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Daily Collectors, Public Good Provision and Private Consumption: Theory and Evidence from Urban Benin

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Abstract

Daily collectors operate worldwide; they charge a fee in exchange for the collection of their client's deposits. The clients recover their savings after one month. With a *negative* nominal return of -3.3% per month, the service is quite expensive but nonetheless prevalent among the very poor. The economic literature so far emphasizes two motives for making deposits: (i) it is safer than bringing the money home, (ii) people want to commit to save. I argue that in addition to these two motives, people make deposits in order to reduce their contribution to the household's expenses and increase their private consumption. This *intra-household motive* is first modelled and then tested using a unique panel data set collected in Benin.

The panel structure of the data allows me to isolate the effect of the third motive. Additionally, I show that daily collectors enable women to make more gifts to their children and acquaintances, and allow men to reduce those gifts and their participation to household's public goods. There is large positive effect of the deposits on people's purchase of new clothes, and making deposits increases women's expenditures on frivolous goods by 200% to 300%. Finally, the *commitment motive* appears to be an important determinant of men's deposits.

Keywords: Intra-household, deposit collectors, micro-savings, non-cooperative household's members, public good provision, commitment.

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1 Introduction

People who do not have access to formal banking and insurance services resort to informal means of obtaining credit, insuring themselves or accumulating savings. These means are often termed micro-insurance, micro-credit and micro-savings. While the former two are extensively studied by development economists, there is much less analysis of the latter, mainly because of a lack of suitable data. Savings are difficult to measure, as they can take many different forms.

I study a particular micro-saving institution called "daily collectors" (DC).[1] Daily collectors charge a fee in exchange for collecting the savings of their clients. After one month, the clients recover their savings minus the fee, which is equal to one deposit. In other words, the clients earn a *negative* nominal return of -3.3% per month on their savings. As documented by Rutherford et al. (1999) and Rutherford (2000), daily collectors exist in various places of the world and do not always operate in the same manner. In particular, daily collectors may also make loans or only take deposits. I restrict attention to collectors who are not also moneylenders.

The daily collection service is extensively used in Benin. In my sample 36% of people with positive income make deposits. On average, they deposit CFAF 516 (1.03$) per day. This is relatively high: on average a client's daily income is equal to CFAF 1 708, of which he deposits around one third. The population under study is poor, and therefore the prevalent use of the daily collection service raises a number of important questions. In particular, a direct policy recommendation for reducing poverty could be to provide the same service at a lower cost. The design of sound policies however requires a clear understanding of the motives that prompt people to make costly deposits rather than choose other forms of savings.

Daily collectors have been studied by economists in different contexts. They are generally mentioned by researchers in micro-finance (see for instance Besley, 1995; Rutherford, 2000; Collins et al., 2009 and Armendariz and Murdoch, 2010). Aryeetey and Gockel (1991) include daily collectors in their work on capital formation in Ghana and Aryeetey and Udry (1997) and Steel et al. (1997) describe them more generally in Sub-Saharan Africa. However very few researchers have really focused on this institution. Among them, Ashraf et al. (2006a) use a randomized control trial in the Philippines, to investigate the determinants of participation in a deposit collection service and evaluate the impact of offering the service (see also Ashraf, 2009). The service that they offer has however important differences with the daily collectors because it is a costless monthly collection. Being married is one important determinant of take up, which suggests that intra-household issues matter. The physical distance to the bank is the other important determinant of take-up. The authors also find that offering the service of deposit collection increased the level of savings and decreased borrowing.

In the same line, Dupas and Robinson (2011) provide a randomly selected sample of self-employed individuals in rural Kenya with access to an interest-free bank account. One of their main findings is that the daily private expenditures of women in the treatment group became 27% to 40% higher than those of women in the comparison group. One interpretation of the authors is that women in the treatment group might have been better able to shield their income from others.

[1] *Daily collectors* have different names in different countries. For instance, they are usually called *tontinier* in Benin, *susu* in Ghana and *esusu* in Nigeria. They are more generally known as *mobile bankers* in West Africa and *deposit collectors* in India.

An important feature of the the daily collection is that the clients commit to deposit the same fixed amount of cash everyday, for 30 days. If a client does not deposit as planned, he has to pay a fee. Therefore some clients are likely to use the daily collection service as a commitment device.

There is an important literature arguing that individuals level of impatience is lower for future trade-offs than for near-term trade-offs. The first models were developed by Strotz (1955) and Phelps and Pollak (1968). Time-inconsistent choices may be due to hyperbolic preferences, temptations, or dual-self agents (see Ashraf et al., 2006b for a review). This literature is however predominantly theoretical. In fact, Ashraf et al. (2006b) are the first to provide field evidence linking hypothetical time discount questions to the decision to use a commitment device. They use a randomized control methodology to determine the motives behind the take-up of a commitment saving product. They find that women who exhibit time-inconsistent choices, and hence could have a preference for commitment, are more likely to choose the commitment product.

I use identical time discount questions to identify time-inconsistent individuals, and I show that time-inconsistency partly explains the use of the deposit collection.

Apart from the *commitment motive*, people may prefer to make deposits rather than to accumulate their savings at home because of safety considerations; clients could simply be afraid of loosing their savings or being robbed. In contrast with Aryeetey and Gockel (1991) who note that 40.3 % of savers in Ghana had lost their money to run-away deposit collectors, in Cotonou I did not get any reports of such dishonest behavior.

The *safety motive* and the *commitment motive* are already well understood. I introduce a third reason, the *intra-household* motive, to explain the use of deposit collection. I argue that individuals make deposits to increase their private consumption at the expense of their household's public consumption. When someone makes deposits, he decreases the amount of money that he brings home and thereby constrains his contribution to the household's public goods.

The main prediction of the model is a non-monotonic relationship between income share and deposit. In the remaining of the paper, the expression *income share* stands for *an individuals income divided by the total income of his household.* Deposits are expected to increase with one's income share when this share is low and to decrease when it is high. The relationship between deposits and income share is tested using first-hand panel data that I collected with Olivier Dagnelie and Philippe Lemay-Boucher in Cotonou in 2004 and 2006.

Because the *safety* and *commitment motives* are unobserved and very hard to measure, I first assume that risk aversion and the need for commitment did not change between the two periods of observation. I control for individual fixed effects, to correctly identify the effect of the income share on the deposits. The results support the theory, with a strong and significant effect of the regressor of interest.

I then use a proxy that identifies time-inconsistent individuals and show that the *commitment motive* partly determines the deposits.

Finally, I compare the pattern of expenses of the daily collector's clients with non-clients. I show that men who make deposits contribute less to some of the household's public goods (electricity bills and school charges) while women's contribution to school charges also decreases when they make deposits.

I also find that both men and women who make deposits spend much more on personal clothes. When they make deposits, women, but not men, increase their purchase of frivolous goods, such as tobacco, alcohol, or candies, by 200% to 300%. These results are in line with the findings of Dupas and Robinson (2011) mentioned above, but they contrast with the literature on the divergence between women and men's preferences. For instance, Hoddinott and Haddad (1995) show that in Ivory Coast, men spend relatively more than women on goods such as alcohol and cigarettes and less on goods that benefit children or the household as a whole (see also Bruce (1989); Thomas (1990); Browning (2000); Duflo and Udry (2004); Ashraf (2009)). In Cotonou men also spend more then women on frivolous goods, but the data show that women use their deposits to sharply increase their purchase of frivolous goods.

Making deposits could also be a way to protect income against financial claims, both because the deposits cannot be readily redrawn and because they might be concealed and unknown to one's relatives and acquaintances. Therefore, those using the service should effectively transfer less money if they consider the claims as illegitimate. On the other hand, using the daily collector enables the accumulation of a lump sum that can be used for legitimate transfers. I find that men who make deposits give less to their children and parish fellows, while women who make deposits give less to their husbands.

The next section discusses some critical characteristics of the functioning of Beninese households and of access to banking services in Cotonou. In section 3, a simple model of strategic interactions between household members shows how deposits are related to one's income share. The model provides the welfare implications of policies improving access to deposit collection service, which are discussed at the end of the section. A unique panel data set collected in Benin is then used to provide evidence supporting the model, and test some of its predictions. The data are presented in section 4. The econometric estimations are examined in section 5: first the relationship between the deposits and the income share, then the impact of the *commitment motive*, and finally the pattern of consumption of users and non-users. Section 6 concludes.

2 Context

Some essential characteristics of the Beninese households and of the access to banking services in Cotonou drive the modeling effort.

First, as shown by Dagnelie and LeMay-Boucher (2007), Beninese households do not pool their resources. There is no common budget between spouses and the contributions to the household's public goods are made independently by the members. As Falen, an anthropologist who conducted research among the Fon for more than a decade[2], concludes: *"the notion of a married couple's communal property or joint bank accounts is totally foreign to most Fon people.(...) Keeping common finances would be dangerous since money is always scarce and people are generally willing to take, borrow, beg, or in other ways extract money from another"*, and he adds that *"most Fon view descent in patrilinear terms, husbands and wives belong to different families, and have few common kinship loyalties. (...) Having the option of diverting money from a conjugal account for use by one's own family could*

[2] Fon is the most populous ethnic group in Benin.

cause irreparable damage" (*Falen, 2011*, p.103-104). Some anthropologists and economists already documented the disconnection between household member's financial spheres (see for instance Moock (1986); Hoddinott and Haddad (1995); Attanasio and Lechene (2002); Rangel and Thomas (2006) for reviews).[3] Therefore, I assume that the household's members take their decisions independently from one another. They are however assumed to behave strategically: their decisions depend on their partner's decisions and vice-versa.

Second, the only alternative to deposits is to accumulate cash at home. The data come from the outskirts of Cotonou, where people live in high density slums. Accumulating assets such as gold, cattle, or land for example is too risky when not simply impossible. Also, most people cannot use an account in a bank or a micro-finance institution (MFI). The first reason is that the minimum balance required by banks is out of reach for most of the population under study. Houssa and Verpoorten (ming) report that, at the time of the study, it varied from CFAF 100 000 to CFAF 500 000. In the sample only 7% of the people earn more than CFAF 100 000 per month and the average monthly income is around CFAF 40 000. People would thus need to accumulate savings in order to open an account. Moreover, most of them cannot afford to keep hundreds of thousands of CFAF unused on a bank account as they live in poverty and have pressing needs. In addition to the minimum balance requirement, people are reluctant to deposit money with banks due to high transport costs. Helms et al. (2005) estimate weekly costs to be equal to CFAF 5000 for banks and CFAF 150 for MFIs. When taking into account the nominal interest rates on deposits, Helms et al. (2005) conclude that one needs to save CFAF 130 000 in a bank or CFAF 36 000 in a MFI, per month, to cover these costs and choose these institutions rather than a daily collector. Moreover, the attractiveness of the daily collector increases furthermore when the opportunity cost of transportation and queuing are accounted for. Finally, as described by Houssa and Verpoorten (ming), the banking sector in Benin went through a severe crisis and collapsed at the beginning of the nineties. The collapse was partly due to adverse economic conditions and partly to the actions of the Kerekou government. Among other policies, the government nationalized all private banks. The banks then started to make loans with zero interest rate and without collateral to politicians and their supporters (Girardon, 1989). Most of these loans were not reimbursed and the banks were liquidated. Households' incomes were severely hit by the collapse of the banks and people today continue to distrust the banking sector.[4] More recently, in what is called *l'affaire ICC-Services*, a microfinance institution lost the savings of thousands of people while playing a *Ponzi* scheme. The affaire provoked a big scandal as close supporters of the President are allegedly involved, and it undermined further that trust that people had in formal saving institutions (for a brief account of the affair, see Nossiter, 2010).

