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Late Payments, Liquidity Constraints and the Mismatch between Due Dates and Paydays

Abstract

This paper examines a small random liquidity shock to reveal the effect of liquidity constraints on late payment behavior. In Jerusalem, water bill due dates are randomly determined and therefore may occur just before or after social security paydays. We compared the likelihood of late payments by low-income households when they receive their social benefits a day after the water bill due date to the likelihood of late payment by the same households when they receive their benefits a day or more before the water bill due date. Using a large administrative data set, we found that a small random liquidity shock leads to a substantial increase in late payments of more than 10 percentage points among income support recipients and around 6 percentage points for old-age pension recipients with supplementary income. The mismatch between utility payment due dates and paydays may result in reduced psychological well-being, as well as interest charges and high late fees, contributing to the poverty penalty.

JEL-Codes: I300, L950, D100.

Keywords: late payment, liquidity, poverty penalty, water, social security, paydays.

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Introduction

Most people pay their bills on time, but a significant share of household bills go past due, resulting in high late fees.[2] Why do certain people delay payment despite the high costs of late fees? One reason may be that the many due dates of their various bills fail to align with paycheck paydays, as suggested by self-reporting consumers (Consumer Financial Protection Bureau 2018). In many countries, utility bills (e.g., water, gas, electricity, telephone, cable television), property tax and many other bills have their own due dates, which poses a cash flow challenge. For example, households in the United States pay an average of 13 monthly bills (Postal Regulatory Commission 2016) using mainly (68%) non-automatic payment methods (ACI worldwide, 2017: 14). These numerous due dates are particularly onerous for low-income households (i.e., credit-constrained households) due to their limited access to the banking system and capital market, which exacerbates the strain of managing bill payments.[3]

In this paper, we hypothesize that because of due date–payday mismatches, low-income households that face liquidity constraints are less likely to pay their bills on time. To examine the effect of liquidity on the likelihood of timely bill payment, we use a negative liquidity shock created by the billing practices of the Jerusalem Water Utility Company (*Hagihon*), focusing especially on low-income social security recipients.[4] Due to human resources considerations, in a given billing cycle, *Hagihon* manually reads the water meters of a portion of Jerusalem households each day until they cover all consumers. The timing of reading water meters dictates the mailing day, which in turn determines the due date. For logistic reasons, the bills are sent to consumers who their meter were read up to the mailing day (twice a week), and a bill's due date is set, according to regulations, to 18 days after it is sent. Consequently, a water bill's due date is

[2] According to a Consumer Financial Protection Bureau (U.S.) report, one in five people pays a late fee on their credit cards.

[3] In Israel, the due dates of water and electric bills are random (i.e., they cannot be known in advance), whereas the deadlines for paying bills for landline phones, property taxes and internet access and mobile phones fall on the 2nd, 15th and 25th of each month, respectively.

[4] We define here a liquidity shock when due date that falls just before payday which implies shrinking "net" income in the current month and the expansion of "net" income in the next month. One may label it also as a negative spending shock.

determined randomly both across households in a particular billing cycle and across billing cycles for a particular household. The same household may receive a bill with an ex-ante uncertain due date that occurs before or after its social security payday in each billing cycle (every two months). Here, we consider a social security recipient who receives a bill with a due date immediately preceding a social security payday to experience a negative liquidity shock relative to all other households, including that same household during other billing cycles. The random mismatch between water bill due dates and social security paydays that affects the same household allows us to isolate the impact of liquidity.

Employing administrative data, we found that a small random liquidity shock in the amount of a bimonthly water bill results in a 10.3 percentage points increase in late payments among working-age recipients of income support (hereafter: income support recipients). The impact of a liquidity shock among old-age supplementary income and disability benefit recipients (hereafter: recipients of old-age pensions with supplementary income) is smaller and equals 3.7 percentage points. This impact almost triples when comparing social security paydays that occur one day after the due date to those that occur on the due date or one day before.

Our findings may provide utility regulators with insights into the desired timing of due dates for bill payment and the related regulation of late fees. This understanding is even more important in times of change. The mismatch between income paydays and bill due dates is expected to increase dramatically because of the COVID-19 pandemic. Millions of people worldwide have lost their jobs, leading to a change in their major income paydays from a salary payday to unemployment benefits paydays. A new payday might not align with the due dates of a person's bills. Thus, the COVID-19 pandemic might exacerbate the potential negative impact of cash flow mismatch on the likelihood of late payment. This deserves the attention of policymakers, who should contemplate ways to alleviate these negative impacts.

Regardless of the COVID-19 crisis, regulations that tend to fit the needs of the majority of customers may unintentionally harm low-income households. This paper contributes to the literature on the consequences of poverty by exploring the effects of liquidity constraints on economic decision-making that may reinforce the conditions of poverty (i.e., the poverty penalty).[5] Orhun and Palazzolo (2019) surveyed recent studies on the poverty penalty and found that liquidity constraints prevent low-income households from using saving strategies such as buying in bulk and accelerating purchases, contributing to a larger poverty penalty. We show that the poverty penalty increases due to the combination of household resources (i.e., liquidity constraints) and the mismatch between payday and multiple due dates. That combination might result in late bill payments and increase the poverty penalty, as late payments are associated with interest expenses, late fees and the potential deterioration of credit scores in certain countries.[6] Late payments might also result in psychological consequences, as suggested by many studies (see below). Thus, exploring the relationship between social security paydays and late payments could expand the available public policy tools to reduce the poverty penalty.

It is quite surprising that late payments of bills have received almost no academic attention, given the considerable interest of businesses, NGOs, government agencies and the press.[7] A quick search reveals numerous websites and blogs that provide advice and tips on how to address the mismatch between a monthly payday and multiple due dates. This reflects the significance of the risk of late payments among the public, which remains largely overlooked by researchers and policymakers. In developed countries, due date regulation for utility bills such as water, electricity and telecommunication tend to focus on the available length of time to pay the bills, late fees, and guidelines for service disconnection, but rarely on the potential negative impact of the mismatch between due dates and paycheck cycles.

Baugh and Wang (2018) is the only paper we are aware of that studies the consequences of pay cycle mismatch on financial outcomes. They found that households with a greater monthly cash

[5] A series of studies also showed that poverty itself might play a role in perpetuating poverty over time due to capital market imperfections (e.g., Loury 1981, Banerjee and Newman 1991, Galor and Zeira 1993, Piketty 1997, Dahan and Tsiddon 1998).

[6] For example, the *Telegraph* reported that Yorkshire Water customers who miss payments could find it harder to get a loan following an agreement between utility provider and credit reference agency Experian (February 18, 2013). By contrast, late water bill payments do not affect credit scoring in Israel.

[7] Research on the late payment of utility bills, particularly water bills, is limited to developing countries. Studies exploring the determinants of water bill nonpayment (rather than late payment) have found consistently that consumer satisfaction with service quality plays an important role in reducing nonpayment in Uganda (Mugabi et al. 2009), Guatemala (Vásquez 2015), and Nicaragua (Vásquez and Alicea-Planas 2017). The results regarding household income are mixed, with positive impacts in Nicaragua (Vásquez and Alicea-Planas 2017) and no effect in Mexico (Aguilar-Benitez and Saphores 2008). Naturally, these findings are of limited relevance for late payment in developed countries.

flow mismatch are more likely to experience financial shortfalls (i.e., bank overdrafts, bounced checks and online payday borrowing). Our study differs from Baugh and Wang's (2018) in four important respects. First, our identification strategy is based on comparing the varying degree of mismatch in different billing cycles for the same household rather than between households, which reduces exposure to selection bias. Second, unlike Baugh and Wang (2018), who imputed the level of mismatch, we directly observed the due date and, consequently, the degree of timing mismatch. Third, we explored the effect of cash flow mismatch on late payments, which is a form of financial shortfall not covered by Baugh and Wang (2018) due to a lack of data. Finally, this study is the first to examine the impact of liquidity shocks on utility bill-related late payment behavior in developed countries.

