INDIVIDUAL MICROCREDIT AND SOCIAL PRESSURE

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Summary: The purpose of this article is to analyse the efficiency of the repayment incentive mechanisms used for individual microcredit, the guarantor mechanism in particular. Little academic research has been devoted to this instrument whereas it is very frequently used. Churchill (1999) notably underscored the fact that, within the framework of microfinance institutions (MFI), the guarantor acts as a vector of social pressure on the borrower rather than as an alternative source of reimbursement. Little to no econometric studies have been devoted to testing this assumption. This is what we propose to do in this article, based on original data from a Brazilian microcredit programme, VivaCred, operating in the Rio de Janeiro *favelas*. Using a simple theoretical model, we will first of all describe the relations between an individual microcredit institution and a borrower in order to highlight the role of social sanction. Next, with an ordered multinomial logit model, we will study the probability of a change in behaviour by the borrower in terms of adherence to the repayment schedule. To be more precise, we will analyse the behaviour of borrowers with repayments significantly overdue in order to determine what encourages them to adhere to repayment deadlines in the future (economic conditions, policy of the MFI, etc.). In particular, results show that the number of guarantors has a positive impact on the likelihood of adherence to the loan repayment schedule in the future. However, it is a one-shot mechanism: the MFI cannot increase the number of guarantors required in the event of repeated delays in repayment over a period of time. On the contrary, the guarantor mechanism does not affect the likelihood of reverse transition. This mechanism thus proves efficient *ex post*, that is to say to encourage borrowers to adhere to the schedule in the event of repayment difficulties but has no preventive properties.

Keywords: Individual microcredit, repayment performance, social pressure, guarantor.

JEL classification: C41, D10, G20, O10, O17, R51.

I. INTRODUCTION

The Nobel Peace Prize awarded jointly to Mohammad Yunus and the Grameen Bank reinforced the interest of the general public and scientific community in microcredit and microfinance. Group lending based on a guarantee mechanism between members is perceived as the major, most widespread innovation in credit to the poor. This form of lending is based on the credible threat of social sanction to limit strategic repayment default by borrowers. This incentive mechanism appears relatively efficient inasmuch as the repayment rates indicated are often in the region of 95%.

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The terms "microcredit" and "solidarity lending" are therefore often confused. However, individual loans are increasingly being used by Microfinance Institutions (MFIs) as an alternative form to group lending or as an exclusive tool for providing finance for the poor. According to MicroBanking Bulletin data (2007), in 2006, only 10% of microfinance institutions offered solely group loans (and 50% proposed both individual and group loans). Thus, since 2004, Grameen Bank has granted an increasing number of individual microloans in order to follow the evolution of its customers' needs. In more general terms, individual microcredit is often the preferred financial instrument of micro-entrepreneurs in transition economies.

While this form of credit is developing, few studies have as yet been devoted to this issue and, in particular, to the incentive mechanisms used for this type of loan. Churchill (1999) devoted an entire monograph to individual microcredit in emerging countries. Recording a certain level of experience in the field, he highlights the guiding principles of individual microcredit. Among these, recourse to (the) guarantor(s) or to non-conventional guarantees seems to be frequently used by MFIs. Nonetheless, as Churchill indicates, the individual guarantee mechanism used in microfinancing has few points in common with the traditional concept developed in financial theory. In particular, it is not generally a question of finding an alternative source of repayment but of integrating the social sanction mechanism into the individual loan agreement. The purpose of these mechanisms is primarily to limit overdue repayment, the main difficulty confronting MFIs and not payment default which is not common (Godquin, 2004).

Churchill's work therefore constitutes an interesting panorama of individual microcredit practices. However, up to now, often due to a lack of data, there have been few studies seeking to empirically validate his conclusions.

The purpose of this article is to study the mechanism to encourage adherence to repayment schedules in individual microcredit, from a theoretical standpoint and by observation. To do this, we first of all propose simple modelling of the various incentive mechanisms used by MFIs to limit late repayment. In this sense, our model is complementary to models existing in literature which focus more on strategy payment default rather than overdue repayment. In the model we notably show the positive incentive-driven role of the threat of social sanction if

repayment schedules are not adhered to. Experience in the field, consolidated by the various Churchill monographs (1999), has led us to consider that this social sanction is mainly exerted via the loan guarantors.

In the econometric part of this article, we endeavour to identify the mechanisms that encourage borrowers to adhere to their repayment schedules. The observation analysis is carried out from an original database recording the loan transactions of a Brazilian microcredit institution, VivaCred, from 1997 to 2004. This programme is established in sensitive areas of Rio de Janeiro such as the Rocinha *favela*.

From an econometric methodology standpoint, we have used an ordered logit multinomial model. This model enables us to assess the risk (or, in a complementary manner, the luck) that a borrower changes his or her behaviour in terms of adherence to repayment schedules from one loan to the next: it involves highlighting the factors that explain why a borrower with overdue payment history in the past becomes a borrower who subsequently adheres to the loan agreement. The methodology implemented also enables us to take into account the moment when the change in behaviour occurs. We can therefore analyse the likelihood of a customer with significant overdue repayments in the past adhering to the repayment schedule for the next loan, after two loans or only after three loans.

The results of the econometric analysis indicate that, apart from the traditional mechanisms such as the amount of the loan or the customer's income, the guarantor (and, to be more precise, the number of guarantors) is a major factor explaining the borrower's change in behaviour in terms of adherence to repayment schedules.

The paper is organised as follows. We will start with a presentation of the main elements ascertained from traditional financing theory regarding the role of the individual guarantee (Section II). Individual microcredit apparently differs from traditional credit notably by the form and use of the individual guarantee. Section III is devoted to presentation of the theory model. In Sections IV and V, we present the data and methodology used. The results are indicated in Section VI with our conclusion in Section VII.

II. JOINT AND INDIVIDUAL GUARANTEES IN MICROCREDIT

In financing theory, the lender uses a guarantee to reduce the risk attached to the loan. The latter is mainly of two types:

- *ex ante*, the borrower is able to conceal the risk attached to his or her investment project. The lender then possesses asymmetrical information, preventing it from making a distinction between the various levels of risk of borrowers; This environment leads to an anti-selection situation where "good" borrowers (i.e. those presenting less of a risk) are the first to leave the market when there is a hike in interest rates. To avoid this, the lender can decide to fix the loan rate at a level beneath that of the market balance rate, thus creating a credit rationing situation (Stiglitz and Weiss, 1981). In this context, the request for a guarantee (in the form of an asset pledged as a guarantee for example) can reduce the occurrence of this phenomenon. In fact, the latter acts as a mechanism that reveals the individual risk attached to the investment project. To do this, the lender proposes a menu of loan agreements, playing solely on two arguments, in the simplest of cases: the amount of the guarantee and the lender interest rate. To simplify, assuming that there are only two categories of borrower, a relatively risky borrower and a relatively safe borrower, the lender may decide to propose only two contracts. In the first, the lender interest rate is high but the amount of the guarantee (attached in a sure manner in the event of non-repayment of the sum due) is low. The second has the exact opposite characteristics. In this context, the borrower with the riskiest project will choose the first agreement since he normally has little chance of paying the high interest rate but, on the other hand, a high risk of losing the guarantee. On the other hand, the safe borrower will tend to choose the second contract. The guarantee therefore acts as a mechanism to reveal the information concealed *ex ante* from the lender since the threat of its certain loss will motivate the borrower to choose the agreement that best corresponds to his or her type. We will see later on that the joint guarantee mechanism underlying group microcredit is based on the same principle.
- *ex post*, that is to say, once the investment has been made, attachment of the guarantee enables the lender to remedy the lack of repayment, whether or not this is intentional on the part of the borrower. The same mechanism applies when a guarantor takes the place of the material guarantee. However, this transfer of ownership procedure may prove costly.