Rotating savings and credit associations (ROSCA), which are very common in Cotonou (Dagnelie and LeMay, 2008), could be another alternative to daily collectors. Participation to a ROSCA does not require the payment of any direct cost. ROSCA members meet regularly and they bring a pre-defined amount of cash money in each meeting. One of the member is then given the total amount collected, called the pot. The main indirect costs are the cost of attending the meetings, the imposed saving

[3] See also Dercon and Krishnan (2000), Duflo and Udry (2004) and Munro et al. (2006), who cast doubt on the unitary model as a relevant representation of household's functioning.

[4] Mathieu Kerekou only left power in 2006

rate that potentially differs from one's optimal level of saving, and the risk that the ROSCA collapses before each member gets the pot.[5] In Cotonou, ROSCAs generally meet every two weeks or every month. Therefore, people still need to accumulate money either at home or through the daily collector if they want to participate in a ROSCA. ROSCAs are used to pool bigger amounts of money, and not to avoid bringing daily incomes home. They also involve a lot of people and it takes several months or even years before all members get the pot.

One might wonder why people do not join daily ROSCAs that would replicate the service offered by daily collectors. For an equal deposit, setting up a ROSCA would however require that at least 30 people meet everyday. Even if one can find 29 other persons who are willing to meet everyday, the cost in time and organization is simply too high.

Finally, Anderson and Baland (2002) investigate individual motives to participate in ROSCAs in Nairobi. Using a Nash bargaining model, they argue that the wives participate in ROSCAs to protect their savings against claims by their husband for immediate consumption. Their argument is close to the *intra-household motive* that I investigate, but is nevertheless very different because they do not allow for strategic interactions between spouses; only the wife has the possibility to join ROSCAs in order to influence the final household's consumption. Their main results would be affected if the husband were also allowed to join a ROSCA or to divert money from the household in reaction to his wife's strategy.

In the context of Cotonou, restricting the set of strategies available to players, as done in Anderson and Baland (2002), would be too strong an assumption. Besides, my main result arises precisely from the strategic interaction that is at play between household's members. When an individual decides how much to deposit, he must take into account how much the other deposits since it affects the money that is available for the household's consumption.

3 The model

The model is written in such a way as to capture the essential characteristic of daily collection: using the service actually amounts to paying someone to be able to bring less money home. The model depicts a world where people have no access to banks to store their revenues. In order to consume a private good, they have to bring some money home or make deposits to the daily collector. I assume that there is no credit market.

There are two agents, a and b, who live for T periods. In each period $t \in T$, agent $i = \{a; b\}$ receives an income w^i. The idea behind the model is that the agents have to choose between their private consumption and how much they contribute to a public good, g. If they can purchase the private goods that they want as soon as they receive their incomes, the agents have no reason to make any deposit. In reality, when they make deposits, they save each day a part of their income and accumulate these savings until the end of the month. These savings allow them to purchase indivisible goods, or simply to delay their expenditures to a more appropriate day, such as the market day. I do not model explicitly the various reasons that push people to save. I am not trying to explain savings

[5] References about ROSCAs include Besley et al. (1993); Bouman (1995); Handa and Kirton (1999); Anderson and Baland (2002); Basu (2008); Anderson et al. (2009). About Benin, see Dagnelie and LeMay (2008) and Dagnelie (2008).

per se, but rather the choice of paying a daily collector rather than simply keeping the money at home. To this end, it is convenient to assume that the agents utilities depend on their total savings, s, and their total consumption of the public good, g. This assumption also allows me to abstract away from considerations of inter-temporal consumption. The utility is given by:

$$U^i = u\left(\sum_{t=1}^{T} g_t; \sum_{t=1}^{T} s_t^i\right)$$

where $g_t = g_t^a + g_t^b$ (g_t^i is i's contribution to the public good in period t) and s_t^i is i's savings in t. The utility is assumed to increase with the public good consumption and with the savings and the marginal utility is non-increasing.

I assume that the agents do not cooperate. They take their decisions simultaneously and independently from one another. But they behave strategically and take into account the other agent's strategies when they choose their own. Both agents have the possibility to make deposits to the collector. The cost of deposits is represented by $k \in \left]\frac{1}{2}; 1\right[$: if an agent deposits d^i, he recovers $k\sum_{t=1}^{T} d_t^i$.[6] In the first period agent i chooses the amount that he will deposit in each period, d^i.

The precise steps of the game are as follows:

1. In the first period, the agents receive their incomes, w^i, and simultaneously and independently choose the level of deposits that they make to the collector $d^i \in \left[0; w^i\right]$.

2. Each agent brings $w^i - d^i$ at home and chooses the level of his contribution, g^i to the public good.

3. In all subsequent periods the agents keep on depositing the same amount and bringing the rest at home where they choose their contribution to the public good.

4. At the end of the last period, the agents recover part of their deposits: $k\sum_{t=1}^{T} d_t^i$.

For simplicity I use the following specific utility functions:

$$U^i = \ln\sum_{t=1}^{T} g_t + \ln\sum_{t=1}^{T} s_t^i \tag{1}$$

The solution concept used is the standard Nash equilibrium in pure strategies. The game is solved by backward induction.

3.1 Step 2: the contributions to the public good

Due to the absence of a credit market, in each period, agent i has to respect the following budget constraint:

$$g^i \leq w^i - d^i$$

[6] The assumption that $k > 1/2$ is convenient because it simplifies the discussion without loosing any relevant insights. It can be shown that when $k \leq 1/2$ the players never make deposits.

He thus saves $w^i - d^i - g^i$ from the money that he brought home. In addition, he recovers $k\sum_{t=1}^{T} d_t^i$ from the daily collector in the last period. His total savings, $\sum_{t=1}^{T} s_t^i$, are thus equal to $k\sum_{t=1}^{T} d^i + \sum_{t=1}^{T} w^i - d^i - g^i = T\left(kd^i + w^i - d^i - g^i\right)$. And the total level of public good is given by $\sum_{t=1}^{T}\left(g_t^a + g_t^b\right) = T\left(g_t^a + g_t^b\right)$.

The utility functions become $U^i = \ln T(g^i + g^i) + \ln T(w^i - (1-k)d^i - g^i)$ which is equivalent to $U^i = \ln(g^i + g^i) + \ln(w^i - (1-k)d^i - g^i) + 2\ln T$.

The agents choose the contribution to the public good that maximizes their own utility, given the other agent's contribution, under the constraint that $g^i \in \left[0; w^i - d^i\right]$.

The first order conditions lead to the following best response functions:

$$g^a = \begin{cases} 0 & \text{if} \quad g^b > A \\ w^a - d^a & \text{if} \quad g^b < 2kd^a - A \\ \frac{A - g^b}{2} & \text{otherwise} \end{cases} \tag{2}$$

$$g^b = \begin{cases} 0 & \text{if} \quad g^a > B \\ w^b - d^b & \text{if} \quad g^a < 2kd^b - B \\ \frac{B - g^a}{2} & \text{otherwise} \end{cases} \tag{3}$$

Where $A = w^a - (1-k)d^a$ and $B = w^b - (1-k)d^b$.

An important characteristic of the system formed by the best response functions, is that the solution depends on the relative incomes of the players. For more clarity, the functions are drawn in Figure 1, when there are no deposits. R^i indicates i's best response functions and NE, the Nash Equilibrium.

$IS^a < 1/3$	$IS^a \in [1/3; 2/3]$	$IS^a > 2/3$

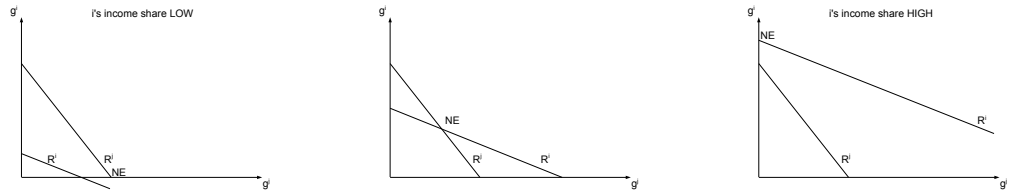


Fig. 1: The best response functions ($IS^a = \frac{w^a}{w^a + w^b}; d^a = d^b = 0$)

When there are no deposits, in equilibrium a does not contribute to the public good if his income is lower than one-third of b's income. If his income is higher than two-thirds of b's income, a is the only contributor. Otherwise, both agents pay for the public good.

It is immediate from equations (4) and (5) that deposits have two types of effects on the players best response functions. For instance, a one unit increase of d^a decreases A by $(1-k)$. A enters directly the best response function and the curves shifts downwards by $(1-k)/2$. But because deposits determine the income that is available in step 2, they also constrain the best response function: the

maximum that can be spent on g^a decreases ($w^a - d^a$ decreases) and it becomes more likely that $g^b > A$ and hence that $g^a = 0$.

Both, direct and indirect effects go in the same direction: in step 1 the agents may make deposits in order to decrease their own contribution to the public good and push their partner to increase his own contribution.

3.2 Step 1: the equilibrium deposits

To structure the discussion I use the two following Lemmas. Both Lemmas are proven in the Appendix.

First, an agent makes positive deposits only if they drive his contribution to the public good down to zero or if they make his contribution just equal to the money that he brings home.

Lemma 1. $\forall\ i = \{a; b\}$*: agent* i *makes positive deposits only if his deposits are such that* $g^i = 0$ *or* $g^i = w^i - d^i$.

Lemma 1 clarifies that making deposits to increase one's private consumption is a useful strategy only if it effectively constrains one's contribution to the public good in Step 2. If in Step 2, agent i is willing to contribute less than his available income permits, $w^i - d^i$, then his deposits do not influence his contribution and their only effect is to reduce his private consumption (since depositing money with the collector is costly). In other words, deposits make sense only if in Step 2, they are such that the agent would prefer to choose a contribution higher than his available income. In this case, the other agent, j, knows that i's contribution will be low and by anticipation j does not make deposits in order to be able to compensate i's low contribution in Step 2. This strategic reaction of the other agent is formally established in Lemma 2, when the first agent does not contribute in Step 2.

Lemma 2 states that if one of the agents equilibrium contribution in Step 2 is zero, then the other agent does not make any deposit in Step 1.