Our paper also relates to the literature on excessive consumption sensitivity. Households may react to liquidity shocks by reducing consumption or delaying payments, which functions as a sort of a forced loan with high costs.[8] Numerous studies have tested the impact of predicted and unpredicted changes to lifetime income on consumption and late payments, but few have examined the impact of a liquidity shock when lifetime income remains unchanged.[9] Baker and Yannelis (2017) and Gelman et al. (2018), who examined the 2013 U.S. government shutdown, directly assessed the impact of liquidity on consumption and late payments. Gelman et al. (2018) found an excessive reduction in consumption, along with delayed recurring payments (e.g., mortgages and credit cards) following the U.S. government shutdown. Although these studies concentrated on consumption response, we focus on the effects of a relatively small exogenous liquidity shock on a household's payment behavior related to a particular bill. Unlike these two studies, which examined the behavior of a selected group of federal workers, our identification strategy is not vulnerable to a selection bias.

In Section 2, we outline a conceptual framework, and in Section 3, we describe the institutional background of water billing and social security paydays in Israel. Section 4 presents bimonthly

[8] Several studies have shown that the expenditures and caloric intake of liquidity-constrained households spike on paydays (Stephens 2003, 2006, Shapiro 2005, Mastrobuoni and Weinberg 2009, Gelman et al. 2014, Carvalho et al. 2016, Dahan 2020a).

[9] The general conclusion emerging from this literature is that consumption is excessively sensitive to current income. See Jappelli and Pistaferri (2010) and Fuchs-Schündeln and Hassan (2016). Using comprehensive data sets, three recent papers confirmed this excessive sensitivity (Ganong and Noel 2019, Kreiner et al. 2019, Gerard and Naritomi 2019).

water bill payment data provided by *Hagihon*, along with additional data sources, and Section 5 outlines the study's empirical design and working hypotheses. In Section 6, we present our results, and we conclude in Section 7 with a summary, a discussion of our main findings and relevant policy implications.

2. A conceptual framework

How do households cope with the recurrent monthly challenge of mismatch between the timing of paydays and various uncertain due dates of expenditures? The standard economic model assumes that a rational household is equipped with the capacity to solve this cash flow problem, set priorities and reach an optimal solution like a supercomputer, but such an extreme assumption is implausible. In reality, households choose various policies to address the mismatch challenge.

A household may choose to request that providers of recurring expenses such as mortgages and credit cards set a due date that matches the arrival timing of its primary income. By using such a strategy, a household avoids the cognitive load of managing the family cash flow, as well as the extra financial costs associated with late payments or bank overdrafts. However, such a strategy presupposes that providers offer customers flexible due dates and that households possess adequate financial literacy to demand a change in due date.

A second strategy to save the costs of managing the family budget is to pay recurring expenses using a credit card or standing order and setting the due date on the income payday. Nevertheless, such a strategy is only available for households with satisfactory access to the capital market (credit cards) and certain banking services (standing orders), as well as utility providers that agree or are bound by regulation to be paid via credit cards or adaptable standing orders (i.e., those with flexible due dates).

The selected strategy is shaped by households' characteristics and external conditions. The first strategy is not viable for financially illiterate households or those who receive their services from suppliers with rigid due dates, whereas the second strategy is limited to households with reduced access to the capital market. When services have inflexible due dates, both strategies are restricted for liquidity-constrained households, as in the case for low-income social security recipients who pay water bills in Jerusalem. Moreover, in our case, the timing of water spending is uncertain, as the due date is random, which reinforces the effect of cash flow mismatch on late payments.

Liquidity-constrained households without adequate liquid assets must invest increased effort in synchronizing spending due dates and income paydays to avoid unplanned loans such as late payments, online borrowing or bank overdrafts. To circumvent the burden of budget planning, such households are expected to employ budgeting heuristics. For each pay cycle, we assume that a household may first allocate resources to expenditures with due dates that fit (intentionally or not) its income paydays and cover committed expenses characterized by heavy adjustment costs such as being evicted or experiencing the disruption of essential services in the event of late payment.[10] The remaining financial resources are allocated to adjustable goods (e.g., food) and services with inflexible due dates scheduled for the last portion of a pay cycle. In the spirit of previous studies (Loewenstein et al. 2003, Zhang 2013, 2017, Baugh and Wang 2018), we suggest that inattention and overconfidence may result in excessive consumption of adjustable goods. Consequently, the arrival of bills with uncertain or inflexible due dates toward the end of a pay cycle could force a household to choose between an undesirable reduction in food consumption, a standard loan or a forced loan in the form of late payments. These choices entail either a temporary calorie intake deficit or high psychological and financial costs due to very high interest rates and late payment charges. Missing payments may be associated with psychological costs, as numerous studies have suggested, because debt and money management may increase stress and negatively affect mental health and well-being (e.g., de Bruijn and Gerrit 2020, Netemeyer et al. 2018, Bridges and Disney 2010). Furthermore, Gennetian and Shafir (2015) suggest that cognitive resources are taxed by financial instability.

Thus, the likelihood of on-time payment is affected by the interaction of households' characteristics and external choice architecture, such as due date flexibility and uncertainty, billing cycle frequency (i.e., monthly or bimonthly), late payment fees and effective interest rates on loans. In this paper, we focus on the interaction between reduced access to the capital market and banking system and the flexibility and uncertainty of the due date, controlling for other household characteristics and the external features of choice architecture. We suggest that a

[10] Here, we follow the distinction made by Chetty and Szeidl (2007, 2016) between committed and adjustable consumption.

household is less likely to pay on time following a negative liquidity shock. A household experiences a negative liquidity shock if its water bill due date falls just before its social security payday. This liquidity shock is similar to an uncertain income delay, which is a classic liquidity shock. Although the fact that the bill will be due is not a shock, its uncertain timing governs whether it is covered by the current or next income cycle. A due date that falls randomly just before payday implies shrinking "net" income in the current month and the expansion of "net" income in the next month, which is equivalent to income deferral in the amount of the water bill. The following hypotheses summarize the above discussion:

H1: Liquidity-constrained households are less likely to pay a water bill on time if its due date falls immediately before payday rather than afterward.

H2: This effect intensifies when comparing the worst day of a pay cycle (i.e., a due date immediately before payday) and the best days (i.e., a due date on payday or immediately afterward).

To test these hypotheses, in the empirical analysis we compare between the treated group which consists of income support recipients who received their benefits one day after the water bill due date, and the control group which includes the same households during other billing cycles when they received their social security checks on various days before or after the water bill due date except for one day after payday. Here, we represent liquidity-constrained households with low-income social security recipients who are eligible for monetary aid due to their having zero or low income and limited access to certain banking services. The estimated impact of a mismatch between the timing of income and expenditure commitments in our study should be seen as a lower bound, as a household might pay on time using bank overdrafts or online loans that are not available in our data. This bias should be seen in view of the growing payday loans in the US (Servon 2017). Unfortunately, we are not aware of a study that explores the extent of payday loans in Israel.