Therefore it is sometimes complicated to implement, especially as legislation is more or less favourable to the creditor, even in developed countries.

To sum up, the introduction of a guarantee (in the form of a pledged asset or a person acting as the guarantor of a loan) is a means at the disposal of the lender to reduce both *ex ante* and *ex post* risk. It acts as a complement to other mechanisms based on the size of the loan or the implementation of dynamic motivation (renewal of the loan in the future if the repayment schedule is adhered to, granting of progressive loans subject to past repayment performance).

However, the guarantee mechanism in general and personal guarantees in particular are only meaningful if:

- The borrower has assets that can be pledged as surety. This implies that the asset in question has a market value or, at least, a certain value in the opinion of the lender. Thus, if the asset is seized (a process that may prove costly for the creditor), the lender can either hope to recover a certain sum covering all or part of the amount due or the loss would be of such a disservice to the borrower that he or she would do the utmost to honour the agreement. Nonetheless, this second type of guarantee poses a problem. In point of fact, only the borrower knows the actual value it has assigned to the asset, which subjects the lender to asymmetry of information that is all the greater in that the asset has no market value. How, in this context, can the lender hope that the borrower will make every effort to retain ownership of the asset?
- The institutional framework (the legal context in particular) permits the *actual transfer* of ownership from the borrower to the creditor. This is directly linked to the quality of the institutional environment: quality of the legal context organising loan agreements, quality of the legal system and procedures, quality of judges and barristers, etc.. Observational work carried out notably by La Porta et al. (1996, 1997, 1999) shows that, in certain developed countries (such as the United States, amongst others) the legal context is more favourable to creditors than in similar countries (France, for example). In this second type of country, actual transfer of the ownership of the guarantee is made more costly and therefore relatively less probable. It is not hard to imagine how more difficult this transfer can be in certain developing countries due to the low level of public budgets devoted to the operation of the legal system, corruption problems, etc..;
- The assets pledged as a guarantee are not very "liquid". If, in fact, the asset pledged is easily transferable, the borrower can part with it without the lender knowing or before the latter is

able to react. This is what Myers and Rajan (1998) call the "paradox of liquidity" since, in a traditional finance approach, the more liquid an asset, the less risky it will be.

In many developing countries, these three conditions are not met. The use of mortgages is still rare in developing or emerging countries such as Brazil, despite the strong influence exerted by de Soto's theses on the community of development experts (de Soto, 2000). Apart from a strong tradition of protecting the borrower in these countries, this issue is notably linked to the central issue of a lack of formal businesses. This informality leads to insufficient valuation of the capital due to the slightest leverage effect that an individual may expect from informal ownership. In fact, it is hard to lend to someone against an asset to which he or she possesses no legal deed of ownership.

This partly explains why traditional credit is not available to the poor. In particular, this is often the case for informal micro-entrepreneurs whose activity nonetheless generates substantial revenue on a micro and macroeconomic level.

This is the type of person that initially interested MFIs. Instead of making purely individual loans and to make up for the lack of surety in the form of assets with an exchange value, a loan technique frequently implemented consisted of lending to groups of poor individuals, jointly liable for the loan granted. In this context (as for the loans granted by the well-known Grameen Bank prior to the 2004 reform), every member receives a loan on an individual basis but providing he or she acts as guarantor of the loans granted to the other members of the group. In other terms, the loan agreement specifies that, should certain members of the group default, the others will be the first to honour the debt. If, the group debt is ultimately not eradicated, the entire group loses access to future credit. Therefore, by completing the joint guarantee system, there is a dynamic incentive that consists of making the granting of new loans subject to the repayment of previous ones.

This technique is based on the "social capital" held by each individual. The principle is that an individual possesses preferential information on the other members of the community to which he or she belongs and vice versa (which implies that the said member has built up a reputation in the group). By making the members of the credit group mutually liable, the lender can reduce the information asymmetry it is subjected to without necessarily having recourse to a personal guarantee (Narajan and Pritchett, 1999). Moreover, this social capital

can help reduce anti-selection and moral hazard problems since borrowers are able to monitor and mutually sanction one another. This is the peer monitoring mechanism which motivates borrowers to adhere to the loan agreement (Varian, 1990; Stiglitz, 1990; Besley and Coate, 1995; Diagne, 1998). In fact, the lender "delegates" control of each individual to the group, contenting itself to monitor and therefore sanction the group as a whole if necessary.

Table 1. Advantages and disadvantages of group lending[3]

Advantages
From an institution standpoint
- Economies of scale: more customers for a given investment
- Economies of scope: this increases the capacity of providing several services via the same mechanism (group loan)
- Reduces information asymmetry by taking advantage of the information that individuals have on one another
- Improves repayment performance due to peer and joint responsibility selection mechanisms
- The costs and risks are transferred to customers
- Reduces moral hazard behaviour of individuals due to the control exerted by group members over one another and the social pressure mechanism.
From the customer's standpoint
- The group allows the social and business network to be extended
- No individual guarantee required but a social guarantee
- Accentuates the mobilisation of savings, particularly if motivation figures in the institution's group lending mechanisms
- Mutual aid with repayments
Disadvantages
From an institution standpoint
- Less efficient mechanism when populations are heterogeneous
- Difficulty to get borrowers to adhere to their agreements
- May lead to greater desertion rates than for individual loans
- Less knowledge of the credit record of each customer by the institution
- Departure of the leader may pose a threat to group survival
- Covariance of project risks when group members carry out the same activity
- Risk of contagion if one of the members is unable to meet repayments
- Training and maintaining consistent groups may prove costly from a resource and time standpoint
From the customer's standpoint
- Corruption or possible taking of control by a small group of people or the group leader
- Limited flexibility of products and risk of imbalance between the service offered and customer requirements
- The costs and risks are transferred to customers

[3] Table adapted from Churchill (1999)

So, as underscored by Churchill (1999), the joint guarantee system has its advantages but there are also many disadvantages. This is illustrated in the table above.

These various aspects may partly explain why many MFIs have opted to set up an individual microcredit system not based on the joint guarantee principle. Moreover, this type of loan is also better tailored to the context in transition countries where the individual financing needs of micro-entrepreneurs are more extensive (Madajewicz, 2003). However, it is precisely in this type of country that private, profit-making MFIs have set up facilities in the past few years. This entry into the fray of private operators has motivated microcredit institutions to focus on more profitable customers, deserting the poorest customers (McIntosh and Wydick, 2005) and therefore promoting individual microcredit rather than group lending.