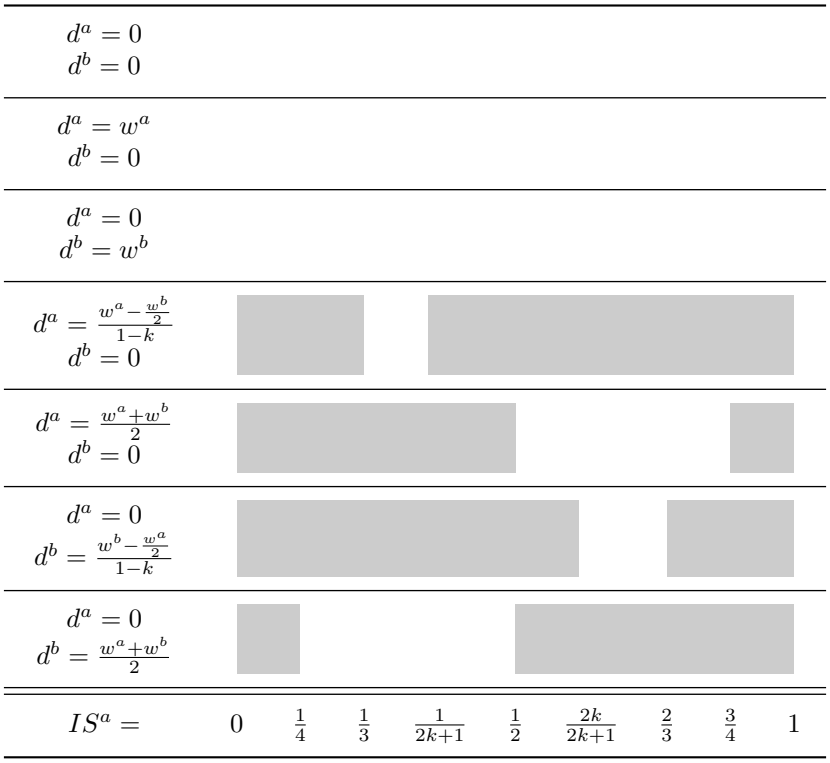
Lemma 2. $\forall\ i = \{a; b\}$*:* $g^i = 0$ *implies* $d^j = 0$ *and* $g^j = x^j = \frac{w^j}{2}$.

Lemma 1 and Lemma 2 imply that in step 1, only the following 8 strategies could be Nash equilibrium strategies. These 8 strategies are called the "candidates":

1. $d^a = 0$ and $d^b = 0$.
2. $d^a = w^a$ and $d^b = 0$.
3. $d^a \in]0; w^a[$, d^a is such that $g^a = 0$ and $d^b = 0$.
4. $d^a \in]0; w^a[$, d^a is such that $g^a = w^a - d^a$ and $d^b = 0$.
5. $d^a \in]0; w^a[$, $d^b \in \left]0; w^b\right[$, d^a is such that $g^a = w^a - d^a$ and d^b is such that $g^b = w^b - d^b$.
6. $d^b = w^b$ and $d^a = 0$.
7. $d^b \in \left]0; w^b\right[$, d^b is such that $g^b = 0$ and $d^a = 0$.
8. $d^b \in \left]0; w^b\right[$, d^b is such that $g^b = w^b - d^b$ and $d^a = 0$.

To determine the Nash equilibrium strategies, I first derive the conditions under which each candidate exists, and thereafter compute the agents utilities corresponding to each candidate. I then compare the candidates in order to determine which ones are Nash equilibria, and under which conditions. This discussion is carried out in the Appendix.

The results of the discussion are summarized in Table 1. A gray zone indicates that a strategy is not feasible given the values of a's income share ($IS^a = \frac{w^a}{w^a+w^b}$). The table should be read as follows: the strategy $d^a = 0$ and $d^b = 0$ is always possible (no gray zone), the strategy $d^a = \frac{w^a - \frac{w^b}{2}}{1-k}$ and $d^b = 0$ is possible only if $IS^a \in \left[\frac{1}{3}; \frac{1}{2k+1}\right]$, etc.



Tab. 1: Existence of the Candidates

The discussion carried out in the Appendix reveals some specific existence conditions given by Equations 14, 17, 22 and 25.

If $IS^a \leq \frac{1}{3}$, a's income is so low compared with b's income that a's contribution is zero even if $d^a = 0$. If $IS^a \geq \frac{1}{2k+1}$, then a's income is so high compared with b's income that a would need to deposit his whole income in order to have a zero contribution in Step 2.

Finally, if $IS^a < \frac{1}{2}$, a cannot choose d^a such that $g^a = w^a - d^a$, because he would have to deposit more than his income. When $IS^a \geq \frac{3}{4}$, if a sets d^a such that $g^a = w^a - d^a$, then b optimally chooses a zero contribution. By Lemma 2, if b's contribution is zero, a's deposits must equal zero. Therefore, when $IS^a \geq \frac{3}{4}$, in equilibrium d^a cannot be such that $g^a = w^a - d^a$.

The discussion of Equations 22 and 25 is identical by symmetry.

In order to determine which of the seven remaining candidates are actual Nash equilibria of the game, I compare the agents utilities in each cases. By doing so, I can check for each candidate under which conditions one of the agents will have an incentive to deviate and choose another strategy. This exercise is carried out in the Appendix. Proposition 1 below summarizes the results of the discussion.

Proposition 1. *There exists $\underline{k}$ such that the only Nash equilibrium of the game is $d^a = 0$ and $d^b = 0$ when $k \leq \underline{k}$ (in the specific case of the log utility functions, $\underline{k} = 8/9$). When $k > \underline{k}$, the Nash equilibria are:*

(i) $IS^a < 1/3$ or $IS^a > 2/3$: $d^a = 0$ and $d^b = 0$

(ii) $IS^a \in \left[\frac{1}{3}; \frac{1-\sqrt{1-\frac{8}{9k}}}{2}\right]$: $d^a = 0$ and $d^b = \frac{w^a+w^b}{2}$

(iii) $IS^a \in \left[\frac{1-\sqrt{1-\frac{8}{9k}}}{2}; \frac{1}{2}\right]$, there are two Nash equilibria: $d^a = 0$ and $d^b = \frac{w^a+w^b}{2}$, and $d^a = w^a$ and $d^b = 0$

(iv) $IS^a \in \left[\frac{1}{2}; \frac{1+\sqrt{1-\frac{8}{9k}}}{2}\right]$, there are two Nash equilibria: $d^a = 0$ and $d^b = w^b$, and $d^a = \frac{w^a+w^b}{2}$ and $d^b = 0$

(v) $IS^a \in \left[\frac{1+\sqrt{1-\frac{8}{9k}}}{2}; \frac{2}{3}\right]$: $d^a = \frac{w^a+w^b}{2}$ and $d^b = 0$

When $k > \underline{k}$, the equilibrium strategies are represented in Table 2 for different values of a's income share, IS^a. The table should be read as follows: when $IS^a \in [0; 1/3]$, the Nash equilibrium is $d^a = 0$ and $d^b = 0$, when $IS^a \in \left[\frac{1-\sqrt{1-\frac{8}{9k}}}{2}; 1/2\right]$, the two Nash equilibria are (i) $d^a = 0$ and $d^b = \frac{w}{2}$ and (ii) $d^a = w^a$ and $d^b = 0$, etc.

$k > \underline{k}$						
$IS^a =$	0	$\frac{1}{3}$	$\frac{1-\sqrt{1-\frac{8}{9k}}}{2}$	$\frac{1}{2}$	$\frac{1+\sqrt{1-\frac{8}{9k}}}{2}$	$\frac{2}{3}$	1
	$d^a = 0$	$d^a = 0$	$d^a = 0$	$d^a = 0$	$d^a = \frac{w}{2}$	$d^a = 0$	
	$d^b = 0$	$d^b = \frac{w}{2}$	$d^b = \frac{w}{2}$	$d^b = w^b$	$d^b = 0$	$d^b = 0$	
			$d^a = w^a$	$d^a = \frac{w}{2}$			
			$d^b = 0$	$d^b = 0$			

Tab. 2: Equilibrium deposits ($w = w^a + w^b$)

The basic intuition underlying Proposition 1 is that when a's income share, IS^a, is low, then a does not need to make deposits, his equilibrium contribution is anyway equal to zero. Simultaneously, if IS^a is sufficiently low, b's income share is so high that b needs to deposit his whole income if he

wants to constraint and reduce his equilibrium contribution. But because the total cost of the deposits increases with the deposits, when b's income is so high b finds it too costly to deposit his income. Therefore, the agents do not make deposits when IS^a is sufficiently low. The situation is perfectly symmetric when IS^a is high: again there are no deposits. Hence, an agent may make deposits only when his income share takes on intermediary values.

A direct implication of Proposition 1 is that in equilibrium at most one agent makes deposits. As shown in the discussion, when an agent makes deposits, his contribution becomes so low that the other agent chooses not to make deposits in order to compensate his partner's low contribution to the public good.

We can now turn to the welfare consequences of the model.

3.3 Welfare

The welfare implications of the game follow directly from its resolution. They are summarized in Proposition 2 (the proof is in the appendix), where the welfare is simply defined as the sum of the agents utilities.

Proposition 2. *$\forall i = \{a, b\}$ and $j \neq i$, compared with the situation where deposits are not possible, allowing for the existence of deposits has the following impact: (i) when an agent makes deposits, his utility increases and the other agent's utility decreases ; the total welfare (ii) increases when the equilibrium of the game is $d^i = w^i$ and $d^j = 0$, (iii) decreases when the equilibrium is $d^i = \frac{w^i + w^j}{2}$ and $d^j = 0$, (iv) remains unaffected when the equilibrium is $d^i = 0$ and $d^j = 0$.*

Proposition 2 informs us that the existence of the daily collection service has an ambiguous impact on total welfare. To know whether it would be beneficial for the agents that the State, or other economic actor such as non-governmental organizations, provide an equivalent service at a lower cost, the impact of an increase of k on total welfare must be determined.

It follows from the analysis made so far that an increase in k could have a positive or negative effect on the agent's utilities. If the agents did not make any deposit before k increases, and one of them makes deposits after, Proposition 2 tells us that the user's utility increases, the non user's utility decreases and the total welfare could increase or decrease. If one of the agents already made deposits before k increases, his utility increases. The effects on the other agent's utility and on total welfare are ambiguous.

If people make deposits only because it is safer, or to commit themselves to save, reducing the cost of the service can only increase the people's welfare. On the other hand, if the *intra-household motive* plays a part, the loss incurred by the non-users may not be compensated by the gain of the users. The policy recommendations may then be reversed. I return to the policy implications of the paper in the conclusion.

4 The Data

The data were collected in 2004 and 2006, in three districts (Vossa, Enagnon, Enagnon-plage) of Cotonou's outskirts. Households were randomly selected and all members were interviewed. Men and

women were always interviewed separately by an enumerator of the same gender: 1179 people older than 16 were interviewed in 2004 and 873 in 2006 (717 in both years). Information about their jobs, earnings, belongings, expenses, financial transfers, education, religion, etc. was gathered, as well as detailed data about the ROSCAs, informal insurance groups and the use of the daily collectors.

The variables that are used in the analysis are standard and do not require any specific explanation. Only the "self-commitment" variable is not trivial. This is a dummy variable that is equal to one when an individual is identified as having a preference for commitment. To measure this variable, we have raised hypothetical time discount questions (see Sub-section 5.2 for methodological explanations).