3. Institutional Background

Hagihon, the only water utility company serving Jerusalem and its suburbs (Mevaseret-Zion and Abu-Ghosh) provides water to approximately 200,000 households. Customers are billed every other month (bimonthly). Water meters are read manually and, due to human resource considerations, each neighborhood is read over the course of a different week until all meters in the municipal area are covered. The data are processed immediately after meter reading, and water bills are distributed twice a week to mailboxes primarily by *Hagihon*, although a smaller portion is distributed by the Israeli Postal Service. In compliance with the Israel Water Authority's regulation ordinances, *Hagihon* allows 18 days for payment from the time the bill is sent, which allows consumers over two weeks to pay. Due to mailing logistical constraints, due dates are set almost evenly on either Monday or Friday both across households in a particular billing cycle and across billing cycles for a particular household.[11] As a result of the described process, a water bill's due date for a particular household is determined randomly for each billing cycle. Thus, households, face an uncertain due date each billing cycle, adding to the management burden of the family budget. Based on the entire data set, the frequency of the bill due date by day of the month is distributed evenly, with the exception of fewer due dates on the 31st because of the corresponding fewer months of that length (Figure 1a). Figure 1b presents data from four households to illustrate that due dates vary across billing cycles for the same household.

Failure to pay bills on time exposes households to collection procedures. According to Water Authority regulations, a household with a delinquent bill receives the first warning letter two weeks after the due date, and it includes a penalty charge of approximately 16 NIS ($5), which is much higher than the effective interest rate charged for an account overdraft in the same amount. *Hagihon* issues around 200,000 first warning letters a year. Late fees are in addition to immediate interest charges on the full outstanding amount of the bill. Two weeks later, a second letter of warning is sent, this time by registered mail, with an additional charge of approximately 23 NIS ($7). *Hagihon* sends about 120,000 second warning letters a year. The accumulated late fees after four weeks (39 NIS, or approximately $12) are around 11% of the average water bill in Jerusalem (390 NIS, or approximately $110). Two months after the due date, letters of foreclosure are sent to all nine Israeli banks. The fee for foreclosure letters is an additional 132 NIS (176 NIS in total, or approximately $48). About 13,000 such letters are sent each year. The

[11] The mailing distribution of water bills to consumers who their water meters were read are either on Thursday or Monday. A bill's due date is set, according to regulations, to 18 days after it is sent, and therefore the due date is randomly on either Monday or Friday, respectively.

warning letters are automatic, but the foreclosure process requires *Hagihon*'s active discretion. If the foreclosure is unsuccessful, as is the case for households without financial assets, the next step is the confiscation of possessions, which entails sending a team of confiscators to the client's home, accompanied by the police. In practice, this method is carried out only if the debt is over 500 NIS ($143). Going to court is the last resort and may be associated with a cost of thousands of shekels.

The water price for urban consumption in Israel has the structure of the increasing block tariffs (IBT) model. It is divided into two price levels: a low price of 6.9 NIS ($1.90) per cubic meter (CM) of water for the first 3.5 CM per capita, and a high price of 13 NIS ($3.60) per CM above that threshold. According to Water Authority regulations, a well-defined group of households, such as those of social security recipients and Holocaust survivors, is entitled to an additional 3.5 CM per capita at the low price. This group consists mainly of social security recipients of income support and old-age benefits who receive supplementary income due to their having low or no income (means-tested benefits). Each month, Israel's social security system, known as the National Insurance Institute (NII), transmits a list of social security recipients to the *Hagihon*, which allows it to grant the water subsidy to the respective beneficiaries automatically.

4. Data

Hagihon provided administrative data on water bill payments of each billing cycle for the years 2013-2016 for all households. The investigated population included billing cycles in which the bill was received in 2016, but the due date was in 2017. We merged the *Hagihon* data set with data provided by the NII to identify two groups of low-income social security benefit recipients: working-age households that received income support and old-age pension recipients who also received supplementary income. Although the original administrative data set contained more than three million observations, we focused on a subset of households that received social security benefits due to their having low or no income. Recipients of income support and old-age pensions with supplementary income (including recipients of disability benefits) comprise 1.3% and 12.2% of the overall population in the merged data set, respectively, including households that pay via standing order (Table 1). The merged data set also allows us to identify the recipients of unemployment benefits and child allowances, which are more economically diverse groups.

The database includes water bill related data, such as water consumption in CM, bimonthly water bill amount, due date, actual date of payment, type of payment (e.g., standing order, cash or credit) and demographic variables such as household size. Table 2 shows that a household spends about 390 NIS ($110) on water every two months, which implies that water consumption in Jerusalem is around 50 CM per capita a year on average. Jerusalem is home to a disproportionally high share of ultra-Orthodox Jews (33%) and Arabs (38%), two groups characterized by very high poverty rates (Dahan 2020b, Grinstien and Nisan 2009). This makes Jerusalem suitable for this research. The household size of old-age pension recipients is smaller compared to the general population and households that receive income support, but the bill amount is only slightly smaller, probably due to age composition, which dictates the consumption of water (Table 2).

We restricted the investigated population to households with water bill due dates on Mondays and who did not pay the water bill via standing order, as only these households can make late bill payments. This decision has the advantage of controlling for the day of the week by construction but at the cost of reduced number of observations. Households that received water bills with Friday due dates, which is the other most frequent date in our data set (Table 3) could not participate in this analysis, given that we employed a one-day gap between social security paydays and water due dates. For bills with Friday due dates, one day after the due date is Saturday, and social security paydays cannot fall on that day (i.e., social security paydays fall on the due date or the day after). We also could not use a similar analysis for Friday even for two days because Israel's five-day work week is Sunday through Thursday. On Fridays, most banks are closed or are open for only a few hours, which may induce consumers to pay bills due on Fridays earlier in the week compared to those with Monday due dates. Note that the Friday due date was in place before the move from six to five working days.

Late payment of water bills in Jerusalem is not a trivial problem. In our data set, 70% of households in Jerusalem pay their water bills on time, and two weeks after the due date, 81% of the average total share of households have paid. A month after the due date, 85% of households have paid, and two months after the due date, over 90% of households have paid. A year after the due date, 99% have paid. About 40% of households in Jerusalem pay their bills via a standing order, which pays the bill on time automatically via credit card or bank transfer. The rest pay their bills online using a credit card or online bank transfers, in person, at banks or at *Hagihon*'s two offices. Among households that do not pay automatically via standing orders, an average of 46.6% pay their water bills late (Table 4). Table 5 shows the share of households that pay their water bills via standing order. There is a noticeable increase over time in the use of standing orders because of deliberate efforts by *Hagihon*. Nevertheless, that share is quite small among income support recipients. These households, which receive monetary aid because of they have very low or no income, are more likely to experience liquidity constraints and face limited access to certain banking services such as standing orders.

In this study, a household experiences a negative liquidity shock if its water bill due date falls just before its social security payday. Israel has four social security paydays for each of its monthly social security benefits: income support, unemployment benefits, child allowances and long-term allowances (old age, disability and survivors). These are deposited into recipients' bank accounts on the 14^{th} (12^{th} since October 2016), 17^{th}, 20^{th} and 28^{th} of the month, respectively. Typically, if the social security payday is a Saturday (Israel's weekly day of rest) or a holiday, the benefits are deposited on the following day. However, at the discretion of the Ministry of Finance, a social security payday may also be advanced on two Jewish holidays (Passover and the Jewish New Year), two Muslim holidays (Eid al-Edha and Eid al-Fitr), one Druze holiday (Nabi Shu'ayb) and one Christian holiday (Christmas).

Table 6 presents the actual paydays of four social security allowances over five years. For example, long-term allowances are usually delivered on the 28^{th}, but in certain months, paydays are advanced or postponed due to holidays or weekends. In our analyses, we focused on households that received income support, as well as recipients of old-age pensions with supplementary income, as such households are more likely to face severe liquidity constraints.