The individual microcredit technique is redeeming the guarantee principle: tangible assets or a guarantor *agreeing to guarantee* the borrower's loan. However, whether in the form of assets or a guarantor, the mechanisms differ from those encountered in traditional bank lending inasmuch as the three conditions indicated above (borrowers with assets with a market value, problem of the overliquidity of assets and quality of institutional environment) are not generally all satisfied at the same time.

As a result, the assets requested are often not conventional. In rural areas of Albania, tangible assets such as stocks are requested as a guarantee alongside more usual guarantees such as land or housing (Armendariz de Aghion and Morduch, 2000). Similar guarantees (equipment, vehicle, mortgage) are requested in CMAC programmes (Cajas Municipales de Ahorros y Créditos) in Peru and Financiera Calpia in Salvador (Churchill, 1999).

As far as the guarantor is concerned, the practices of certain MFIs seem a far cry from those of the traditional banking sector. In fact, the essential role of a guarantor is to be a vector of social pressure and not an alternative source of loan repayment. Thus, in his monograph, Churchill (1999) emphasised that “the use of guarantors […] is similar to the screening mechanism employed by group lenders. Responsible guarantors would not cosign a loan if they did not think the applicants were trustworthy and that their businesses would be able to repay the loan. As with group lending, the use of cosigners creates a social obligation for the client to repay” (Churchill, *ibid.*, p. 46). As a result, the presence of a guarantor primarily acts as an *ex ante* signal inasmuch as:

- First of all, it requires costly efforts for the potential borrower to find one or more guarantors. Thus, it can be hoped that credit applicants with little motivation will be discouraged. The request for guarantors therefore acts as a borrower self-selection mechanism. Moreover, the institution itself can evaluate the individual's social capital (or reputation) and make it one of the major decisive factors for granting the credit. An efficient way still needs to be found to assess the quantity of social capital that the borrower possesses. Requesting one or more guarantors and making it one of the conditions of eligibility of the loan can fulfil this role. This is highlighted by Jaunaux (2007) by showing that the number of guarantors presented by the borrower has a positive effect on the likelihood of access to the loan.
- Secondly, as underscored by Churchill (1999), every cosigner also lays its reputation on the line (very rarely its resources) by guaranteeing the borrower. It can reasonably be hoped that a commitment of this type is not made lightly.

This is why being able to produce guarantors is often considered by MFIs as a mechanism that reveals the quality of the project upstream: if the individual accepts to look for guarantees and can produce them, his or her project can then be considered genuine.

However, it is also an *ex post* sanction mechanism inasmuch as:

- If the agreement is not adhered to, the cosigner may lose his reputation to the same extent as the borrower. In this case, the cosigner may be tempted to sanction the latter.
- The sanction may be exerted via the guarantor(s). Contacted by the lender, the guarantor can put pressure on the borrower to meet his or her commitments. The guarantor can even apply direct sanctions by revealing his or her "bad" conduct to neighbours or, more generally, to members of the community he or she belongs to.

The guarantor also obviously plays a role as a vector of social pressure in developed countries. In fact, in the same way, the parents of a young person borrowing a sum of money from a bank will put the pressure on in the event of repayment difficulties. Similarly, the lender may make a parental guarantee a *sine qua non* condition of granting the loan. However, there are at least two essential differences with the situation observed in developing countries: firstly, the social pressure role is less extensive in that there are credible alternative sanction measures (legal sanction, amongst others); secondly, the guarantor actually replaces the borrower and repays the sums owed.

The interesting point here is more the *ex post* role as a vector of social pressure played by the guarantor. The issue is thus complementary to the one indicated in the article by Jaunaux (2007). The aim of this study is to test the role of the guarantor as defined by the institution. Finally, according to the programme credit agents and managers, the social capital held by borrowers is not so much thought of as an *ex ante* mechanism revealing the quality of the borrower but more, as in group lending, as a "social pressure" instrument. This is exerted on customers to urge them to reimburse on time on the heels of overdue repayment on the previous loan.

VivaCred systematically asks for at least one guarantor when the first loan is granted. The number of guarantors required for subsequent loans is a direct consequence of previous experience: VivaCred requires more guarantors for borrowers with significant late repayments of the previous loan. From this standpoint, the technique used by the institution is therefore relatively similar to the elements noted in observation studies of group lending. In this type of analysis, in fact, the size of the group is often considered to be a veritable proxy for the amount of social pressure exerted on each member. For example, Zeller (1998) highlights the fact that the size of the group has a positive impact on the repayment performance of Malagasy borrowers. This result was confirmed by Wydick (1999).

At first sight, increasing the number of guarantors amounts to adopting a social pressure "quantity" criterion. But the "quality" of the latter is an equally decisive factor: only one guarantor can prove as efficient as a whole host of cosigners. Thus, asking for additional guarantors is a way of stepping up social pressure but may also be a sign of the poor quality of the cosigner(s) of the previous loan. VivaCred seems to take both these aspects into account. First of all, guarantee requirements are fairly flexible. In fact, the guarantor requested for the first loan is often a member of the borrower's family. This makes initial access to credit easier, the amount of which is often low.
However, VivaCred is aware of the limits of this system which seems to make social pressure less effective. A certain number of observation studies confirm these difficulties. Thus, Sharma and Zeller (1997), based on data from programmes in Bangladesh, show that the existence of a family relationship between members of the group has a negative impact on the proportion of loans paid on due date. This is why VivaCred requests a larger number of cosigners from the applicant if repayments were not made on schedule for the previous loan. The institution makes certain that these new guarantors are not members of the family circle.

There is therefore a differentiating loan policy that enables the institution not to over-restrict initial access to credit to "good" borrowers since this might turn them away from this type of financial service but which sanctions dubious borrowers by making it complex for them to obtain financing.

This being said, individual microcredit is apparently based on one of the major characteristics of group lending: the importance of taking social capital into account in the credit relationship. This aspect was pointed out in documents by Giné and Karlan (2007). In fact, in their opinion, individual microcredit has the advantage of making the most of the social links between individuals but, unlike group lending, avoids having recourse to direct social pressure mechanisms that create tension between borrowers. As a result, unlike in the case of group lending, one customer is no longer liable for another. However, indirect sources of social sanction continue to be felt via the collection of repayments at joint weekly meetings. These meetings enable any customer to know the current status of another borrower and therefore lay the latter's reputation on the line. Giné and Karlan (2007) thus show that individuals with an extensive social network present less of a risk of not reimbursing their individual loans than those with low social capital: customers with a dense social network repay their loans in order to protect it.

The guarantor mechanism is then another means available to the individual microcredit institution to bring social capital into play as regards the borrower's performance.

All these various aspects concerning social pressure and the guarantor mechanism will be initially examined using a theoretical model and then by means of a study of VivaCred.