Basic descriptive statistics are presented in Table 3. We see that 31% of sample individuals are clients of a daily collector (36% if the sample is restricted to the individuals who actually earn an income). Most of these clients are women, working in a market. This is not very surprising since collectors are mainly active in markets and most people working in the markets are women. There is also a larger proportion of people living in a couple, both monogamist and polygamist, among the clients. Clients are on average richer than non-clients, and they come from poorer households.

These first statistics also come into line with Proposition 1: 57% of the clients have an income that represents between 25% and 75% of their total household income, while only 33% of the non-clients do. As predicted by Proposition 1, the non-clients rather have a low income share.[7] The fact that some clients have high income shares does not contradict the theory: one should control for different variables. For instance, richer people have higher income shares and are more likely to make deposits. Therefore the econometric analysis is required to properly test the main prediction of the model.

Finally, there are more men identified as *time-inconsistent* among clients than non-clients. This is however not true for women.

[7] Note that most of the individuals whose income share equals 100% are living alone and should not be affected by the *intra-household motive*.

	All sample	D.C. clients	Non-clients	
Number of observations	2052	644	1408	
Women	52%	72%	42%	***
Man's monthly income (if >0) (CFAF)	63 000	64 303	59 620	
Woman's monthly income (if >0) (CFAF)	43 000	47 657	32 983	***
Household monthly income (CFAF)	121 000	112 000	127 000	**
Income share $< 25\%$	39%	15%	49%	***
Income share $\in [25\%; 50\%[$	22%	32%	18%	***
Income share $\in [50\%; 75\%[$	18%	25%	15%	***
Income share $\in [75\%; 100\%[$	6%	8%	5%	***
Income share $= 100\%$	15%	20%	13%	***
Time inconsistent women	15%	15%	15%	
Time inconsistent men	20%	27%	19%	*
Literacy rate	51%	34%	59%	***
Age	34	37	33	***
Household size	5. 2	4.8	5.3	***
Living in a monogamous couple	38%	47%	34%	***
Living in a polygamous couple	11%	15%	9%	***
Household size	5.2	4.8	5.3	***
Works in a market	37%	66%	23%	***
Works as taxi-motorbike	2.2%	3.3%	1.7%	**
Has a bank account	10.4%	8%	11.6%	***
Participates in a ROSCA	16.6%	21%	15%	***

, ** and * indicates that the difference in means between clients and non-clients is significant at 10%, 5% and 1%.*

Tab. 3: Descriptive statistics

Table 4 presents additional information about the importance of the deposits. The sample is restricted to the people who make deposits. Deposits are relatively high, since on average the clients deposit 36% of their income with a daily collector. Moreover, half of the clients deposit more than one-fourth of their income.

mean	s.d.	25%	median	75%	95%	mean deposit/income
15 317	21 258	6 000	9 000	15 000	45 000	36%

Tab. 4: Information on deposits (CFAF)

Deposits compose a rather large share of people's incomes, but they are small amounts in absolute values: the median of CFAF 9 000 corresponds to € 13.72.

It can be added that 21% of the people who did not use the services of a daily collector in 2004 were making deposits in 2006, while 45% of the people who did use a daily collector in 2004 were not resorting to it anymore in 2006. This variation is large and will be exploited in the econometric analysis.

5 Empirical results

5.1 Deposits and relative income

The model predicts a specific, non-monotonic, relationship between the ratio of an individual's income to the total household's income, and his deposits. Deposits are expected to increase with the income share when this share is low and to decrease when it is high. There are however other factors that are expected to influence people's deposits.

Deposits shall depend on the individual's level of income and his household income independently from his income share. Given that the variable of interest is the individual income divided by his household income, I cannot control for both the household and the individual's income in addition to the income share. In the following tables, I control for the total household income. The regressions with the individual's income instead of the household's income give similar results.

The daily collectors have offices, where people can go to make deposits, and they also operate in the markets where they go from client to client in order to collect the deposits. People working in the markets have thus a better access to the service. The taxi-moto drivers, who ride around the city all day long also have a better access because they can easily stop by a daily collector's office. Hence the inclusion of two dummy variables indicating whether the individual works on the market or is a taxi-moto driver.

I include binary variables that indicate whether the individual owns a bank account or is a member of a ROSCA, since those individuals have a possible alternative to the daily collector.

I also control for the size and the composition of the household. All regressions include controls for the time of the survey (2004 or 2006) and for the neighborhood of the individual (Vossa, Enagnon and Enagnon plage).

There exist different ways of testing the non-monotonic relationship between deposits and income share. Here are displayed estimations that include the income share and the income share squared. I obtain similar results with regressions that allow the effect of income shares to change with their level or with semi-parametric regressions (see appendix B for the results of Robinson (1988) semi-parametric estimation).

Given that the dependent variable, the deposits, is censored at zero and that nearly 70% of the observations are zeroes, I use a Tobit estimator.[8] As is often the case with expenditures data, the residuals are not normally distributed when the level of the expenditures is used. Because the non-normality of the residuals causes a bias of the Tobit estimates, I follow Cameron and Trivedi (2009) by using the logarithm of the positive expenditures and then setting the truncation point to zero. Given the panel dimension of the data, standard errors are clustered at the individual's level. I first apply the Tobit model to the pooled data. The results are displayed in Table 5. In the first three columns, the whole sample is used. Columns 4 to 6 give the results for the sub-sample of women and columns 7 to 9 for the sub-sample of men.

As expected from the theory, the relationship between the deposits and income share is first increasing and then decreasing. In the "All sample" and "Women" regressions, the impact of the income share becomes negative when the income share exceeds around 68%. For men, this reversal happens after 73%. The impact of the income share is quantitatively very high. According to the regression "All sample (3)", everything else being equal, when the income share increases from 20% to 30%, the deposits increase by 75%. The impact goes down to 6.5% when the income share increases from 60% to 70%. Deposits decrease by 28% when the income share goes from 80% to 90%.

All other effects are as expected, women, people working in the markets or as taxi-moto and people coming from bigger families make more deposits, while bank account holders make less deposits.

The estimations presented in Table 5 are vulnerable to the following endogeneity problem: since individuals who are versed in financial matters would better manage their income, their savings and their business, such unobserved ability would simultaneously affect the income of the individuals and the use of a daily collector. In this case, the positive effect of the income share would be over-estimated and its negative effect under-estimated. There is no reason, however, to believe that this ability would have changed between the two observed periods and therefore controlling for individual fixed effects eliminates the problem.

Another possibility is that clients use their deposits to invest in their business. In this case, using the service would have a positive impact on income. This is not plausible though: the savings recovered are small (23€ on average, and below 44€ in 95% of the cases) and insufficient to purchase the capital goods that would increase labor productivity. For example, there are many fishermen in the sample. To increase their productivity significantly, fishermen need to rent bigger and quicker boats or larger nets, things that are considerably more expensive than what they can save from a month income. Moreover, I know from the surveys that only 5% of the clients deposit the money recovered each month on their bank account or in a ROSCA. The remaining 95% spend it immediately on consumption goods. Also, during the last six months before they were interviewed, the collector's clients have made professional investments worth CFAF 918 on average, while the non-clients have spent CFAF 1292 on average. The difference is not statistically different from zero (Wald test), which indicates that the clients do not invest more in their business then the non-clients.

[8] The increasing-decreasing relationship between the income share and the deposits is very robust to the model specification, it remains intact for instance if I use OLS estimators and standard panel Fixed Effects estimators.

	All I b (s.e.)	All II b (s.e.)	All III b (s.e.)	Women I b (s.e.)	Women II b (s.e.)	Women III b (s.e.)	Men I b (s.e.)	Men II b (s.e.)	Men III b (s.e.)
Household's earnings	0.001	0.001*	0.001	0.004***	0.003***	0.003***	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Income share	12.897***	11.694***	11.808***	13.491***	10.331***	10.529***	14.981***	15.126***	15.160***
	(0.777)	(0.899)	(0.903)	(0.857)	(1.068)	(1.072)	(1.850)	(1.923)	(1.927)
Income share squared	-9.559***	-8.652***	-8.580***	-9.941***	-7.697***	-7.712***	-10.277***	-10.390***	-10.324***
	(0.751)	(0.784)	(0.777)	(0.772)	(0.882)	(0.874)	(1.727)	(1.731)	(1.737)
Woman		1.230***	1.212***		.	.		.	.
		(0.209)	(0.209)		.	.		.	.
Working in a market		1.310***	1.306***		1.488***	1.451***		0.679	0.695
		(0.202)	(0.201)		(0.237)	(0.233)		(0.528)	(0.537)
Taxi (moto)		1.630***	1.645***		.	.		1.658***	1.664***
		(0.463)	(0.468)		.	.		(0.591)	(0.594)
Bank account holder		-0.701**	-0.696**		-0.268	-0.271		-1.295**	-1.290**
		(0.285)	(0.284)		(0.375)	(0.373)		(0.507)	(0.505)
Member of a ROSCA		-0.193	-0.224		-0.259	-0.293		-0.258	-0.270
		(0.192)	(0.191)		(0.211)	(0.211)		(0.403)	(0.401)
Household size			0.065**			0.082**			0.025
			(0.032)			(0.035)			(0.080)
Constant	-4.048***	-5.018***	-5.353***	-3.167***	-3.470***	-3.859***	-7.155***	-7.122***	-7.266***
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mcfadden R^2	0.075	0.132	0.133	0.105	0.125	0.128	0.081	0.093	0.093
Sample size	2052	2052	2052	1064	1064	1064	988	988	988

Standard errors clustered at the individual level
**** significant at 1%, ** significant at 5%, * significant at 10%*

Tab. 5: Pooled data: Tobit estimations of log(deposits)

The fixed effects regressions should also clear the other motives for making deposits - *self-commitment* and *safety*- under the assumption that the individual's aversion to risk and his preference for commitment did not change between the two periods of observation.

Because it is not possible to consistently estimate a standard Tobit model with individual fixed effects, I use the Trimmed LAD (Tlad) estimates as described by Honoré (1992).

In Table 6, the fixed effects estimations confirm the results. Compared with the previous Tobit model, the differences between men and women virtually disappear. The reversal points for the whole sample, for women and for men are now all close to 68%. As can be seen in Figure 2, the marginal effects change and the effect of income share is lower in absolute value. According to the fixed effects regression "All sample (3)", deposits increase by 37% when the income share increases from 20% to 30%. They increase by 2% when the income share increases from 60% to 70%, and they decrease by 16% when the income share goes from 80% to 90%.

The effects of all other variables have vanished and some coefficients change a lot: the effect of the household size becomes stronger, the coefficient of working in a market decreases, having a bank account also has lower effects but the effect of belonging to a ROSCA increases. Even though these changes can be attributed to some individuals unobserved characteristics, part of the low statistical significance of the coefficients can be explained by the dramatic loss in the degrees of freedoms and the lack of within-individual variations when controlling for individuals fixed effects (see the increase in the standard errors of taxi-moto for instance).