5. Empirical Analysis

We exploited a panel data set on the bimonthly water bills of Jerusalem households that did not pay via standing order over the four-year period (2013-2016) and data on actual income support and long-term allowance paydays in Israel to test the effects of a liquidity shock on late payments. To estimate the impact of receiving social security benefits one day after a water bill due date on the probability of paying on time, we employed the following statistical model:

$$(1)\ \mathrm{P}_{\mathrm{i,d,m,y}} = \mathbf{Z}_{\boldsymbol{i,d},\mathbf{m,y}}\mathbf{a_0} + \mathbf{ID_i a_1} + \mathbf{Da_2} + \mathbf{Ma_3} + \mathbf{Ya_4} + \mathbf{X_{i,d,m,y}a_5} + \mathrm{u}_{\mathrm{i,d,m,y}}$$

where $\mathrm{P}_{\mathrm{i,d,m,y}}$ is a dummy variable assigned a value of one if household *i* in due date day *d* in month *m* in year *y* paid the water bill on time (i.e., before or on the due date) and zero otherwise. Our key explanatory variable, $\mathbf{Z_{i,d,m,y}}$, is a dummy variable that receives a value of one if the water bill's due date is a day before the social security payday for household *i* in due date day *d* in month *m* in year *y* and zero otherwise. Note that data set is organized such that we have one observation for each household in each billing cycle (limited to bills with due date on Monday). For each specific analysis, $\mathbf{Z_{i,d,m,y}}$ accounts for one of the social security allowances (income support, unemployment benefits, child allowances and long-term allowances) paid on the $12^{th}/14^{th}$, 17^{th}, 20^{th} and 28^{th}.

We employ the actual due date despite the fact that a letter of warning is sent two weeks after the due date for three reasons. First, being in debt is associated with psychological costs, as many studies indicate. Second, high-interest charges are accumulated immediately after the due date, which discourages late payment. Third, most households pay on time, which indicates that paying the water bill after the due date but before the arrival of the first warning letter (two weeks after the due date) is undesirable.

The variable $\mathbf{ID_i}$ denotes household fixed effect, whereas **D, M** and **Y** represent day, month and year fixed effects. In one of our sensitivity analyses, we also controlled for time-varying household characteristics, $\mathbf{X_{i,d,m,y}}$, namely the water bill in NIS and the number of household members. These variables provide an additional proxy for the household wealth level (see Dahan and Nisan 2007).[12] Unobserved determinants of the probability of paying on-time the water bill are represented by the error term $u_{i,d,m,y}$. The coefficients $\boldsymbol{a}_0$ are unknown parameters that may be estimated to reveal the effects of a liquidity shock; the variation across sub-groups in the size of

[12] Dahan and Nisan (2010) found that in the margin, water consumption per capita is linear for household size, but the additional consumption is related to household wealth.

coefficients on $\mathbf{Z}_{i,d,m,y}$ dummy variables may reveal the differential effect of a liquidity shock on the probability of paying the water bill on time.

The treated group comprises income support recipients who received their benefits one day after the due date, whereas the control group includes the same income support recipients in other billing cycles during which they received their benefits either before or after the water bill due date, excluding one day after the due date. To ensure that these two groups are quite similar, we present the distributions of billing amount of households of treated and control groups in Figure 2. As can be seen, the two distributions are almost identical (Figure 2).

6. Results

Before showing the estimated regressions, we illustrate our key results regarding the effect of payday–due date mismatches by calculating the actual share of households that paid on time in various timings relative to a benchmark timing when the payday occurred a day after the due date (Figures 3a and 3b). For example, there was a 10.7 percentage points difference between the share of households that paid their bills when the income support payday was one day before the due date compared to our benchmark timing (Figure 3a). In contrast, we observed no difference when the payday was two days after the due date compared to when it occurred a day after the due date. The result that emerges from Figure 3 is that low-income social security recipients are more likely to pay their water bills on time when their paydays occur before the due date than when they occur afterward. Although the simple calculations in Figure 3 communicate the main conclusion, they ignore time fixed effects and other factors that the estimated regressions take into account.

We present the main findings of this paper in Table 7. In line with our first hypothesis, the likelihood of on-time water bill payment is 10.3 percentage points lower when income support recipients receive their benefits one day after the due date, controlling for household and time fixed effects (Table 7, column 2). This implies a 17.7% increase in late payments relative to the share of late payments in this group of households (58.3%: Table 5).[13] The treated and control groups include the same income support recipients, so the coefficient provides a clean estimate

[13] The results are similar when we include households who pay their water bills via standing orders during certain billing cycles and other forms of payments during other cycles (not reported here).

of the impact of a negative liquidity shock on payment patterns that is not contaminated by differences in personal traits or task characteristics.

The estimated coefficient of a one-day gap between the old-age pension payday and the water bill due date implies a 3.7 percentage points reduction in the share of households that paid on time. The estimated effect is in line with our hypothesis that low-income households are more likely to experience liquidity constraints at the end of the allowance cycle. Although sizable, this effect is slightly lower when compared to that of income support recipients. The smaller impact is in line with the lower degree of liquidity constraint that recipients of old-age pensions with supplementary income might face compared to income support recipients. According to an NII report, recipients of old-age pensions with supplementary income are in better economic conditions than do income support recipients (NII Annual Report, 2017).

Next, we present our analyses for two other social security paydays: unemployment benefits and child allowances. Compared to those of the previous two groups of low-income social security benefit recipients, the estimated coefficients for these allowances are smaller or insignificant. These results are unsurprising, given that the recipients of unemployment benefits and child allowances vary across a much wider range of the socio-economic spectrum than do income support and old-age pension recipients. As a result, they are also more diverse in terms of their access to credit markets. These findings lend extra support to our main hypothesis.

In Table 8, we test whether our main finding is sensitive to the inclusion of two important time-varying variables: billing amount and number of people in the household. The estimated effect should remain the same given the nature of the empirical design. The treated and control groups represent the same households and differ only due to a random shock caused by the due date. Thus, adding the households' other characteristics, such as billing amount and the number of people in the household, to the household's fixed effects should not have a noticeable impact. Indeed, a similar picture emerges after controlling for these two variables. The coefficient of the liquidity shock is slightly higher for income support recipients after accounting for billing amount and household size (Table 8). The estimated coefficient of the billing amount is negative and significant. This result indicates that a higher billing amount is associated with increased liquidity constraints that reduce the likelihood of on-time payment. The estimated effect of family size is positive but insignificant. Table 8 also provides two falsification tests. As expected, the coefficient of the key explanatory variable becomes insignificant once we employ a false payday (i.e., the old-age pension payday for income support recipients and the income support payday old-age pension recipients). These results provide additional support for the main findings.

Next, we performed a sensitivity analysis to reveal the differences according to the liquidity constraints' potential severity by comparing payment behavior on the worst and best possible days of the expenditure cycle (i.e., right before payday vs. right after). This exercise came at the cost of a reduced number of observations, which we mitigated somewhat by excluding time fixed effects. Table 9 provides various time windows by adding a day to both the treated and control groups up to seven days. In column 1, the treated group consists of income support recipients who received their benefits one day after the water bill due date, whereas the control group includes the same households during other billing cycles when they received their social security checks precisely on the water bill due date. This is fundamentally different from our baseline control group, which included social security recipients who got their benefits on various days before or after the water bill due date except for one day after payday (an average over all other days). In column 2, the treated group is the same as in column 1, but the control group includes the same households during other billing cycles in which they received their social security benefits a day before or exactly on the due date. In column 3, we add to the treated group in column 1 recipients who received their benefits two days after the water bill due date, whereas the control group includes the same recipients but in other billing cycles when they received their social security checks a day or two before the due date or exactly on the due date. In columns 4-8, we follow the same logic for longer time gaps.