III. MOTIVATION AND OVERDUE REPAYMENT: AN INDIVIDUAL MICROCREDIT MODEL

Before making an econometric analysis, we will present a very simple model describing the relations between the microcredit institution granting individual microloans and the micro entrepreneur. Here we will focus on overdue repayment inasmuch as this constitutes one of the main financial difficulties faced by MFIs (Churchill, 1999, Godquin, 2004), more so than irrecoverable debt. This is a fairly original approach since, to our knowledge, the problem has not been studied by a theoretical model whereas there are a number of models (Ghatak and Guinanne, 1999 for example) covering payment default. In their paper, Armendariz de

Aghion and Morduch (2000) describe a certain number of *ex ante* incentives available to individual microcredit institutions to optimise the efforts made by the borrower to repay the sums owed. Our approach is appreciably different as we propose to explain part of the *ex ante* incentives available to MFIs, in the hope that the micro-entrepreneur *adheres to the repayment schedule set out in the loan agreement.* In other words, this involves finding mechanisms such that it is not in the borrower's interest to intentionally postpone payments of the sums owed in the perspective (favourable as far as he or she is concerned) of renegotiation of the debt that may lead to partial cancellation of the latter. The objective of the institution here is to use *ex ante* mechanisms limiting "*strategic delays in repayment"*. These mechanisms are based on the *credible threat of sanctions* in the event of strategic behaviour on the part of the borrower. The latter include dynamic motivation such as the threat of non-renewal of the loan or a decrease in the amount loaned in the future, as well as more unusual sanctions such as increasing the number of cosigners for a future loan and/or social sanctions.

As in Armendariz de Aghion and Morduch (2000), we have used a two-period model where the institution has full negotiating powers. A loan for an amount L can be granted at the beginning of each period; in view of the poverty of the borrowers, we are assuming that the microcredit is their sole source of financing. The amount lent in the second period depends on the repayment behaviour chosen by the borrower in light of the loan granted in the first period. The individual investment project produces revenue net of repayment Y. In light of the finished nature of the issue, it is certain that the borrower will default at the end of the second period. In other terms, he will never reimburse the debt for the second period. Once the borrower has amount Y, he chooses to make repayments over a period of time or to defer repayment. As previously indicated, late repayment means he can obtain a partial reduction of his debt for the first period. Here, this partial cancellation of the debt implies that the borrower only repays a fraction ϕ of the total sum due (R): since $\phi R < R$ where $\phi < 1$.
To limit this type of behaviour *ex ante*, it is in the MFI's interest to set up mechanisms to encourage the borrower to make an effort to make repayments in line with the schedule specified in the contract.

Thus, if the loan is repaid in line with the specified schedule:

- the borrower is certain of receiving finance once again from the microcredit institution for the second period. If we call the *ex ante* probability of being financed for the second period v, this gives us $v = 1$;

- the lender will increase the size of the loan in proportion to the amount granted for the first period. For the second period, the amount lent will therefore be δL where $\delta > 1$.

On the other hand, if the loan is repaid late:

- the borrower will only have an *ex ante* probability of being financed again for the second period of $v < 1$;
- the lender will reduce the amount of the loan granted. In other terms, the amount of the loan for the second period will only represent a fraction α ($\alpha \in]0,1[$) of the initial loan;
- a "social" sanction S is applied to the borrower, thus reducing the usefulness hoped for. For example, the sanction may result in a loss of the borrower's reputation.

This last point concerning the social sanction on a dubious borrower is particularly important. Armendariz de Aghion and Morduch (2000) define the sanction as follows: “such [social] sanctions include loss of reputation, exclusion from the village community, and so on”. In our paper, in line with the practice of the VivaCred institution, we assume that this sanction is applied by the loan guarantor(s). This is in line with the idea that the cosigner's major role is to put social pressure on a borrower who does not respect the terms of the loan agreement. In actual fact, in the event of overdue repayment, VivaCred contacts the cosigner(s), asking for pressure to be put on the borrower. The guarantor(s) phone(s) the borrower, go(es) to his home if necessary, speak(s) to the neighbours, etc.. To sum up, recourse to (a) guarantor(s) is tantamount to a means to threaten to harm the reputation of dubious borrowers by making their lack of reliability public (to the neighbours in particular).

In this model, we assume that the borrower decides whether or not to adhere to the repayment schedule for the first loan. Thus, from the viewpoint of the lender institution, there is an endogenous probability, written as p that the borrower repays the loan on time. The scenario is therefore as follows: First of all, the MFI proposes a loan agreement with a schedule and total repayment amount, R. Next, the borrower chooses the effort to be made, which in fact amounts to choosing the probability p of repaying the loan on time. If this is not the case, the borrower is certain to be subjected to the above-mentioned sanctions.

However, we assume that the effort is costly for the borrower. Given

$$c(p) = \Omega \frac{p^2}{2} \tag{1}$$

the non-monetary cost associated with the effort, where Ω is a fixed cost and the quadratic form enables the increasing marginal cost of the effort made by the borrower, non-observable by the bank, to be taken into account.

The borrower therefore chooses *p* such that:

$$\max_p \; p\left(y - R + \beta\delta y\right) + (1-p)\left(y - \phi R - S + \beta v\alpha y\right) - c(p) \tag{2}$$

where β < 1 the borrower's psychological discount rate.

The first order condition is written as:

$$\beta y\left(\delta - v\alpha\right) + S + \left(\phi - 1\right)R = \Omega p \tag{3}$$

This leads to a level of effort and therefore an optimum probability *p*:

$$\hat{p} = \frac{\beta y\left(\delta - v\alpha\right) + \left(\phi - 1\right)R + S}{\Omega} \tag{4}$$

Thus the individual is particularly encouraged to make an effort to adhere to the repayment schedule inasmuch as:

- the progressiveness of the loan (δ) is high when the terms of the loan agreement are complied with;
- the social sanction incurred (*S*) is costly in terms of usefulness;
- the reduction of the debt for the first period (ϕ) is low when repayments are late;
- the probability of renewal of the loan relationship (v) is low and the amount of the second loan is reduced (α) in the event of late repayment of the first period loan.

Anticipating this optimum level of effort, the microcredit institution will propose a repayment amount *R* maximising the revenue hoped for. The latter depends on the probability of repayment within specified timeframes (*p (R)*) and the amount repaid, *R*, therefore:

$$\max_R \; p(R).R + (1-p).\phi R \tag{5}$$

where $p = \dfrac{\beta y\left(\delta - v\alpha\right) + \left(\phi - 1\right)R + S}{\Omega} = \hat{p}$

The first order condition leads to the following optimum repayment:

$$R^* = \frac{1}{2(1-\phi)}\left[\beta y(\delta - v\alpha) + S + \frac{\Omega\phi}{(1-\phi)}\right] \quad (6)$$

Optimum repayment is therefore all the higher inasmuch that the social sanction *S*, the project yield *y*, the psychological discount rate β, the gain in revenue if the borrower makes an effort to make repayments according to the planned schedule ($y[\delta - v\alpha]$) and the progressiveness of the loan if the agreement is adhered to are high. Moreover, the lower the reduction of debt for the first period (i.e. ϕ closer to 1), the less late interest the borrower has to repay. Thus, R^* is also an increasing function of ϕ. Finally, the optimum repayment amount chosen by the lender increases with Ω (fixed cost of effort). In fact, the higher this cost, the lower the effort deployed by the borrower. Aware of this, the microcredit institution requires the equivalent of a risk premium that will increase the size of the repayment.