	All sample I b (s.e.)	All sample II b (s.e.)	All sample I b (s.e.)	Women I b (s.e.)	Women II b (s.e.)	Women III b (s.e.)	Men I b (s.e.)	Men II b (s.e.)	Men III b (s.e.)
Household's earnings	-0.001	-0.000	0.000	0.001	0.001	0.001	-0.004	-0.005*	-0.005*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Income share	6.450***	6.089***	5.953***	5.597***	4.974***	4.969***	9.298***	9.779***	9.353***
	(1.196)	(1.374)	(1.371)	(1.354)	(1.530)	(1.573)	(2.521)	(3.325)	(2.775)
Income share squared	-4.977***	-4.696***	-4.391***	-4.203***	-3.827***	-3.618***	-7.144***	-7.197**	-6.770***
	(1.032)	(1.135)	(1.141)	(1.103)	(1.202)	(1.248)	(2.299)	(2.953)	(2.547)
Working in a market		0.371	0.428		0.588*	0.645**		-0.691	-0.663
		(0.360)	(0.354)		(0.333)	(0.308)		(0.847)	(0.840)
Taxi (moto)		1.678*	1.596		.	.		1.680	1.634
		(0.964)	(0.996)		.	.		(1.077)	(1.103)
Bank account holder		-0.323	-0.333		-0.056	-0.012		-0.624	-0.623
		(0.389)	(0.377)		(0.569)	(0.506)		(0.480)	(0.490)
Member of a ROSCA		0.024	0.030		-0.159	-0.135		0.673	0.665
		(0.239)	(0.241)		(0.275)	(0.290)		(0.461)	(0.463)
Household size			0.122*			0.154**			0.085
			(0.070)			(0.078)			(0.131)
Sample size	2052.000	2052.000	2052.000	1064.000	1064.000	1064.000	988.000	988.000	988.000

**** significant at 1%, ** significant at 5%, * significant at 10%*

Tab. 6: Panel: Tlad - fixed effects estimation of log(deposits)

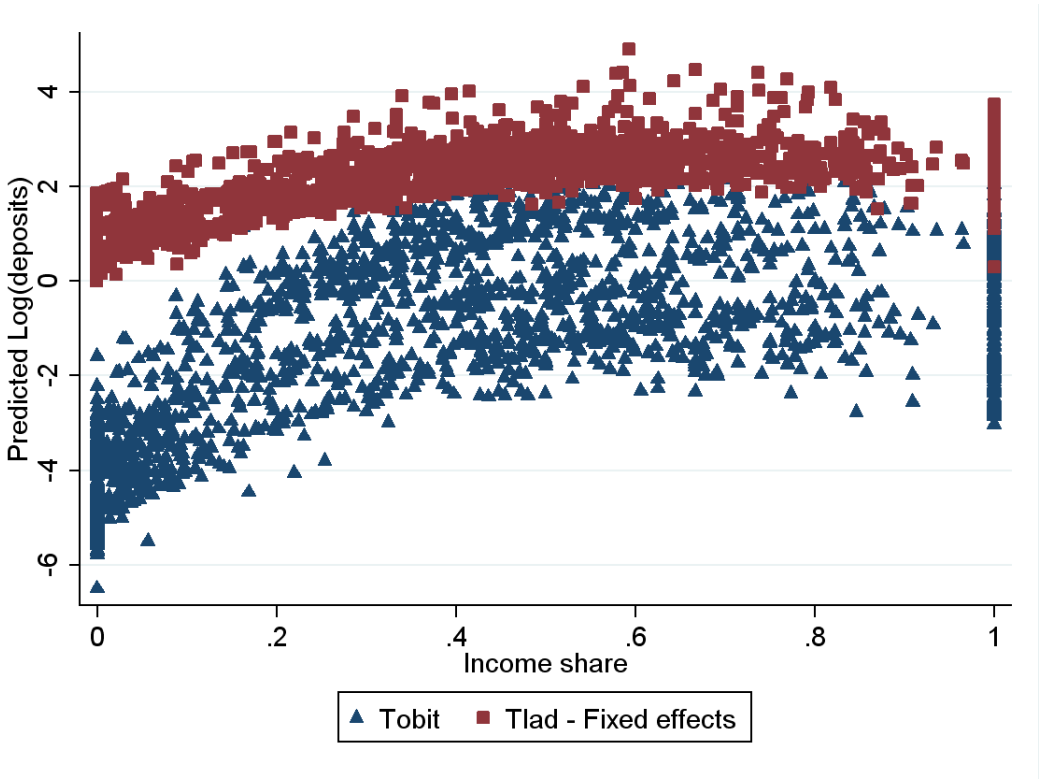


Fig. 2: Predicted values of the log(deposits)

5.2 Estimation of the commitment motive

For the second period of observation (2006), a proxy can be used to assess the importance of the self-commitment motive. The proxy is a dummy equal to one if the individual is identified as potentially making time-inconsistent choices.

The individuals were asked the following hypothetical questions:

A "Would you prefer to receive CFAF 1000 guaranteed in one week or CFAF 1500 guaranteed in one week and one month ?"

and later:

B "Do you prefer to receive CFAF 2000 guaranteed in one year or CFAF 3000 guaranteed in one year and one month ?"

People who are impatient today but prefer to be patient in the future are expected to make time inconsistent choices: because in the future they will be in the same situation as today, they will choose not to wait. If they are *sophisticated* (i.e. aware of their time inconsistent choices), they could look for a self-commitment device. The results of these questions are given in Table 7:

	Later (B)		
Now (A)	Patient	Impatient	Total
Patient	414 (74%)	144 (26%)	558
Impatient	**46 (17%)**	221 (83%)	267
Total	460	365	825

Tab. 7: Time-inconsistent choices

The result is that 17% of the individuals are identified as susceptible of looking for a commitment device. This identification of time-inconsistent individuals is very imperfect. For instance, it depends on the amounts and the time frame used in the questions.

Despite its shortcomings, I believe that it is worth checking whether the proxy indeed affects the deposits and to assess the magnitude of its impact. The estimations of the cross-section estimation (2006) including a binary variable for time-inconsistent choices are given in Table 8. The variable is called "Self-C", and "Self-C*woman" is the interaction of being a woman and being identified as time-inconsistent. The dependent variable is a dummy equal to one if the individual makes a deposit. The econometric specification is the same as in Table 5.

In contrast with the findings of Ashraf et al. (2006b), the effect is positive for men, but negative for women**.** I do not have enough information on the people's preferences to further investigate the negative effect on women. The positive effect on men is quantitatively high: deposits increase by 202%[9] among the men identified as *time-inconsistent.* The effect of the income share remains similar to what was estimated in Tables 5 and 6.

[9] $e^{1.106}$-1=202%.

	All sample I b (s.e.)	All sample II b (s.e.)	All sample III b (s.e.)	Women I b (s.e.)	Women II b (s.e.)	Women III b (s.e.)	Men I b (s.e.)	Men II b (s.e.)	Men III b (s.e.)
Household's earnings	0.005***	0.005***	0.004***	0.006***	0.006***	0.005***	0.003	0.003	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Income share	14.246***	14.301***	12.542***	14.826***	14.829***	11.374***	14.343***	14.546***	15.613***
	(1.240)	(1.238)	(1.391)	(1.253)	(1.252)	(1.654)	(3.297)	(3.355)	(3.457)
Income share squared	-10.398***	-10.462***	-9.114***	-11.416***	-11.456***	-8.747***	-8.551***	-8.649***	-9.384***
	(1.124)	(1.123)	(1.197)	(1.132)	(1.131)	(1.361)	(2.833)	(2.870)	(2.938)
Woman	2.590***	2.869***	1.777***	.	.	.	.	.	.
	(0.255)	(0.286)	(0.388)	.	.	.	.	.	.
Self-C		0.897*	0.862*		-0.585	-0.723**		1.191*	1.106*
		(0.503)	(0.497)		(0.357)	(0.339)		(0.639)	(0.646)
Self-C * woman		-1.466**	-1.554**		.	.		.	.
		(0.633)	(0.623)		.	.		.	.
Working in a market			1.325***			1.558***			0.688
			(0.353)			(0.414)			(0.916)
Taxi (moto)			0.729			.			0.209
			(0.758)			.			(0.921)
Bank account holder			-0.779*			-0.491			-1.309*
			(0.417)			(0.538)			(0.742)
Member of a ROSCA			-0.226			0.092			-1.078
			(0.313)			(0.321)			(0.720)
Household size			0.023			0.062			-0.016
			(0.052)			(0.052)			(0.135)
Constant	-6.447***	-6.644***	-6.188***	-3.510***	-3.429***	-4.062***	-8.655***	-8.937***	-8.841***
	(0.457)	(0.468)	(0.523)	(0.382)	(0.381)	(0.512)	(1.158)	(1.168)	(1.274)
Location fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R^2	0.127	0.130	0.142	0.120	0.122	0.142	0.092	0.098	0.109
Sample size	825	825	825	442	442	442	383	383	383

Robust standard errors
**** significant at 1%, ** significant at 5%, * significant at 10%*

Tab. 8: The self-commitment motive

5.3 Additional evidence: consumption patterns

The *intra-household motive* asserts that people make deposits to lower their contributions to the household's current expenses and increase their private consumption. Therefore, we should observe different patterns of consumption between clients and non clients. However, if the other motives are at play, making deposits may also allow people to resist temptations and increase their expenditures on various public goods as well as private goods.

I do not have precise information on what people do with the money that they recover from the collectors. I can however compare the purchases made by those who make deposits and those who do not. I use the purchase of one private good, clothes, and three public goods: the electricity bills, house repairs and school charges. I chose these items because they are the most common expenditures on goods that are not immediate, current, consumption. On average, they amount to 64% of those expenditures. Table 9 shows the mean expenses made by men and women, daily collector clients and non-clients. As expected from the *intra-household motive*, clients spend less then non-clients on all three public goods and more on the private good.[10]

Additionally, I look at the expenditures on frivolous goods. Frivolous expenditures are the sum of the expenditures made on tobacco, alcohol, candies and other fancy food during the week that preceded the survey. According to the *intra-household motive*, daily collector clients shall use their deposits to increase their consumption of frivolous goods, but on the other hand, according to the *self-commitment motive* and temptation theories, the clients may make deposits in order to decrease their consumption of frivolous goods. The descriptive statistics show that the last effect seems to dominate on average for women. However, without proper controls, descriptive statistics could be very misleading. For instance, richer people are expected to purchase more frivolous goods and be less likely to make deposits (they have a higher income share). This could also explain that women seem to spend more on electricity when they make deposits.

Therefore, I use Tobit and Tlad estimations to compute the effect of the deposits on these various expenditures. The results are displayed in Table 13. I again use the logarithm of the positive expenditures and then set the truncation point to zero. "DC user" is a dummy variable equal to one if the individual makes deposits. I control for the income of the individual and of his household, his age and gender, whether he is the household head and whether he owns his house, the composition of the family, whether he works in a market and I add time and neighborhood fixed effects. It emerges from the regressions that among the public goods, making deposits only affects men's expenditures on electricity (it decreases by 93%) but not women's. Both men and women who make deposits spend less on school charges. Men who make deposits spend more on house repairs than other men. In the Fon habits, it is a man's role to provide a roof for his family (Falen, 2011) and it seems that this item matters sufficiently to prompt men to use their deposits to repair the family house. Private expenditures are strongly correlated with deposits. expenditures on clothes increase sharply for daily collectors clients, both men and women.