Because of the larger number of observations, we first present the sensitivity analysis for recipients of old-age pensions with supplementary income. We found the largest coefficient when we compared receiving benefits one day after the water bill due date (the worst day) with receiving them exactly on the due date (the best day). The coefficient increased from 3.7 percentage points in our baseline estimation to 8.9 percentage points, which implies a 21.7% higher delinquency rate than average within this group (Table 9a). As the time frame expands, the estimated effect size decreases, indicating that households tend to pay the bill after receiving their social security benefits. Although the estimated coefficient also decreases for income support recipients as the time frame expands, the coefficient size is similar to our baseline estimation when comparing the likelihood of paying on time when payday is a day after the due date to when it falls precisely on the due date (Table 9b). This result may be driven by the low number of observations. Overall, these findings lend additional empirical support to our second hypothesis regarding the larger size effect of a liquidity shock on the likelihood of paying on time as the severity of liquidity constraints intensify.

7. Summary and conclusion

This paper exploits a small random liquidity shock to reveal the effect of liquidity constraints on late payment behavior. In Jerusalem, water bill due dates are randomly determined because of limitations related to water utility human resources. This introduces a small liquidity shock that places an undue burden on certain low-income social security recipients during certain billing cycles. As a result, the bill may be due a day or more before the social security payday or a day or more afterward. We compared the likelihood of late payments for low-income households that received their benefits a day or more after the water bill due date to the same households when they received their benefits a day or more before the water bill due date. Using a large data set of water consumers, we found that a small random liquidity shock in the amount of a water bill leads to a 10.3 percentage points increase in late payments among income support recipients. This implies a 17.7% decrease in the likelihood of paying on time relative to the actual share of late payments. The estimated effect for long-term allowances recipients is 3.7 percentage points higher, and this almost triples when we compare beneficiaries who receive their benefits a day after the due date to the same households when they receive their social security paychecks exactly on the due date.

The mismatch between low-income households' social security paydays and bill due dates may generate undesirable liquidity disruptions. Our findings suggest that this unintended misalignment has negative monetary and potentially psychological consequences for disadvantaged families, which may be forced to pay interest charges and late-payment fees, as well as receive lower credit rating scores in particular countries, which can further exacerbate their economic conditions (poverty penalty). In our empirical design, late payments could not be explained by differences in personality (as we compared behavior of the same household in different months), task characteristics (the task of paying a water bill is identical every month) and demographics.

This study adds to our knowledge by exploring the importance of the interaction between the external environment (payday–due date mismatch) and household characteristics (liquidity constraints and limited banking access) in determining payment behavior. In light of our findings, setting due dates deserves special attention from regulators worldwide. Inflexible due dates might be a way by which a monopolistic provider implicitly raises the price of a service if overall late payment charges exceed the extra cost of debt collection but such behavior is socially undesirable. An inflexible due date could be also the result of inattention by utility companies. Utility regulation authorities in the developed world tend to regard the period of time between issuing the bill and the actual payment deadline as providing households enough time to pay their bills. However, regulators seem to fail to pay sufficient attention to the mismatch between the billing due date and paycheck cycles, as evidenced by the multiple due dates of various utilities. Our findings call for a rethinking of payment regulation in light of the negative consequences in terms of equity and efficiency. A random due date also imposes an unnecessary managerial burden on *Hagihon*, which must invest undue resources in payment collection.

One potential direction is to allow households to select their own due dates to ensure alignment with their scheduled paydays. Our findings suggest that such a policy might have promising outcomes that reduce late payments. However, we should be cautious with this prediction due to general equilibrium considerations, as it might improve the likelihood of paying certain bills on time at the cost of late payments for others. Alternatively, the due date could be set to match low-income households' most important paydays. For the reasons explained about, however, extending the bill payment period to a month or more, which utilities regulations can consider a policy device aimed at reducing late payments, may not be adequate to remedy the mismatch. A natural next step is to employ random controlled testing of such policy interventions to explore their effectiveness in increasing the likelihood of timely payments.

Table 1: Data set [1, 2]

Year	Number of observations (households in parentheses)	Share of households receiving income support	Share of households receiving old-age pensions with supplementary income [3]	Share of households receiving unemployment benefits	Share of households receiving child allowances
2013	719,063 (139,029)	1.3%	12.1%	0.7%	9.8%
2014	807,801 (140,945)	1.3%	12.2%	0.8%	9.9%
2015	820,448 (142,235)	1.3%	12.1%	0.7%	10.0%
2016	835,060 (144,460)	1.3%	12.4%	0.7%	10.0%
2017	213,180 (137,622)	1.2%	11.9%	0.6%	9.9%
All years	3,395,552 (166,395)	1.3%	12.2%	0.7%	9.9%

1. Observations for 2017 represent households that received a bill in 2016 with a due date in 2017.
2. All observations, including those for households that paid their water bills via standing orders
3. Including disability benefits

Table 2: Descriptive statistics [1]

Year	Average number of people per household, by group			Average bimonthly bill per capita, in NIS (₪), by group		
	All households	Income support	Old-age pensions with supplementary income [2]	All households	Income support	Old-age pensions with supplementary income [2]
2013	3.9	4.2	3.4	97.4	100.8	97.3
2014	4.0	4.4	3.5	90.2	94.8	91.1
2015	4.1	4.6	3.5	83.9	92.0	84.9
2016	4.1	4.8	3.6	76.2	72.9	77.8
2017	4.2	5.0	3.6	71.8	69.3	73.3
All years	4.1	4.6	3.5	85.6	88.8	86.5

1. All observations, including those for households that paid their water bills via standing orders
2. Including disability benefits

Table 3: Due date distribution by day of the week

Day of the week	Number of observations	Share	Cumulative distribution
Sunday	52,836	1.6%	1.6%
Monday	1,651,062	48.6%	50.2%
Tuesday	21,495	0.6%	50.8%
Wednesday	4,018	0.1%	50.9%
Thursday	51,663	1.5%	52.5%
Friday	1,608,937	47.4%	99.8%
Saturday	5,541	0.2%	100.0%
Total	3,395,552	100.0%	100.0%

All observations, including those for households that paid their water bills via standing orders

Table 4: Share of households with late payments, by social security recipients [1]

Year	All households	Social security recipients			
		Recipients of income support	Recipients of old age pensions with supplementary income [2]	Recipients of unemployment benefits	Recipients of child allowances
2013	48.5%	59.0%	42.1%	52.7%	55.8%
2014	47.1%	59.7%	41.7%	51.1%	54.7%
2015	45.6%	57.8%	40.4%	47.5%	53.3%
2016	45.3%	56.7%	39.6%	47.4%	52.6%
2017	46.0%	57.4%	42.2%	49.2%	53.0%
All years	46.6%	58.3%	41.0%	49.7%	54.0%

1. Excluding households that paid their water bills via standing orders
2. Including disability benefits

Table 5: Share of households paying via standing orders, by social security recipients[1, 2]

Year	All	Social security recipients			
		Income support	Old-age pensions with supplementary income [3]	Unemployment benefits	Child allowances
2013	35.9%	11.8%	35.2%	29.2%	26.6%
2014	40.0%	14.0%	38.5%	35.7%	32.1%
2015	42.3%	16.3%	39.9%	39.6%	35.9%
2016	44.8%	16.4%	42.5%	41.6%	38.8%
2017	45.0%	16.0%	43.4%	40.3%	38.8%
All years	41.2%	14.8%	39.5%	36.9%	34.0%