This model illustrates the idea according to which it is in the interests of the microfinance institution to set up efficient incentive mechanisms to prevent the borrower from knowingly deciding to repay the loan late, hoping for a reduction of the debt in this case. We assume that the *ex ante* probability of keeping to the schedule is chosen by the borrower so as to maximise its usefulness. However, this choice is made knowing that the effort is costly and he may have a strategic advantage in deferring his reimbursement. Among other mechanisms, social sanction is a possible manner of limiting this type of behaviour. Although this latter element only appears as a parameter *S* in the model, the practices of a certain number of MFIs granting individual microcredits indicate that they often take advantage of the guarantor to apply this sanction inasmuch as he is able to put pressure on the borrower. While this type of sanction is credible in the eyes of borrowers, repayment behaviour must reflect it. This is precisely what we are highlighting in the econometric analysis in the next sections.

IV. DESCRIPTION OF THE DATA

The database studied was established with data from the VivaCred institution in Rio de Janeiro[4]. This data was collected by credit agents via questionnaires covering the potential

[4] VivaCred is a medium-sized institution in Brazil. It had 3,558 active customers in June 2005. Established in 1997, it is one of the oldest institutions and has a certain reputation with the Rio de Janeiro administrative

borrower's household and company. In fact, for each credit application, a credit agent analyses the household's economic situation, evaluates the credit applicant's activity and studies the company's potential. The agent thus assesses the future borrower's ability to repay a loan. The database therefore contains information on three levels: the individual, company and loan agreement. The complete base contains all credit applications addressed (accepted and refused) by agents for a period of eight years, from 1997 to end 2004 - a total of 16,535 applications submitted by 6,693 individuals.

For the purposes of our study, we will focus solely on the institution's customers and will therefore not analyse rejected applicants. Initially we will study the mechanisms explaining the change in the customer's behaviour in terms of adherence to repayment deadlines. The base thus solely includes individuals who have always made repayments very late over the period and individuals who have changed their behaviour *at least once,* that is to say they began to adhere to the repayment schedule. Secondly and symmetrically, we will study the individuals whose repayment performance over the period has always been good and individuals who have changed their behaviour *at least once,* that is to say they began to no longer adhere to the repayment schedule.

The change in a customer's behaviour only makes sense if:

- There is no systematic exclusion of the borrower when repayments were made late for the previous loan;
- Borrowers who have had problems in keeping to repayment schedules change behaviour when they are at least authorised to borrow more than once.

Microcredit institutions, unlike purely profit-making traditional bank institutions, are intentionally more flexible in terms of late repayment: a borrower who does not keep to his repayment schedule is not systematically excluded from the programme in the future (which is in line with the model in the previous section). As a result, VivaCred takes the decision to lend once again on a case-by-case basis. The institution can then assess whether or not the repayment is intentionally late or not, if it is the result of an external difficulty (violence, economic recession) or temporary worsening of the borrower's situation, etc.

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authority and the Brazilian Development Bank, etc.. Microcredit has expanded in Brazil over the past few years. By comparison, only nine institutions had over 2,000 active customers in 2002.

It is possible to calculate the percentage of individuals that leave the programme as soon as their credit repayment performance is bad. It can be noted that *44%* of individuals leave the programme after poor reimbursement performance for the previous loan. Among these individuals, there are obviously those who have not fully or partially repaid their credit, individuals excluded for other reasons (moral hazard, etc.) as well as those who do not apply for other loans. It can be assumed here that these borrowers leave the programme permanently even if it is possible that a certain number may have borrowed again after 31 December 2004. This second-chance policy implemented by VivaCred is based on the principle that the behaviour of borrowers is not deterministic: a customer with a late payment record in the past can start to adhere to repayment deadlines. This is confirmed by data - *68.4%* of individuals with poor repayment performance change their behaviour.

Inasmuch as we have data over several years, the individual may change behaviour several times over the study period. As we will see later, this does have an effect on the methodology used.

In Table 2, it appears that borrowers change behaviour a maximum of twice (repayment deadlines not observed, then observed) over the period and the average number of transitions per individual is low: a figure of 1.02.

Table 2: Transition from "non-observance" of deadlines to "observance of deadlines"

Number of observations	2,456
Number of individuals	651
Number of transitions	445
Average number of transitions per individual	1.02
Maximum number of transitions for an individual	2

Once a customer has changed behaviour, he rarely makes further late repayments and, in addition, changes his behaviour quickly. The statistics in Table 3 indicate that the borrower often achieves good reimbursement performance by the second loan. The customer's fast reaction can be explained in two ways: the latter is either afraid of losing access to financing in the future and therefore has a prompt reaction, independently of the guarantee mechanism, or (not exclusively), the institution quickly takes the appropriate measures (reduction in the amount of the credit or via the guarantor mechanism).

The objective of this work is to test the second assumption and highlight the role of the guarantor as a mechanism to motivate adherence to the repayment schedule.

Table 3: Statistics concerning the transition from "non-observance of the repayment schedule" to "observance of the repayment schedule"

Transition between loans:	No. of observations	%
1-2	303	68%
2-3	96	22%
3-4	35	8%
4-5	11	2%
Total	445	100%

3.1. Guarantor mechanism and reimbursement performance

VivaCred - Qualification of a borrower as "poor" or "good" refers to the customer rating grid drawn up by VivaCred. In fact, the institution assigns a rating according to late repayments (cf. Table 4).

Table 4. Ratings according to customer repayment times

Average no. of days late	VivaCred assessment of the customer	Ratings
0 to 3	Excellent	1
3 to 5	Good	2
5 to 7	Normal	3
7 to 10	Poor	4
>10	Possibility of exclusion from the programme in the future	5

We consider the individual to be a "poor" payer if he obtains a rating strictly above 3 and a "good" borrower in all other cases. In *70.5%* of loans, borrowers obtained a rating between 1 and 3. If the default rate is low – an average of 1.5% of borrowers do not fully reimburse their loans – overdue payments constitute a real problem for the institution since, in *26%* of loans borrower repayment performance was poor (i.e. they obtained a rating of 4 or above).