[10] Except for the expenses that women make on electricity and house repairs.

	All sample				Men			Women		
	All	DC clients	Non-clients		DC clients	Non-clients		DC clients	Non-clients	
Public goods:										
Electricity	5 606	5 025	5 872		8 816	9 019		3 907	1 635	***
House repairs	2 458	1 061	3 096	*	1 336	5 237		954	213	
School	11 087	7 098	12 912	***	13 427	17 019		4 643	7 380	*
Private goods:										
Clothes	11 900	15 924	10 057	***	15 896	11 137	***	15 936	8 601	***
Frivolous	1 811	1 835	1799		2 681	2 364		1 507	1 040	***

, ** and * indicates that the difference in means between clients and non-clients is significant at 10%, 5% and 1% (unilateral test).*

Tab. 9: Expenditures on household public goods and private goods (CFAF)

What is more unexpected is the effect of making deposits on the purchase of frivolous goods: it is nil for men but positive and strong for women. On average, a woman's expenditures on frivolous goods increase by 196% (Tobit) to 305% (Tlad) if she makes deposits.

5.4 Daily deposits and redistributive pressure

As discussed by Platteau (ming), redistributive norms are pervasive and persistent in African countries, compared with countries of other continents. The few economists who have discussed redistributive norms in the context of developing countries tend to stress their negative effects on economic development. This follows from the disincentives that they cause. Platteau (ming) distinguishes between three type of disincentives. First, redistributive pressures discourage effort, since the gains resulting from any additional productive effort cannot be fully enjoyed but have to be shared. Second, they discourage entrepreneurship and risk-taking because if a project fails, the risk-taker may have to bear the burden alone, while if it is successful he will have to share the profits. Finally, redistributive pressures encourage misallocation of human resources: a successful individual will be compelled to hire his relatives and friends whenever possible. Additionally, it has been argued that belief in magic also hinder development since it encourages people to blame a reason external to themselves for their very own failures (Brain, 1982).

Clearly, making deposits could be a way to protect income against financial claims, both because the deposits cannot be readily redrawn and because they might be concealed and unknown to one's relatives. Therefore, those using the service should effectively transfer less money if they consider the claims as illegitimate. On the other hand, using the daily collector enables the accumulation of a lump sum that can be used for legitimate transfers.

Consequently, it is expected that daily collector's clients increase some transfers and reduce others. In Table 11, the amount of transfers given are presented for four categories of recipients: kids, spouse, acquaintances and parish fellows. [11]

From the all sample columns, it seems that using the daily collector permits to decrease all transfers. However the decomposition by gender offers a more subtle pattern. Transfers by men-users all decrease, but women's use of a daily collector seems to enable them to reduce their transfers to their husband and to increase their transfers to their kids and friends.

[11] Only the irregular transfers appear in the table. For example if a father gives his son CFAF 150 every morning for his lunch, this transfer is not in the table. But if the son asks his father some help to buy a bicycle, it is included. The reason is that regular transfers are the results of longer terms arrangements (as documented by Falen, 2011). A husband for example will give CFAF 2 000 to his wife on the market days and CFAF 150 to his son each morning for his lunch and that long-lasting arrangement shall not be interrupted or modified in the month in which the husband decides to make deposits.

	Electricity		House repairs		School charges		Clothes		Frivolous goods	
	Tobit	Tlad	Tobit	Tlad	Tobit	Tlad	Tobit	Tlad	Tobit	Tlad
	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)	b (s.e.)
DC user	-2.637**	-2.957**	-0.793	8.307***	-0.098	-1.576*	2.447***	2.040**	0.413	-0.305
	(1.264)	(1.471)	(3.308)	(2.756)	(0.867)	(0.927)	(0.545)	(0.852)	(0.271)	(0.394)
DC*woman	3.571*	5.797**	-3.074	-6.228	1.812	0.202	0.184	-0.317	1.087***	1.398**
	(2.046)	(2.643)	(5.642)	(5.444)	(1.440)	(1.491)	(0.741)	(1.036)	(0.372)	(0.551)
Earnings	0.000	-0.000	-0.000	0.000	0.000**	0.000*	0.000*	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH earnings	0.004	0.006	0.007	-0.011	-0.007	-0.010*	0.000	0.008**	0.003***	0.003
	(0.006)	(0.014)	(0.022)	(0.045)	(0.007)	(0.006)	(0.003)	(0.004)	(0.001)	(0.002)
Woman	-3.877***	.	-4.282	.	-0.241	.	2.469***	.	-0.894***	.
	(1.357)	.	(4.189)	.	(1.057)	.	(0.541)	.	(0.298)	.
Chief	17.706***	11.200***	23.394***	-9.111	17.860***	6.125***	6.995***	-1.313	3.043***	-0.523
	(1.226)	(2.362)	(4.081)	(0.000)	(0.990)	(1.683)	(0.555)	(1.314)	(0.293)	(0.644)
Owner	3.207***	-1.171	8.589***	5.191	0.794	0.027	-1.015**	-2.516***	-0.447**	-0.751**
	(1.101)	(1.592)	(3.079)	(7.322)	(0.853)	(1.759)	(0.410)	(0.855)	(0.190)	(0.378)
Market	1.427	2.658*	3.092	1.012	2.006**	2.239	3.676***	0.415	1.817***	0.774*
	(1.172)	(1.406)	(3.318)	(2.729)	(0.955)	(1.391)	(0.469)	(0.759)	(0.239)	(0.415)
HH size	0.438**	-0.035	-0.196	1.880*	1.544***	0.846***	-0.267***	0.011	-0.028	-0.105
	(0.184)	(0.234)	(0.551)	(0.967)	(0.145)	(0.197)	(0.089)	(0.179)	(0.039)	(0.085)
Constant	-23.635***		-62.284***		-25.706***		-4.925***		2.456***	
	(1.767)		(5.675)		(1.450)		(0.782)		(0.375)	
Time f.e.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Location f.e.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
McFadden R^2	0.128		0.116		0.155		0.087		0.059	
Sample size	2052	2052	2052	2052	2052	2052	2052	2052	2052	2052

Tobit standard errors clustered at the individual level
**** significant at 1%, ** significant at 5%, * significant at 10%*

Tab. 10: Tobit and Tlad estimations of public and private expenses

	Mean value of the gifts in CFAF and (% of Income)					
	All Sample		Men		Women	
	DC clients	Non-clients	DC clients	Non-clients	DC clients	Non-clients
Transfers given to:						
Children	59 (0.11%)	90 (0.2%)	0 (0%)	141 (0.29%)	82 (0.15%)	22 (0.08%)
Spouse	60 (0.17%)	156 (0.33%)	211 (0.59%)	247 (0.48%)	2 (0%)	33 (0.12%)
Acquaintances	37 (0.05%)	76 (0.27%)	3 (0%)	127 (0.44%)	51 (0.07%)	7 (0.03%)
People of the same parish	4 (0.02%)	24 (0.04%)	0 (0%)	32 (0.05%)	6 (0.03%)	13 (0.04%)

Tab. 11: Summary of Gifts

The Tobit and Tlad estimations given in Table 12. The regressions partly confirm the descriptive statistics. Everything else equal, men who make deposits make less gifts to their children and parish fellows. For women, the only effect is that they make less gifts to their spouse.

	Children		Spouse		Friends		Parish fellows	
	Tobit	Tlad	Tobit	Tlad	Tobit	Tlad	Tobit	Tlad
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
DC user	-71.426***	-16.713***	3.146	2.946	1.068	1.815	-56.779***	-0.081
	(4.369)	(4.768)	(3.675)	(5.513)	(2.034)	(2.311)	(3.037)	(0.000)
Female X DC user	72.157***	18.508**	-15.039**	-15.422	-3.148	-4.040	57.660***	.
	(4.282)	(9.142)	(6.535)	(0.000)	(2.660)	(4.107)	(3.612)	.
Earnings	0.000	0.000***	-0.000	0.000	0.000	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household's earnings	-0.063	-0.247***	0.010	-0.065	0.003	-0.039*	-0.006	0.025
	(0.050)	(0.084)	(0.009)	(0.059)	(0.011)	(0.024)	(0.016)	(0.104)
Dependant relatives	4.608***	-3.485*	0.299	-0.568	0.498	0.099	0.626	-4.898
	(0.989)	(2.107)	(0.825)	(1.778)	(0.404)	(1.370)	(0.920)	(8.064)
Chief	0.534	-7.244	11.625***	0.156	8.176***	8.430	-0.167	-14.544***
	(3.811)	(5.077)	(3.320)	.	(1.906)	.	(3.936)	(4.529)
Household size	-4.529***	3.978**	-0.800	-0.289	0.179	0.133	-0.199	3.705
	(1.361)	(1.847)	(0.821)	(1.192)	(0.426)	(1.177)	(0.951)	(4.709)
Constant	-35.819***		-45.230***		-31.995***		-45.523***	
	(6.409)		(4.634)		(2.589)		(4.669)	
Time fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Location fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
McFadden R^2	0.076		0.111		0.098		0.062	
Sample size	2052	2052	2052	2052	2052	2052	2052	2052

Standard errors clustered at the individual level
**** significant at 1%, ** significant at 5%, * significant at 10%*

Tab. 12: Estimations of gifts

6 Conclusion

I wrote a model of strategic interactions between two members of a single household. In equilibrium, the model's agents use the daily collection service in order to bring less money home and constrain their own contribution to the household's public current expenses. By doing so they can divert some resources from the household's public consumption to their own private consumption and drive their partner to increase his contribution to the public good. I called this strategy the *intra-household motive* for making deposits.

According to the model, only the people with an income close to their partner's income make deposits. If two people have very different incomes, in equilibrium the one with the lowest income contributes very little, or even not at all, to the public good and therefore do not make costly deposits to decrease a contribution that is already very low. Simultaneously, the one with the highest income would need to make very high deposits if he wants to prompt the low income earner to increase his contribution. Because the cost is proportional to the deposits, he will prefer not to make any deposits either.

In the empirical part, I provide strong evidence in support of the *intra-household motive*. I used the panel structure of the data and fixed effects at the individual level to clear the estimations from the time constant motives of *safety* and *commitment*.

Moreover, using a proxy that identifies time-inconsistent individuals, I showed that the *commitment motive* is an important determinant of men's deposits, but not of women's.

I finally showed that users and non-users of the daily collection service exhibit different patterns of consumption: men users contribute less to the purchase of electricity, both men and women users spend less on school expenditures for their children and spend more on new personal clothes. Women consumption of frivolous goods also increase by 200% to 300% when they make deposits.

I also find that men who make deposits make fewer gifts to their children and parish fellows, while women give less money to their spouse if they make deposits.

These findings are important for the understanding of a widespread informal saving device. In particular, the *intra-household motive* has strong policy implications. As the model showed, improving the access to the daily collectors may hurt rather than favor the population as a whole. Now that big donors are pushing small financial institutions to encourage savings,[12] the negative effects that I underlined may need to be evaluated.

The evidence also emphasizes the importance of savings among the poorest members of society and lead me to disagree with the researchers who pretend that the poor cannot and do not save.