1. Observations for 2017 represent households that received a bill in 2016 with a due date in 2017.
2. The calculations are based on observations and include households that paid their water bills via standing orders.
3. Including disability benefits

Table 6: Actual social security paydays (2013-2017)

	14th Income support					17th Unemployment benefits				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
January	14	14	14	14	12(C)	17	17	18(A)	17	17
February	14	14	15(A)	14	12(C)	17	17	17	17	17
March	14	14	15(A)	14	12(C)	17	17	17	17	17
April	14	10(B)	14	14	6(B)	17	10(B)	17	17	10(B)
May	13(B)	14	14	15(A)	12(C)	17	18(A)	17	17	17
June	14	15(A)	14	14	12(C)	17	17	17	17	17
July	14	14	14	14	12(C)	17	17	14(B)	17	18(E)
August	8(B)	14	14	14	13(A)	18(A)	17	17	17	17
September	15(B)	14	10(B)	8(B)	12(C)	15(B)	17	11(B)	18(A)	17
October	11(B)	14	14	13(B)	10(B)	11(B)	17	18(A)	13(B)	17
November	14	14	15(A)	14	12(C)	17	17	17	17	17
December	15(A)	14	14	12(C)	12(C)	17	17	17	17	17
	20th Child allowances					**28th Long-term allowances**				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
January	20	20	20	20	17(B)	28	28	28	28	29(A)
February	20	20	20	21(A)	20	28	28	27(D)	28	28
March	20	20	20	20	20	21(B)	28	29(A)	28	28
April	21(A)	20	20	20	20	22(B)	23(B)	21(B)	20(B)	21(B)
May	20	20	20	20	21(A)	28	28	28	29(A)	28
June	20	20	19(A)	20	20	28	29(A)	28	28	22(B)
July	21(A)	20	14(B)	20	20	28	24(B)	28	28	28
August	20	20	20	21(A)	20	28	28	28	28	28
September	16(B)	21(A)	20	20	17(B)	23(B)	22(B)	21(B)	28	27(B)
October	20	20	20	14(B)	20	28	28	28	28	29(A)
November	20	20	20	20	20	28	28	29(A)	28	28
December	20	21(A)	20	20	20	22(B)	22(B)	22(B)	22(B)	21(B)

A. The payday was on Saturday and was therefore delayed until Sunday.
B. The payday was on a holiday and was therefore brought forward.
C. The income support payday changed from the 14th to the 12th of every month in December 2016.
D. A delay until Sunday would have meant that the allowance was given in the next month; therefore, it was brought forward to Friday.
E. The date was changed for an unknown reason.

Table 7: The effect of receiving social security paychecks one day after due date on paying on time

(Dependent variable: paying on time=1)

	(1) All households (using income support payday)	(2) Income support recipients	(3) Recipients of old age pensions with supplementary income and disability benefits	(4) Recipients of old age pensions with supplementary income (i.e., excluding recipients of disability benefits)	(5) Recipients of unemployment benefits	(6) Recipients of child allowances
Payday one day after due date	0.013** (0.006)	-0.103*** (0.037)	-0.037*** (0.012)	-0.058*** (0.018)	0.060 (0.082)	-0.020* (0.012)
Constant	0.454*** (0.004)	0.332*** (0.029)	0.482*** (0.011)	0.502*** (0.018)	0.364*** (0.070)	0.395*** (0.011)
Observations	978,879	18,883	124,716	47,846	7,289	109,827
Households	123,540	3,048	18,011	5,763	4,201	15,523

Observations with Monday due dates only, excluding standing orders

Clustered standard errors appear in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 8: The effect of receiving social security paychecks one day after the due date on paying on time: sensitivity analysis adding control variables and using falsification tests

	Adding control variables		Falsification tests	
	(1) Recipients of income support	(2) Recipients of old age pensions with supplementary income and disability benefits	(3) Recipients of income support old age pension payday	(4) Recipients of old age pensions with supplementary income and disability benefits Income support payday
Payday one day after due date	-0.105*** (0.037)	-0.039*** (0.012)	-0.008 (0.034)	0.017 (0.015)
Billing amount (in units of 100 NIS)	-0.002** (0.001)	-0.01*** (0.001)		
Number of people in household	0.001 (0.006)	0.005 (0.004)		
Constant	0.335*** (0.04)	0.491*** (0.017)	0.329*** (0.029)	0.482*** (0.011)
Observations	18,883	124,716	18,883	124,716
Households	3,048	18,011	3,048	18,011

(Dependent variable: paying on time=1)

Observations with Monday due dates only, excluding standing orders

Clustered standard errors appear in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 9a: The effect of receiving <u>old-age pension</u> one day after the due date on paying on time, by various time gaps between payday and the due date
(Dependent variable: paying on time=1)

	(1) **1 After vs. on 0 (due-date)**	(2) **1 After vs. 0-1 Before**	(3) **1-2 After vs. 0-2 Before**	(4) **1-3 After vs. 0-3 Before**	(5) **1-4 After vs. 0-4 Before**	(6) **1-5 After vs. 0-5 Before**	(7) **1-6 After vs. 0-6 Before**	(8) **1-7 After vs. 0-7 Before**
Coefficient	-0.089*** (0.017)	-0.044*** (0.010)	-0.021** (0.008)	-0.026*** (0.007)	-0.016*** (0.006)	-0.004 (0.005)	-0.004 (0.005)	-0.014*** (0.004)
Constant	0.586*** (0.009)	0.575*** (0.004)	0.576*** (0.004)	0.587*** (0.004)	0.586*** (0.003)	0.590*** (0.002)	0.585*** (0.002)	0.589*** (0.002)
Observations	9,591	14,254	17,679	24,916	34,901	39,004	49,559	58,421
Households	6,747	9,154	9,460	10,647	12,131	12,806	14,352	15,290

Observations with Monday due dates only, excluding standing orders, and without time fixed effects
Clustered standard errors appear in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 9b: The effect of receiving <u>income support</u> one day after the due date on paying on time, by various time gaps between payday and the due date
(Dependent variable: paying on time=1)

	(1) **1 After vs. on 0 (due-date)**	(2) **1 After vs. 0-1 Before**	(3) **1-2 After vs. 0-2 Before**	(4) **1-3 After vs. 0-3 Before**	(5) **1-4 After vs. 0-4 Before**	(6) **1-5 After vs. 0-5 Before**	(7) **1-6 After vs. 0-6 Before**	(8) **1-7 After vs. 0-7 Before**
Coefficient	-0.070** (0.032)	-0.104*** (0.022)	-0.093*** (0.021)	-0.073*** (0.014)	-0.060*** (0.013)	-0.059*** (0.012)	-0.054*** (0.012)	-0.058*** (0.011)
Constant	0.379*** (0.014)	0.417*** (0.004)	0.418*** (0.004)	0.428*** (0.007)	0.426*** (0.005)	0.425*** (0.005)	0.422*** (0.006)	0.428*** (0.005)
Observations	1,225	2,753	2,800	4,878	6,525	6,921	8,708	9,915
Households	920	1,338	1,338	1,708	2,022	2,044	2,176	2,354

Observations with Monday due dates only, excluding standing orders, and without time fixed effects
Clustered standard errors appear in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Figure 1a: The distribution of due dates by day of the month

