or a promise for a future donation is

[2]To this end, we combined information on the sending phone number with address information retrieved from the public database `//kort.degulesider.dk`.

[3]Given that information on the payment method is essential for the analysis, these ten observations are discarded.

unknown.

Table 3: Summary Solitor Data [individual records]

| | | | | |
|---|---|---|---|---|
| **# Records** | **6,973** | | | |
| Not home | 3,776 | | | |
| **Households home** | **3,197** | | | |
| No Donation | | 788 | | |
| **Donations** | | **2,409** | | |
| cash | | | 1,806 | |
| unknown | | | 10 | |
| **Mobile donations** | | | **593** | |
| now | | | | 263 |
| unknown | | | | 3 |
| **Delayed mobile donations** | | | | **327** |

How do the mobile donations in the solicitor records match with the administrative MobilePay data summarized in Table2? The table shows that 239 of the 263 immediate donations (according to the solicitors) can be matched with a specific actual transfer recorded by MobilePay. A further four MobilePay donations can be identified as immediate transfers but without a match to a specific solicitor record.[4] Of the 327 donations said to be transferred at a later moment, 42 can be matched to an actual MobilePay transfer. For 45 of the 80 unmatched MobilePay transfers, we also know that these must be later payments.[5] For 31 MobilePay transfers, we cannot tell whether these are immediate or later payments. Having identified 243 of the 263 recorded immediate donations, we know at most 20 of these unidentified donations can be immediate. However, the actual number is lower when, say, for technical reasons, a transfer has been aborted without the solicitor noticing. In other words, of the 327 future donations respondents announce to the solicitor, between 98 ($= 42 + 45 + (31 - 20)$) and 118 ($= 42 + 45 + 31$) are actually transferred. The implication is that two-thirds of the announced digital donations are never received.

### 1.3 Primary Outcome Variable

Our main interest is in the actual donations of the 327 respondents who have indicated to donate at a later point using their mobile phone. For this reason, the PAP defined the primary outcome variable as follows:

[4]This for example happens when there are no unmatched future payments in a solicitors but two immediate payments without an exact time stamp. In such an instance, we know that both MobilePay transfers must be immediate donations, but we cannot one-to-one match these transfers to the two solicitor records.

[5]For example because the time stamp of the payment is after the solicitor has returned to the distribution center.

- $g_j$: *the average donation made by respondents in the group of solicitor $j$ who indicated a preference to complete the donation by mobile phone at a later moment. This average is defined as the sum of donations wired via MobilePay to the phone number assigned to solicitor $j$ net of the mobile phone donations that are made on the spot, divided by the total number of such donations.*

The PAP also defined a secondary outcome variable regarding pledged amounts

- $p_j$: *the average pledge (indicated intended amount) made by respondents in the group of solicitor $j$ who indicated a preference to complete the donation by mobile phone at a later moment.*

## 1.4 Hypotheses to be tested

### 1.4.1 Main hypothesis

The main hypothesis tested in this trial is:

H1 $H_0 : g_{FPk} = g_{SPk}$ vs. $H_a : g_{FPk} \neq g_{SPk}$ for $k = \{7, \infty\}$.

That is: the actual donation by respondents who indicate that they will give later via their mobile phone will not be affected by the firmness of the pledge they have to make. The PAP noted that this hypothesis would be tested on two different samples: the treatments with ($k = 7$) and without ($k = \infty$) a deadline, with a correction for multiple hypothesis testing using the methods outlined in List *et al.* (2016). Given the smaller than envisioned number of unique routes (81 where the target was 300) and the fact that previous studies in a similar setting have found little evidence of the impact of deadlines[6], we will ignore the difference in deadline in our analysis when the statistical analysis does not reveal significant differences between the groups with and without deadline.

In that case, our focus will be on the difference in outcomes between the three main treatments: No Pledge ($NP$), Soft Pledge ($SP$) and Firm Pledge ($FP$). The unique main hypothesis that will be tested is:

H1* $H_0 : g_{FP} = g_{SP}$ vs. $H_a : g_{FP} \neq g_{SP}$.

The unit of observation is at the solicitor level. Given the number of solicitors, which is relatively small, the use a nonparametric Wilcoxon-Mann-Whitney rank-sum test is most appropriate to test the hypothesis and this will be the default test. The outcome of a Student's $t$-test will be reported as well.

[6] Damgaard and Gravert (2016); Knowles and Servátka (2015); Knowles, Servátka and Sullivan (2016).

### 1.4.2 Other hypotheses

The other, more exploratory hypotheses mentioned in the PAP will also be tested ignoring the difference in deadline whenever statistical tests allow us to ignore the impact of deadlines. For completeness sake, we state the resulting hypotheses below.

H2* $H_0 : p_{SP} = p_{NP}$ vs. $H_a : p_{SP} < p_{NP}$.

The alternative hypothesis reads: respondents who indicate a preference for using their cell phone to transfer a donation at a later point will pledge a lower intended amount the more firm is the commitment made.

H3* $H_0 : g_{SP} = g_{NP}$ vs. $H_a : g_{SP} > g_{NP}$.

The alternative hypothesis reads: respondents who indicate a preference for using their cell phone to transfer a donation at a later point will donate more if the intended gift is announced to another person.

### 1.4.3 Balancing Checks

See the text in the PAP to this study. The tests to check the balance between the treatment groups are the following.

- The number of solicitors in each treatment group should be about equal. That is, under random assignment, the NP, SP and FP treatments should each contain about $p = 1/3$ of all solicitors. Test: Chi2-test.
- In a balanced design, there are no systematic treatment differences in pre-treatment solicitor characteristics. We check this by regressing various solicitor traits (age, gender, accompanying children (Yes/No)) on treatment dummies to test for significant between-treatment differences in these traits. The dummy variable on whether or not a solicitor has experience in this task is not included in this check due to too little variation in this variable (only 6 out of 68 solicitors, less than 10%, indicate not to have experience).
- If solicitors present the questions to respondents in the right order, there should be no significant between-treatment differences in the average cash revenue. To verify this, we estimate the regression equation

$$g_j^c = \alpha + \mathbf{D_j}'\theta + \mathbf{X_j}'\beta,$$

with $g_j^c$ the sum of cash donations received by solicitor $j$, $\mathbf{D_j}$ a full set of treatment dummies, and $\mathbf{X_j}$ a vector of control variables, including the region in Copenhagen were the solicitor was active, the gender and age of the solicitor. The use of the sum of cash donations as a dependent variable is a deviation from the PAP which mentions the average cash donation per cash donor, $\bar{g}_j^c$. The reason is that the former measure is more reliable: for some solicitors we have administrative data on the sum of cash but not one the number of respondents who have donated cash. The $F$-test $\theta_1 = \theta_2 = \theta_3 = 0$ is performed.

- Balance checks are also conducted for equivalence across treatments of the average fraction of households opening the door, the fraction of households donating conditional on being home, and the fraction of households donating cash conditional on being home. If solicitors correctly followed the procedure, no treatment differences in these variables should emerge, for the variation between treatments only happens after respondents have indicated that they wish to donate and which payment instrument they prefer to use.

## 2 Power

Given a total of 81 solicitors and three main treatments, for a significance level $\alpha = 0.05$ and a power $\kappa = 0.80$, the standardized effect size (MDES) equals 0.32.[7] In other words, treatment effects with a minimum impact equal to 0.32 standard deviations will be detected. This means that our design is moderately powered.

## References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[7] $MDES = (t_\kappa + t_\alpha)/(1/3 \cdot 1/3 \cdot N) = (0.842 + 1.960)/8.821 = 0.318$.