I believe that the popularity of the daily collection service and the relevance of the three motives -*safety, commitment* and *intra-household*- arise from the possibility to deposit savings in the same day as the income is received. This is a service that more formal institutions such as banks or MFIs do not currently offer. However, if one wants to increase the level of formal savings in developing countries then using new technologies such as '*mobile money*', where deposits on a bank account could be made at a very low cost and at any time using a mobile phone, sounds very promising.[13]

[12] The Bill & Melinda Gates Foundation for instance announced grants worth $38m to MFIs in South Asia, Latin America and Africa to encourage them to expand their savings offerings (The Economist, 2010).

[13] For examples of '*mobile money*' see The Economist (2009) and The Economist (2011).

Before recommending policies that result from the model, such as the targeting of low-cost deposit collection in favor of women or individuals living alone, further investigations are however needed.

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Proofs and discussion of the model

1. Proof of Lemma 1:

   The Lemma is proven for A. If A's deposits are such that $g^a = \frac{A-g^b}{2}$, there are three possibilities:

   (a) If $g^b = 0$: $g = \frac{A}{2}$ and $x^a = \frac{A}{2}$. Both, g and x are decreasing in d^a. Therefore A's utility is decreasing in d^a and A optimally chooses $d^a = 0$.

   (b) If $g^b = w^b - d^b$: $g = \frac{A-\left(w^b-d^b\right)}{2}$ and $x^{a*} = \frac{A+\left(w^b-d^b\right)}{2}$. Again, A's utility is decreasing in d^a and A optimally chooses $d^a = 0$.

   (c) If $g^b = \frac{B-g^a}{2}$: $g = \frac{1}{3}(A+B)$ and $x^a = \frac{1}{3}(A+B)$. A's utility is decreasing in d^a and A optimally chooses $d^a = 0$.

2. Proof of Lemma 2:

   The Lemma is proven when $g^a = 0$. If $g^a = 0$, then either (i) $g^b = w^b - d^b$ and $x^b = kd^b$ or (ii) $g^b = \frac{B}{2}$ and $x^b = \frac{B}{2}$.

   (a) In case (i): $U^b = ln\left(w^b - d^b\right) + ln\left(kd^b\right)$. In Step 1, B chooses $d^b = \frac{w^b}{2}$ and B's utility becomes $U^b = ln\left(\frac{w^b}{2}\right) + ln\left(k\frac{w^b}{2}\right)$.

   (b) In case (ii): g^b and x^b are both decreasing in d^b. Therefore B chooses $d^b = 0$ in Step 1 and his utility is equal to $U^b = ln\left(\frac{w^b}{2}\right) + ln\left(\frac{w^b}{2}\right)$.

   Clearly, B prefers case (ii) to case (i). Because B can always choose to make zero deposits, he chooses $d^b = 0$ in Step 1 if $g^a = 0$, in order to obtain the level of utility of case (ii) rather then the one of case (i).

3. Existence of the candidates and corresponding payoffs:

   (a) If $d^a = 0$ and $d^b = 0$, three cases follow from Equations 2 and 3 :

      i. If $IS^a < \frac{1}{3}$, then $g^a = 0$, $g^b = x^b = \frac{w^b}{2} = g$ and $x^a = w^a$:

$$U_{1a}^a = ln\left(\frac{w^b}{2}\right) + ln\left(w^a\right) \tag{4}$$

$$U_{1a}^b = ln\left(\frac{w^b}{2}\right) + ln\left(\frac{w^b}{2}\right) \tag{5}$$

      ii. If $IS^a > \frac{2}{3}$, then $g^b = 0$, $g^a = x^a = \frac{w^a}{2} = g$ and $x^b = w^b$:

$$U_{1b}^a = ln\left(\frac{w^a}{2}\right) + ln\left(\frac{w^a}{2}\right) \tag{6}$$

$$U_{1b}^b = ln\left(\frac{w^a}{2}\right) + ln\left(w^b\right) \tag{7}$$

iii. If $IS^a \in \left[\frac{1}{3}; \frac{2}{3}\right]$, then $g^a = \frac{2}{3}w^a - \frac{1}{3}w^b$, $g^b = \frac{2}{3}w^b - \frac{1}{3}w^a$ and $g = x^a = x^b = \frac{1}{3}\left(w^a + w^b\right)$:

$$U_{1c}^a = ln\left(\frac{w^a + w^b}{3}\right) + ln\left(\frac{w^a + w^b}{3}\right) \tag{8}$$

$$U_{1c}^b = ln\left(\frac{w^a + w^b}{3}\right) + ln\left(\frac{w^a + w^b}{3}\right) \tag{9}$$

(b) If $d^a = w^a$ and $d^b = 0$, then $g^a = 0$, $x^a = kw^a$ and by Lemma 2 $d^b = 0$, $g^b = x^b = \frac{w^b}{2} = g$:

$$U_2^a = ln\left(\frac{w^b}{2}\right) + ln\left(kw^a\right) \tag{10}$$

$$U_2^b = ln\left(\frac{w^b}{2}\right) + ln\left(\frac{w^b}{2}\right) \tag{11}$$

(c) If $d^a \in]0; w^a[$, d^a is such that $g^a = 0$ and $d^b = 0$. In this case, $x^a = w^a - (1-k)d^a$. From Equations 2 and 3, we know that d^a is such that $g^a = 0$ if $d^a \geq \frac{w^a - g^b}{1-k}$. This inequality is called condition C2. By Lemma 2 $d^b = 0$, $g^b = x^b = \frac{w^b}{2} = g$. Therefore, condition C2 becomes $d^a \geq \frac{w^a - \frac{w^b}{2}}{1-k}$. Since g is independent of d^a and x^a is decreasing in d^a, A optimally chooses the lowest value of d^a. Under condition C2, $d^a = \frac{w^a - \frac{w^b}{2}}{1-k}$:

$$U_3^a = ln\left(\frac{w^b}{2}\right) + ln\left(\frac{w^b}{2}\right) \tag{12}$$

$$U_3^b = ln\left(\frac{w^b}{2}\right) + ln\left(\frac{w^b}{2}\right) \tag{13}$$

Note that this candidate only exists if $\frac{w^a - \frac{w^b}{2}}{1-k} \in]0; w^a[$. This existence condition can be rewritten as:

$$IS^a \in \left]\frac{1}{3}; \frac{1}{2k+1}\right[\tag{14}$$

Where IS^a is A's income share in the total income: $IS^a = \frac{w^a}{w^a + w^b}$.

(d) If $d^a \in]0; w^a[$, d^a is such that $g^a = w^a - d^a$ and $d^b = 0$. From Equations 2 and 3, we know that d^a is such that $g^a = w^a - d^a$ if $d^a \geq \frac{w^a + g^b}{1+k}$. This inequality is called condition C4. Two cases have to be discussed:

i. If $w^a - d^a \leq w^b$ then $g^b = 0$ and by Lemma 2 $d^a = 0$, which contradicts that in candidate 4: $d^a \in]0; w^a[$.

ii. If $w^a - d^a > w^b$ then $g^b = \frac{w^b - g^a}{2} = \frac{w^b - w^a + d^a}{2}$, $g = \frac{w^b + w^a - d^a}{2}$ and $x^a = kd^a$. Under these equalities, i's utility is maximized when $d^a = \frac{w^a + w^b}{2}$ and therefore, in equilibrium, $g^a = \frac{w^a - w^b}{2}$, $g^b = \frac{3}{4}w^b - \frac{1}{4}w^a$, $g = x^b = \frac{w^a + w^b}{2}$:

$$U_4^a = ln\left(\frac{w^a + w^b}{4}\right) + ln\left(k\frac{w^a + w^b}{2}\right) \tag{15}$$

$$U_4^b = ln\left(\frac{w^a + w^b}{4}\right) + ln\left(\frac{w^a + w^b}{4}\right) \tag{16}$$

Note that this candidate only exists if $w^a - \frac{w^a+w^b}{2} > w^b$, $\frac{w^a+w^b}{2} < w^a$ and $\frac{w^a+w^b}{2} \geq \frac{w^a+\left(\frac{3}{4}w^b - \frac{1}{4}w^a\right)}{1+k}$. These conditions can be rewritten as:

$$IS^a \in \left]\frac{1}{2}; \frac{3}{4}\right[\tag{17}$$

(e) If $d^a \in]0; w^a[$, $d^b \in \left]0; w^b\right[$, d^a is such that $g^a = w^a - d^a$ and d^b is such that $g^b = w^b - d^b$. From Equations 2 and 3, we know that d^a is such that $g^a = w^a - d^a$ if $d^a \geq \frac{w^a+g^b}{1+k}$ and d^b is such that $g^b = w^b - d^b$ if $d^b \geq \frac{w^b+g^a}{1+k}$. Given that $g^a = w^a - d^a$ and $g^b = w^b - d^b$, these conditions become $d^a \geq \frac{w^a+w^b-d^b}{1+k}$ and $d^b \geq \frac{w^a+w^b-d^a}{1+k}$. The two conditions together imply that $d^a \geq \frac{w^a+w^b}{2+k}$ and $d^b \geq \frac{w^b+w^a}{2+k}$, which are possible only if (i) $\frac{w^a+w^b}{2+k} < w^a$ and (ii) $\frac{w^a+w^b}{2+k} < w^b$. Nonetheless, (i) holds when $w^a > \frac{w^b}{k}$ and (ii) holds when $w^a < kw^b$: since $k < 1$, one of the two conditions (i) and (ii) is necessarily violated. Hence, candidate 5 cannot exist.

(f) If $d^b = w^b$ and $d^a = 0$, then $g^b = 0$, $x^b = kw^b$ and by Lemma 2 $d^a = 0$, $g^a = x^a = \frac{w^a}{2} = g$:

$$U_6^a = ln\left(\frac{w^a}{2}\right) + ln\left(\frac{w^a}{2}\right) \tag{18}$$

$$U_6^b = ln\left(\frac{w^a}{2}\right) + ln\left(kw^b\right) \tag{19}$$

(g) If $d^b \in \left]0; w^b\right[$, d^b is such that $g^b = 0$ and $d^a = 0$. By symmetry with Candidate 3, $d^b = \frac{w^b - \frac{w^a}{2}}{1-k}$:

$$U_7^a = ln\left(\frac{w^a}{2}\right) + ln\left(\frac{w^a}{2}\right) \tag{20}$$

$$U_7^b = ln\left(\frac{w^a}{2}\right) + ln\left(\frac{w^a}{2}\right) \tag{21}$$

This candidate only exists when:

$$IS^a \in \left]\frac{2k}{2k+1}; \frac{2}{3}\right[\tag{22}$$

(h) If $d^b \in \left]0; w^b\right[$, d^b is such that $g^b = w^b - d^b$ and $d^a = 0$. By symmetry with Candidate 4, $d^b = \frac{w^a+w^b}{2}$:

$$U_8^a = ln\left(\frac{w^a + w^b}{4}\right) + ln\left(\frac{w^a + w^b}{4}\right) \tag{23}$$

$$U_8^b = ln\left(\frac{w^a + w^b}{4}\right) + ln\left(k\frac{w^a + w^b}{2}\right) \tag{24}$$

This candidate only exists when:

$$IS^a \in \left]\frac{1}{4};\frac{1}{2}\right[\tag{25}$$

4. Identification of the Nash equilibria (Proof of Proposition 1):

   (a) When $IS^a \in \left[0;\frac{1}{4}\right]$, the agents can only choose to make zero deposits or to deposit their whole income. The comparison of Equation 4 with Equation 10 and Equation 5 with 19 shows that $U^a\left(d^a=0 \mid d^b=0\right) \geq U^a\left(d^a=w^a \mid d^b=0\right)$[14] and $U^b\left(d^b=0 \mid d^a=0\right) \geq U^b\left(d^b=w^b \mid d^a=0\right)$. Therefore, the only Nash equilibrium is $d^a=0$ and $d^b=0$.