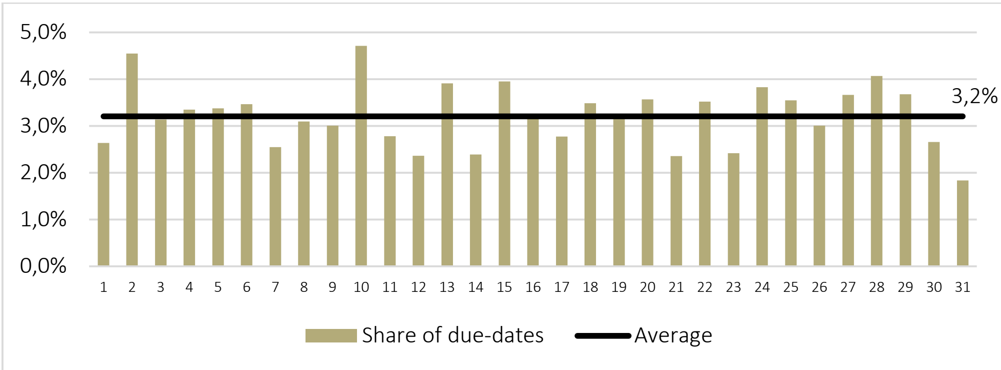
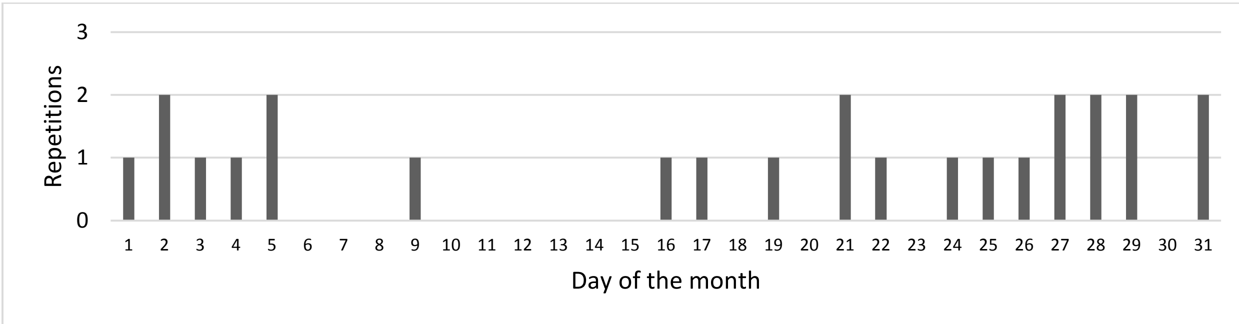
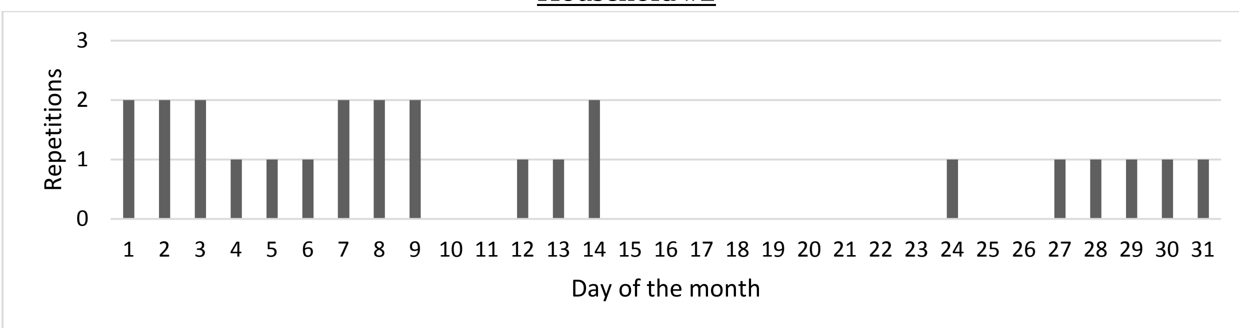


Figure 1b: The distribution of due dates, by day of the month
Illustration of 4 particular households

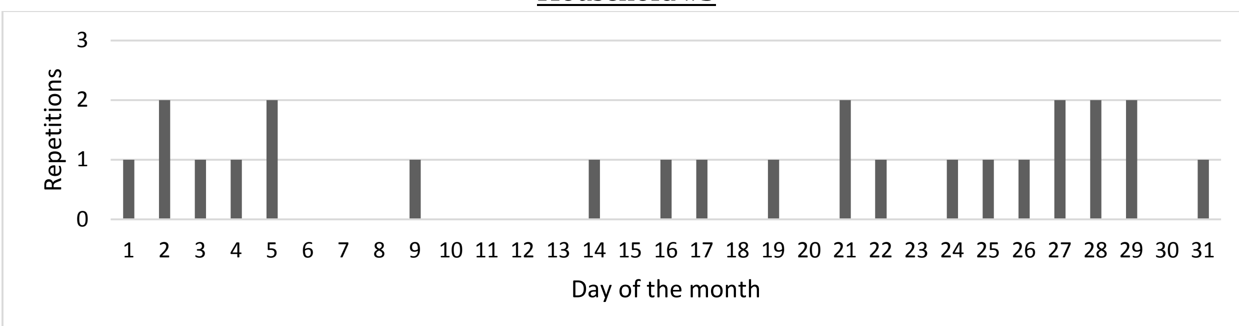
Household #1



Household #2



Household #3



Household #4

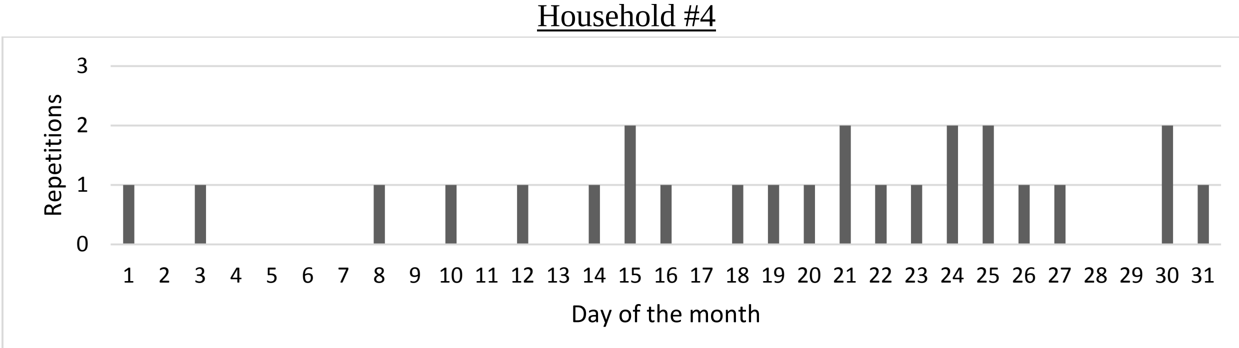


Figure 2: The distribution of bimonthly billing amounts (NIS) in the treated and control groups