The objective of this article being to study the efficiency of the guarantor mechanism, an accurate description of it is therefore necessary. As previously indicated, one of the original features of individual microcredit programmes such as VivaCred, apart from conventional incentive mechanisms (progressive loans and threat of non-renewal of the loan in the future) is the use of a guarantor who cosigns the loan. The guarantor must not belong to the

borrower's company but may, however, be a relative or friend if his professional activity is quite separate from that of the borrower. *The existence of a guarantor is compulsory for the granting of a first loan. On the other hand, it is no longer compulsory afterwards.* A visit is made to the guarantor's company if he is unable to prove the existence of income. The guarantor must have a monthly income which, less family expenses, represents *70%* of the value of the monthly repayment. As a result, if the guarantor's income is not sufficient, the individual may have recourse to several guarantors. The actual value of the guarantee in institutions offering individual microcredit is nonetheless of secondary importance inasmuch as the guarantor's assets or income are very rarely seized.

For VivaCred purposes, the guarantor mechanism operates as follows:

1) For the first loan, the individual is obliged to have a guarantor irrespective of his or her personal characteristics and those of the company;
2) Subsequently, if the individual's repayment performance is good, he may be authorised not to have a guarantor. Discussion with VivaCred personnel and customers has enabled us to understand that no longer having guarantors was a request made by the customer probably due to difficulty in finding a guarantor and the related social pressure;
3) If the individual has problems meeting repayments, he will be asked to provide a guarantor once again if he had been authorised to no longer have a guarantor or to increase the number of guarantors if he already had at least one. As previously indicated, particular attention is paid to ensuring that the additional guarantor(s) is (are) not part of the family circle. In fact, according to senior management and credit agents, the family[5] is often the principal source for guarantors. It is, in effect, easier to call first on relatives. However, this choice may have a negative impact on repayment performance as indicated above.

The number of guarantors is thus determined by the borrower's past performance. In the event of poor past repayment performance, the number of guarantors increases whereas the value of the loan is reduced (in line with the model in the previous section). Table 5 below reflects these results from a statistical standpoint. If we compare the average number of

[5] The term "family" is used in its broadest sense, that is to say, parents, brothers and sisters, uncles and aunts, cousins, brothers-in-law, etc..

guarantors before the change in status, that is to say when the borrower is considered "poor" by VivaCred, with the number corresponding to a loan where the individual is considered "good", the average number of guarantors observed is lower in the first case than in the second. On the other hand, the average amount of the loan decreases when the borrower has experienced significantly late repayments.

The guarantor mechanism is an occasional instrument used by VivaCred. In fact it is used as a reaction to poor behaviour on the borrower's part and is therefore a one-shot mechanism. The institution cannot actually indefinitely increase the number of guarantors required because it is often costly for the borrower to seek them out (time, effort, etc.). As a result, once the mechanism has been implemented:

- the individual either becomes a "good" borrower (or reduces repayment delays), in which case the number of guarantors is often maintained as a precaution;
- or he remains a "poor" borrower. As indicated above, VivaCred then has little additional room to manoeuvre in using the guarantor mechanism. In fact, VivaCred cannot infinitely increase the number of guarantors, particularly as it is costly for the borrower to find a guarantor.

Table 5. Statistics concerning the average number of guarantors and the average amount of the loan between two successive borrower statuses: "poor" and "good"

Previous rating	Subsequent rating	No. of observations	%	Previous average no. of guarantors	Subsequent average no. of guarantors	Average variance of the loan amount
5	1	254	59.2	1.21	1.57	-20%
4	1	64	14.9	1.18	1.44	-1%
5	2	61	14.2	1.44	1.48	-17%
4	2	10	2.3	1.50	1.70	9%
5	3	29	6.8	1.10	1.14	-45%
4	3	11	2.6	1.10	1.27	-25%

Thus, in analysing the transition from a "poor" to a "good" borrower, the variable key is not so much whether there is a guarantor or not (*variable taking the value 1 if the individual has a guarantor and 0 if not*) but the *number of guarantors.* An individual rated as "poor" for the previous loan will be obliged to have at least one guarantor for the next loan.

Discussion with programme credit agents and senior management has confirmed that the guarantor mechanism and, to be more precise, the number of guarantors, is, in their opinion, designed as a social pressure instrument and not a second source of reimbursement.
We are thus testing here the assumption that the number of guarantors can lead to a change in the borrower's behaviour due to the greater social pressure suffered.

V. METHODOLOGY

In general, the phenomena of transition from one status to another are analysed with a "survival" (or period) model, the best known one being the Cox model (1972, 1975). The advantage of modelling is to determine whether being in a status for a certain period of time does or does not contribute to the maintenance of this status and/or what the causes are when changes occur. This methodology also enables the functions of the risk of transition and non-survival. Nonetheless, it assumes that the event studied can be measured over a period of time or that we wish to estimate a risk between two periods.

For the purposes of this paper, we will analyse the probability of transition from the status of a "poor" payer to that of a "good" one to highlight the mechanisms set up by the institution *between two contracts.* We will therefore not look at the changes in behaviour of the borrower over a particular period or between two periods but more at the transition of the borrower's status *between two loans.* Here we therefore have *one observation per loan*. As a result, the phenomenon observed does not actually come within a timeframe but within a *contractual relation* which makes the use of a period model inappropriate.

Conventional logit or probit models are often used to analyse binary changes in behaviour or status. This is the case, for example, when we study the transition from an autocratic regime to a democracy or the transition from a state of war to a state of peace (Gartzke, 1998, O'Neal and Russet, 1997). Multinomial logit models are also used when transitions lead to multiple statuses. This is notably the case for the activity transitions of workers: unemployment, salaried employment, independent workers, etc. (Corisini and Guerrazzi, 2007).

In our analysis, two factors must be taken into account:

- The first aim of this paper is to study what determines the change in a borrower's behaviour from the status of a "poor" to a "good" borrower.
- However, we also wish to take into account the moment when this change took place. In fact, as previously pointed out, the institution generally reacts immediately to poor repayment performance by the borrower, either by reducing the amount of its customer's loan or by increasing the number of his guarantors. In return, the customer may or may not be influenced by these decisions more or less in the short term (at the time of the next loan or after two loans, etc.). However, his behaviour may be solely linked to the economic conditions experienced independently of the motivations set up by VivaCred.

In order to take both these aspects into account, we have therefore used an ordered multinomial model that enables the probability of the borrower changing his behaviour to be analysed, that is to say have good repayment performance for the next loan after two or three or loans or more.

The dependent variable then takes on the following values:
- 0 if the customer subsequently still has a poor repayment performance;
- 1 if his behaviour changes for the next loan;
- 2 after two loans:
- 3 after three or more loans.

Category 0 is the reference category. Each coefficient therefore measures the impact of the explanatory variable on the probability that a customer changes his repayment behaviour by the next loan, after two loans or three or more loans in relation to a situation where the individual continues to be a "poor" borrower. The parameters associated with the reference modality are standardised at zero and only the parameters associated with modality 1, 2 and 3 are estimated.