   (b) When $IS^a \in \left[\frac{1}{4};\frac{1}{3}\right]$, B does not need to deposit his whole income in order to drive his contribution down to zero. He could choose $d^b=\frac{w^a+w^b}{2}$. The comparison of Equations 5 and 24 however shows that $U^b\left(d^b=\frac{w^a+w^b}{2} \mid d^a=0\right) \geq U^b\left(d^b=0 \mid d^a=0\right)$ only if $IS^a \leq \frac{2-\sqrt{k}}{2}$. This inequality cannot hold since $\frac{2-\sqrt{k}}{2} > \frac{1}{3}$ and $IS^a < \frac{1}{3}$. Moreover, $U^b\left(d^b=0 \mid d^a=0\right) \geq U^b\left(d^b=w^b \mid d^a=0\right)$ (Equations 5 and 19) and $U^a\left(d^a=0 \mid d^b=0\right) \geq U^a\left(d^a=w^a \mid d^b=0\right)$ (Equations 4 and 10). The only Nash Equilibrium is $d^a=0$ and $d^b=0$.

   (c) When $IS^a \in \left[\frac{1}{3};\frac{1}{2k+1}\right]$, by comparing Equations 8 and 12 I obtain that $U^a\left(d^a=0 \mid d^b=0\right) \geq U^a\left(d^a=\frac{w^a-\frac{w^b}{2}}{1-k} \mid d^b=0\right)$. Equations 9 and 24 reveal that $U^b\left(d^b=0 \mid d^a=0\right) \geq U^b\left(d^b=\frac{w^a+w^b}{2} \mid d^a=0\right)$ only if $k \geq \frac{8}{9}$. Moreover, by comparing Equations 19 and 24 we learn that $U^b\left(d^b=\frac{w^a+w^b}{2} \mid d^a=0\right) \geq U^b\left(d^b=w^b \mid d^a=0\right)$. The comparison of Equations 8 and 10, and Equations 9 and 19, uncovers that $U^a\left(d^a=0 \mid d^b=0\right) \leq U^a\left(d^a=w^a \mid d^b=0\right)$and $U^b\left(d^b=0 \mid d^a=0\right) \leq U^b\left(d^b=w^b \mid d^a=0\right)$ if $k > \frac{8}{9}$ and $IS^a \in \left[\frac{1-\sqrt{1-\frac{8}{9k}}}{2};\frac{1+\sqrt{1-\frac{8}{9k}}}{2}\right]$. This cannot happen because $\frac{1-\sqrt{1-\frac{8}{9k}}}{2} > \frac{1}{2k+1}$. Therefore, the Nash equilibrium is $d^a=0$ and $d^b=0$ if $k \leq \frac{8}{9}$ and $d^a=0$ and $d^b=\frac{w^a+w^b}{2}$ if $k > \frac{8}{9}$.

   (d) When $IS^a \in \left[\frac{1}{2k+1};\frac{1}{2}\right]$. We already know that $U^a\left(d^a=0 \mid d^b=0\right) \leq U^a\left(d^a=w^a \mid d^b=0\right)$ and $U^b\left(d^b=0 \mid d^a=0\right) \leq U^b\left(d^b=w^b \mid d^a=0\right)$ if $k > \frac{8}{9}$ and $IS^a \geq \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$. We also know that $U^b\left(d^b=0 \mid d^a=0\right) \geq U^b\left(d^b=\frac{w^a+w^b}{2} \mid d^a=0\right)$ if $k \leq \frac{8}{9}$ and that $U^b\left(d^b=\frac{w^a+w^b}{2} \mid d^a=0\right) \geq U^b\left(d^b=w^b \mid d^a=0\right)$. Therefore, if $k > \frac{8}{9}$ and $IS^a \geq \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$, there are two Nash equilibria (i) $d^a=w^a$ and $d^b=0$ (ii) $d^a=0$ and $d^b=\frac{w^a+w^b}{2}$. If $k > \frac{8}{9}$ and $IS^a < \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$, the only Nash equilibrium is $d^a=0$ and $d^b=\frac{w^a+w^b}{2}$. If $k \leq \frac{8}{9}$, the only Nash equilibrium is $d^a=0$ and $d^b=0$.

   (e) When $IS^a \in \left[\frac{1}{2};\frac{2k}{2k+1}\right]$. By symmetry, if $k > \frac{8}{9}$ and $IS^a \leq \frac{1+\sqrt{1-\frac{8}{9k}}}{2}$, there are two Nash equilibria (i) $d^a=\frac{w^a+w^b}{2}$ and $d^b=0$ (ii) $d^a=0$ and $d^b=w^b$. If $k > \frac{8}{9}$ and $IS^a > \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$, the only Nash equilibrium is $d^a=\frac{w^a+w^b}{2}$ and $d^b=0$. If $k \leq \frac{8}{9}$, the only Nash equilibrium is $d^a=0$ and $d^b=0$.

[14] This inequality should be read: conditional on B playing $d^b=0$, A's utility is higher if A plays $d^a=0$ than if A plays $d^a=w^a$.

(f) When $IS^a \in \left[\frac{2k}{2k+1}; \frac{2}{3}\right]$. By symmetry, the Nash equilibrium is $d^a = 0$ and $d^b = 0$ if $k \leq \frac{8}{9}$ and $d^a = \frac{w^a + w^b}{2}$ and $d^b = 0$ if $k > \frac{8}{9}$.

(g) When $IS^a \in \left[\frac{2}{3}; \frac{3}{4}\right]$. By symmetry, the only Nash equilibrium is $d^a = 0$ and $d^b = 0$.

(h) When $IS^a \in \left[\frac{3}{4}; 1\right]$, again the only Nash equilibrium is $d^a = 0$ and $d^b = 0$.

5. Proof of Proposition 2:

If $IS^a \leq \frac{1}{3}$ or $IS^a \geq \frac{2}{3}$, in equilibrium the agents do not make deposits and therefore their utilities are not affected by the possibility to make deposits. Therefore I only compare the utilities for the case where $IS^a \in \left]\frac{1}{3}; \frac{2}{3}\right[$. In this case, if the agents are not allowed to make deposits, from Equations 2 and 3 we know that in Step 2, their contributions are:

$$g^a = \frac{2}{3}w^a - \frac{1}{3}w^b \tag{26}$$

$$g^b = \frac{2}{3}w^b - \frac{1}{3}w^a \tag{27}$$

And their utilities are given by:

$$U^i_{NOd} = ln\left(\frac{w^i + w^j}{3}\right) + ln\left(\frac{w^i + w^j}{3}\right) \tag{28}$$

In equilibrium, if agent i makes deposits, either $d^i = w^i$ or $d^i = \frac{w^i + w^j}{2}$.

First, when $d^a = w^a$, A's utility is given by U^a_2 (Equation 10) and B's utility is given by U^b_2 (Equation 11) : $U^a_2 > U^a_{NOd}$ when $IS^a > \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$ and $U^b_2 < U^b_{NOd}$ when $IS^a > \frac{1}{3}$. Moreover, the gain in A's utility, $U^a_2 - U^a_{NOd}$ is higher than the loss in B's utility, $U^b_{NOd} - U^b_2$ if

$$\begin{array}{ccc} U^a_2 - U^a_{NOd} & > & U^b_{NOd} - U^b_2 \\ \frac{9k}{2}\frac{w^a}{w^a+w^b}\frac{w^b}{w^a+w^b} & > & \frac{9}{4}\left(\frac{w^b}{w^a+w^b}\right)^2 \\ \frac{9k}{2}IS^a\left(1 - IS^a\right) & > & \frac{9}{4}\left(1 - IS^a\right)^2 \\ IS^a & > & \frac{1}{2k+1} \end{array}$$

The conditions that $IS^a > \frac{1-\sqrt{1-\frac{8}{9k}}}{2}$, $IS^a > \frac{1}{3}$ and $IS^a > \frac{1}{2k+1}$ are guaranteed since otherwise $d^a = w^a$ could not be an equilibrium strategy.

Second, when $d^a = \frac{w^a + w^b}{2}$, A's utility is given by U^a_4 (Equation 15) and B's utility is given by U^b_4 (Equation 16) : it is immediate that $U^a_4 > U^a_{NOd}$ when $k > 8/9$ and that $U^b_4 < U^b_{NOd}$ and $U^a_4 + U^b_4 < 2U^a_{NOd}$.

The case of $d^b > 0$ is symmetrical and therefore part (i), (ii) and (iii) of the proposition have been proven. Part (iv) is straightforward.

Robinson (1988) Semi-Parametric Estimator

The results of semi-parametric estimations, following Robinson (1988), confirm that deposits are increasing in the income share when the income share is low, and decreasing when it is high. The turning point computed also corresponds to the results of the Ols, Tobit and panel Fixed Effects displayed above. The econometric model controls for the linear relationship between the deposits and all the controls used in the paper (corresponding to column 3 of Tables 5, 6 and 7), but the relationship between deposits and income share is not constrained to be linear. The routine developed by Verardi and Debarsy (2011) is used to compute the coefficients. The results are presented in Figure 3. The predicted values of the logarithm of the deposits are on the vertical axis and the income share on the horizontal axis.

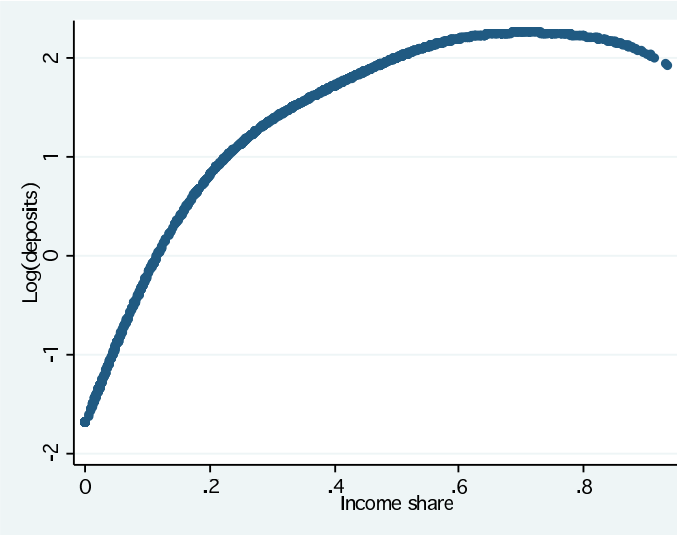

Fig. 3: Semi-parametric estimation: predicted relationship between log(deposits) and income share