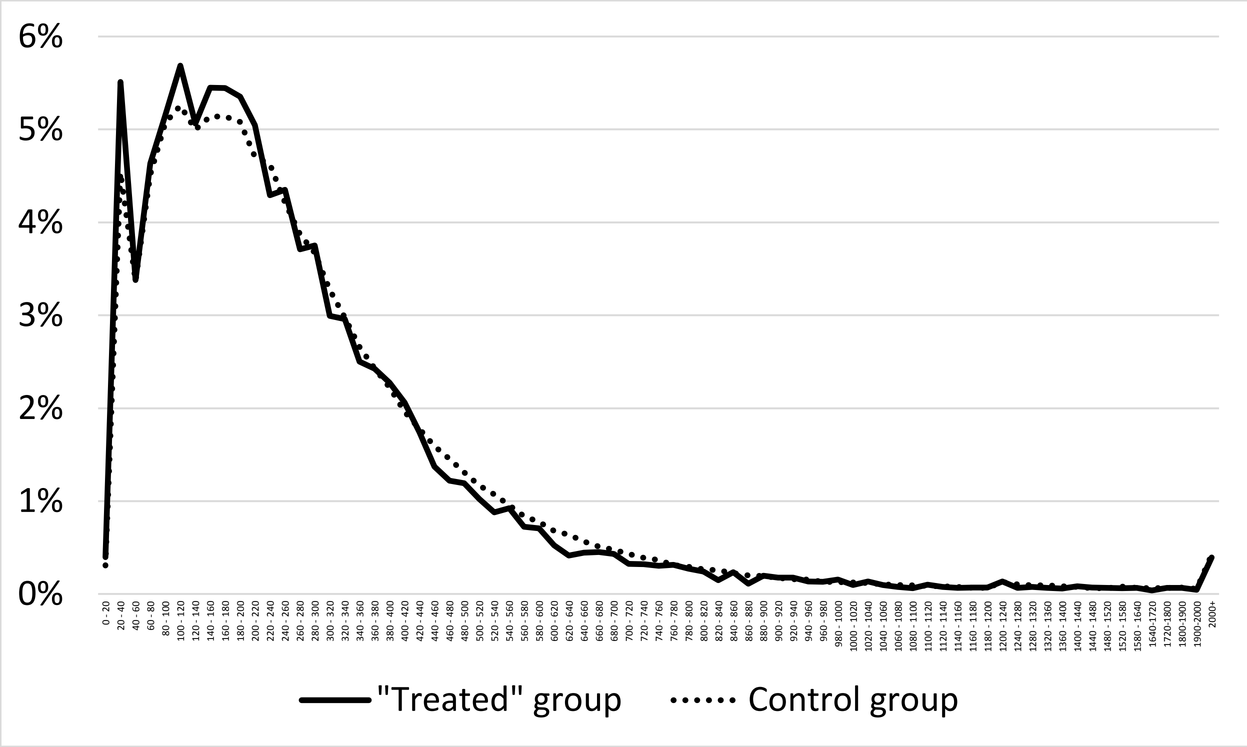


Figure 3a: The actual probability of paying on time by the time gap between payday and due date [relative to paydays fall a day after due dates (i.e., day 1 in graph)]
Recipients of income support

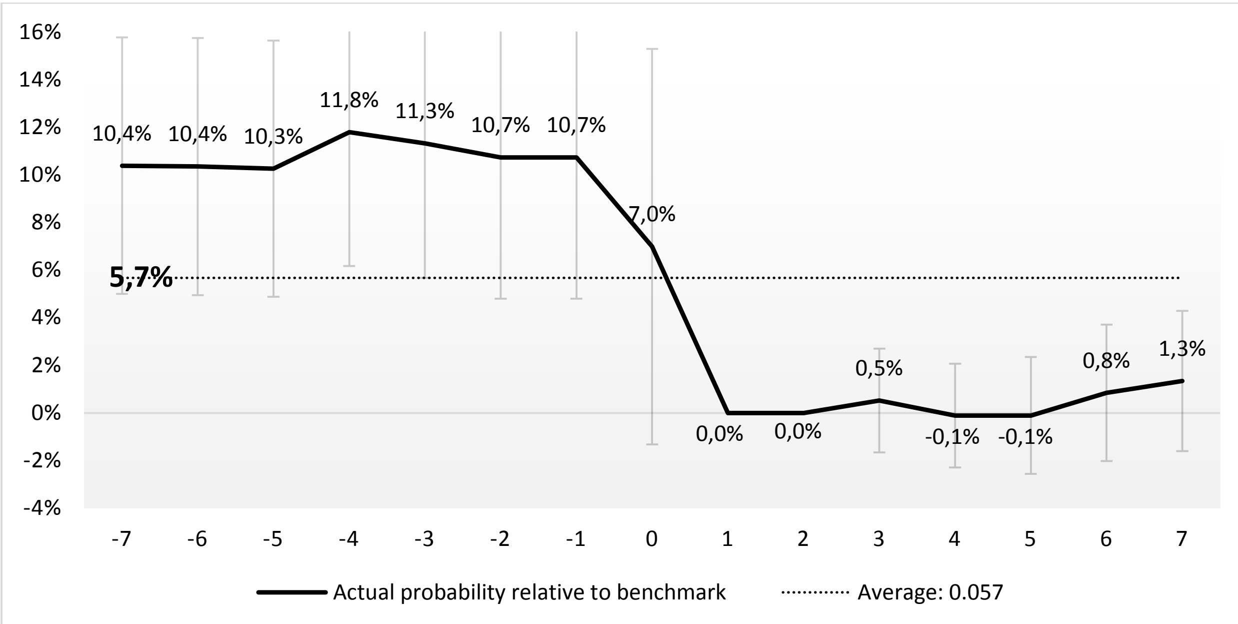
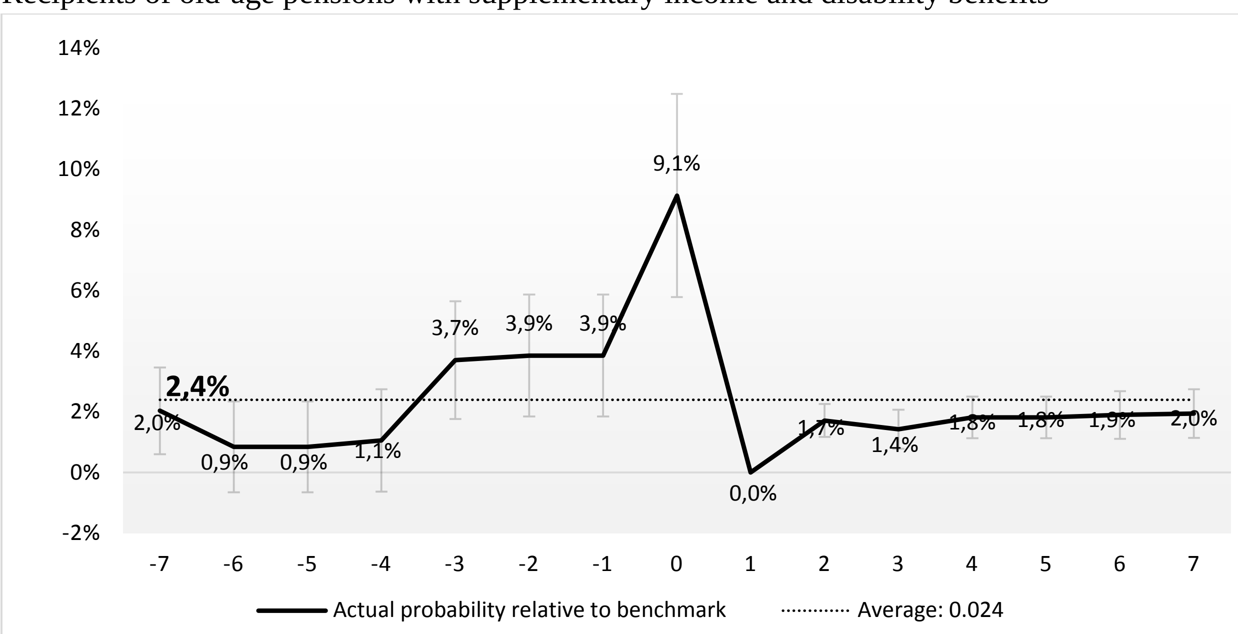


Figure 3b: The actual probability of paying on time by the time gap between payday and due date [relative to paydays fall a day after due dates (i.e., day 1 in graph)]
Recipients of old-age pensions with supplementary income and disability benefits



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