In a multinomial logit model with three modalities, the probability associated with the j^{th} modality depends on the variance of $\beta_k - \beta_j$ with $k \neq j$ and k = 0, 1, 2, 3. It has the following form:

$$(\text{Repaymt. prob}_{\text{i}} = j) = \frac{\exp(x_i \beta_j)}{\sum_{k=0}^{m} \exp(x_i \beta_k)} = \frac{1}{1 + \sum_{\substack{k=0 \\ k \neq j}}^{m} \exp\left[x_i (\beta_k - \beta_j) \right]} \quad (7)$$

Where the explanatory variables x_{ik} are as follows:

- **AGE**, the borrower's age;
- **SEX,** the borrower's sex, the variable is 1 if the borrower is a man and 0 if not;
- **NO_DEPENDENTS**, the number of dependents for which the borrower is responsible apart from his or her spouse;
- **TOTAL_INCOME**, the total monthly income of the household. It includes household income from the company and outside the company;
- **INFORMAL**, the variable takes the value of 1 if the individual has a company not legally declared and 0 if not;
- **CREDIT**, the amount of the loan granted to the individual;
- **GUARANTOR,** the number of borrower guarantors.

To complete the above-mentioned analysis, we also studied the probability of the reverse transition, that is to say from a "good" to a "poor" borrower with the same explanatory variables.

VI. RESULTS

We will therefore analyse the transition from the status of a "poor" borrower to that of a "good" one using the ordered multinomial logit model. The results are given in Table 6[6].

The results indicate that *the number of guarantors required by VivaCred has a positive impact on the probability of becoming a "good" borrower by the next loan after the occurrence of late repayments.* On the other hand, if the borrower does not become a "good" one by the second loan, the guarantor mechanism is no longer efficient. In fact, as previously indicated to us, it is difficult to indefinitely increase the required number of guarantors.

In addition, the older the borrower, the greater the probability that he will become a "good"

[6] We obviously checked beforehand that there was no correlation between the variables of our regressions The correlation matrices are presented in Appendix I.

borrower by the next loan. Age may in fact be considered as a proxy variable for experience. This result is in line with the one highlighted by Jaunaux (2007) studying the impact of the informal nature of activity on the reimbursement performance of VivaCred customers and to the work of Hermes et al. (2005) covering the repayment performance for a joint credit programme in Eritrea.

The total monthly income of the household also appears to have a positive effect on the probability of having good repayment performance by the next loan or after two loans. The results are along the lines anticipated: the higher the income, the greater the individual's likelihood of becoming a "good" borrower.

The amount of the loan granted by the institution appears to be a significant variable in explaining the transition from a "poor" to a "good" borrower: the higher the amount of the loan, the greater a customer's difficulty in adhering to his repayment schedule. As a result, in a very intuitive manner, this result suggests that it is crucial for an institution to correctly assess the customer's reimbursement capacity if it wishes to avoid late repayment.

Moreover, the number of people dependent upon the borrower increases the likelihood of transition from the status of a poor borrower to that of a good one, from the second loan onwards. This is an interesting result since it points to the fact that another form of social pressure can complete the guarantor mechanism which only seems efficient for the first loan. In fact, we can imagine that dependents with access to the financing via the borrower (head of the family) may put pressure on him to keep more closely to the repayment schedule. A social pressure mechanism within the family (in the broadest sense of the term) would then complete the pressure exerted by guarantors for a first loan. However, there is an alternative explanation which, to some extent, is the opposite of the one just proposed. In fact, it would rather consist of social pressure exerted by the head of the family over his dependents to force them to participate in the microcredit repayment schedule. We would then find some of the drift brought to light in the group lending system where the head of the group can potentially misuse his dominant position to get others to make repayments instead of him.
However, whether one or other of these approaches is preferred, it is still a social pressure mechanism exerted via the number of the borrower's dependents.

Table 6. Probability of becoming a "good" borrower compared with that of remaining a "poor" borrower - Ordered multinomial model

Variables			Coefficients	Standard variance	Khi-2	Pr>Khi-2
THRESHOLDS		1	-1.3119	0.34	14.28	0.0002
		2	-4.3215	1.43	9.03	0.0027
		3	-5.3528	2.19	5.96	0.0147
TOTAL_INCOME		1	**0.0001*** **	0	7.61	0.0058
		2	**0.0003*** **	0.0001	7.3	0.0069
		3	0.0001	0.0001	1.11	0.2916
NO_DEPENDENTS		1	-0.0502	0.04	1.14	0.2864
		2	**0.2002***	0.1	3.38	0.0661
		3	**0.4911** **	0.22	4.8	0.0285
INFORMAL	1	1	-0.1219	0.23	0.27	0.6013
		2	0.7464	1.14	0.42	0.5154
		3	-1.6871	1.13	2.21	0.1372
SEX	1	1	0.0231	0.11	0.04	0.847
		2	0.1999	0.35	0.31	0.5784
		3	-0.0204	0.99	0	0.9835
GUARANTOR		1	**0.2124*** **	0.06	11.7	0.0006
		2	0.2629	0.19	1.84	0.1754
		3	0.0761	0.48	0.02	0.8764
LOAN		1	**-0.0002*** **	0	24.27	<.0001
		2	**-0.0011*** **	0.0003	14.89	0.0001
		3	-0.0002	0.0002	0.67	0.4148
AGE		1	**0.0107** **	0.005	4.39	0.0362
		2	0.0115	0.01	0.58	0.4465
		3	0.00822	0.04	0.03	0.8586
Number of observations		1510				
Likelihood Ratio		2028.98				

By way of comparison, we have also analysed the likelihood of having repayment problems compared with the likelihood of remaining a "good" borrower by using the same econometric methodology. The dependent variable then takes on the following values:

- 0 if the customer remains a "good" borrower;
- 1 if he changed behaviour for the next loan;
- 2 after two loans:
- 3 after three loans.
- 4 after at least four loans

Category 0 is the reference category as previously. The results are given in Table 7.

Table 7. Probability of becoming a "poor" borrower compared with that of remaining a "good" borrower - Ordered multinomial model

Variables			Coefficients	Standard variance	Khi-2	Pr>Khi-2
THRESHOLDS		1	**-1.4416*** **	0.2822	26.09	<.0001
		2	**-3.4657*** **	0.4222	67.38	<.0001
		3	**-4.9921*** **	0.5816	73.68	<.0001
		4	**-4.7579*** **	0.7629	38.9	<.0001
TOTAL_INCOME		1	**-0.0001*** **	0.000042	7.35	0.0067
		2	2.71E-06	0.000021	0.02	0.8949
		3	-0.00012	0.000074	2.69	0.1007
		4	-0.00016	0.000109	2.25	0.1337
NO_DEPENDENTS		1	-0.031	0.0399	0.6	0.4379
		2	0.00283	0.0573	0	0.9606
		3	0.096	0.0731	1.72	0.1894
		4	0.0878	0.1055	0.69	0.4051
INFORMAL	1	1	**-0.5819*** **	0.1733	11.27	0.0008
		2	-0.0338	0.2711	0.02	0.9008
		3	-0.0176	0.3562	0	0.9605
		4	**-0.7101***	0.4224	2.83	0.0928
SEX	1	1	-0.1228	0.0975	1.59	0.208
		2	0.1006	0.1454	0.48	0.4888
		3	0.3101	0.2022	2.35	0.1251
		4	-0.3984	0.2835	1.98	0.1599
GUARANTOR		1	0.0221	0.0559	0.16	0.6929
		2	-0.00368	0.0828	0	0.9646
		3	-0.00525	0.1112	0	0.9623
		4	0.0411	0.1557	0.07	0.7919
LOAN		1	-8.02E-06	0.000034	0.06	0.8117
		2	0.00002	0.000038	0.29	0.5894
		3	**0.000167*** **	0.000048	11.94	0.0005
		4	**0.0002*** **	0.000068	6.09	0.0136
AGE		1	**-0.0176*** **	0.00431	16.57	<.0001
		2	**-0.011***	0.00638	2.98	0.0841
		3	0.00242	0.00849	0.08	0.776
		4	0.00438	0.0118	0.14	0.7114
Number of observations		10150				
Likelihood Ratio		7328.74				

The number of guarantors no longer appears a significant variable. For individuals having proved their quality in the past, VivaCred does not subsequently use this incentive mechanism. In other words, the institution's behaviour is more "flexible" with its good customers. Thus, it appears that the number of guarantors is primarily an *ex post* mechanism used by VivaCred. It is therefore not a preventive but a corrective mechanism that puts the borrower back on the straight and narrow.

The transition from "good" to "poor" is thus explained by other factors such as *the*

modification of the total income of the household. Thus, in a very intuitive manner, the borrower is more likely to become a customer that adheres to repayment schedules for the upcoming loan when his income increases. However, this effect subsequently disappears after. There is probably an economic situation effect in this: the rise in income increases the borrower's immediate capacity for repayment but does not seem to guarantee this capacity (or willingness) in the medium term.

The company status is also a very significant factor – having an 'informal' business reduces the likelihood of becoming a "poor" borrower for the next loan, which is in line with the results obtained by Jaunaux (2007). Informal companies excluded from conventional financial services count heavily on access to microcredit and continual, lasting access to it. They therefore demonstrate good repayment performance and their behaviour may be motivated by the risk of losing financing in the event of poor behaviour (dynamic incentive mechanisms).

The borrower's age also has a negative impact on the risk of becoming a poor borrower[7]. In the same way as for the analysis of the transition from "poor" to "good", the borrower's age may be thought to be a proxy for the borrower's experience; thus the older the borrower, the less likelihood there is of him becoming a "poor" borrower.

The loan is also a significant variable for a change in behaviour after three or more loans. The amount of a loan granted at a moment *t* depends on past repayment performance. An individual recognised as being a "good" customer is granted loans of increasing amounts, in line with the logic of loan amount progressiveness over a period of time. However, the results highlight the difficulty for certain customers to reimburse excessively high amounts: in fact, the higher the amount of the loan, the higher the likelihood of borrowers incurring repayment problems. As previously emphasised, this reflects the benefit of reassessing customer repayment capacities for each new loan.

[7] For borrower age, total household income and loan amount variables, we tested the linearity of these variables on the transition from a "good" to a "poor" borrower. Each of these variables has a linear effect on the likelihood of becoming a "poor" borrower.

VI. CONCLUSION

To our knowledge, little theoretical and/or empirical work has been devoted to guarantors and the efficiency of this type of incentive mechanism, which completes conventional dynamic motivation. However, as underscored by Churchill (1999) based on a large number of case studies, the guarantor seems to play an essential incentive role, notably via the social pressure exerted by him on the borrower.

Our study shows that the number of guarantors required by VivaCred, which depends on past repayment performance, is *one of the mechanisms that explain an immediate change in behaviour from that of a "poor" to a "good" borrower*. However, it is not the only variable that explains this transition: age, the loan amount, the number of dependents and income also play an important role. Following on from Churchill (1999), we consider that we should probably see an expression of social pressure behind the number of guarantors.

On the other hand, the guarantor mechanism does not affect the likelihood of reverse transition. In other words, the mechanism based on the number of guarantors seems relatively effective in urging borrowers to adhere to repayment schedules but it does not prevent certain of them from becoming "poor" borrowers.

To conclude, an essential question still remains. While the reasons urging the lender to require a borrower to provide a guarantor and those that lead to the borrower finding one seem relatively clear, the same does not apply to the guarantor's motivations.

In effect, what are the reasons that push a guarantor to agree to guarantee a loan?
There are normally three major categories of elements that might lead an individual to act as the guarantor for an individual microcredit:

1) The guarantor may enjoy established moral authority in the community to which he belongs. In this case, by acting as a guarantor, he further consolidates his social position as a person of significance. He may also use his role as cosigner to acquire moral authority. In this other case, the guarantee becomes a vector amongst others to accumulate social capital. If this first category of explanations is pertinent, we should

then observe that the guarantor is often the same person or that guarantors have common social characteristics;

2) An individual that today agrees to act as a guarantor can hope that someone will do the same for him in the future. This comes back to the idea of reciprocity between individuals which functions like an insurance system for access to credit in the future: acting as guarantor today means hoping someone will provide a guarantee in the future and therefore ensuring future financing;
3) Finally, agreeing to be a guarantor means sending out a positive signal to the lender in terms of goodwill, morality or efficiency (the guarantor ensures, despite any difficulties, that the borrower ultimately repays what he owes). This may motivate the institution to grant a loan more easily in the future to the person acting as guarantor or even guarantee preferential financing conditions in terms of interest rates or loan amounts. Here again, agreeing to be a cosigner acts as an insurance system guaranteeing access to financing.

The guarantor's in-depth motivation should give rise to further research in the future.

APPENDIX I. Correlation Matrices

1) Analysis of the transition from a "poor" to a "good" borrower

	Sex	Age	No. of dependents	No. of employees	Loan amount	Total family income	Diversification	Informal	Guarantor
Sex	1								
Age	0.02	1							
No. of dependents	0.04	0.08	1						
No. of employees	0.08	0.002	0.02	1					
Loan amount	0.07	0.06	0.07	0.29	1				
Total family income	0.08	0.08	0.09	0.39	0.66	1			
Diversification	-0.12	0.07	0.02	-0.12	-0.13	-0.14	1		
Informal	-0.003	-0.04	-0.07	-0.37	-0.37	-0.42	0.14	1	
Guarantor	0.06	0.007	-0.07	0.08	0.05	0.02	0.01	-0.006	1

2) Analysis of the transition from a "good" to a "poor" borrower

	Sex	Age	No. of dependents	No. of employees	Loan amount	Total family income	Diversification	Informal	Guarantor
Sex	1								
Age	-0.08	1							
No. of dependents	0.03	0.05	1						
No. of employees	0.02	-0.04	0.03	1					
Loan amount	0.09	-0.03	0.06	0.22	1				
Total family income	0.06	-0.02	0.05	0.29	0.47	1			
Diversification	-0.1	0.09	0.02	-0.1	-0.17	-0.12	1		
Informal	0.06	0.004	-0.03	-0.27	-0.36	-0.28	0.12	1	
Guarantor	0.003	-0.008	-0.008	0.05	0.09	0.06	-0.05	-0.02	1

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