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ORIGINAL ARTICLE

Determinants of microcredit repayment in Portugal: analysis of borrowers, loans and business projects

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Abstract

Microcredit programs in Portugal represent a unique case for studying the microcredit repayment determinants in a developed country, as it experienced a financial hardship in 2008–2009, with economic and social consequences that led to unemployment crisis. This research examined the determinants of microcredit loan repayment based on a sample of 752 microcredit loans granted in Portugal by the National Association for the Right to Credit, adopting individual lending mechanisms and granting loans through partnerships with several credit institutions. This is the first study to ascertain the influence that a set of factors – grouped into three categories: borrowers' individual characteristics; loan characteristics; and characteristics of business projects implemented by borrowers – has on the repayment ability of microcredit programs, in a developed country of the Eurozone. Moreover, this is the first study using an ordered logistic regression (OLR) in estimating the determinants of microcredit loan repayment. Similar to previous studies, married borrowers tend to repay loans faster as they tend to be more responsible than single borrowers. Nationality seems to be an issue as foreigners tends to default the repayment loans. Finally, those involved in manufacturing activities perform better than those involved in service activities in repaying their loans. This clearly indicates that in developed countries special attention needs to be provided to minority groups as well as market/supply conditions, which are not normally considered in less favored economic countries.

Keywords Microcredit · Determinants of repayment · Ordered logistic regression · Borrowers' characteristics · Loan characteristics · Business projects characteristics · Portugal

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1 Introduction

The concept of microfinance includes different types of financial services, such as loans, savings, insurance policies, and other products oriented to the poorest, most economically excluded individuals. More specifically, microcredit can be defined as that part of microfinance that consists of granting small loans for business purposes (Ledgerwood 1999; Sengupta and Aubuchon 2008; Nawai and Shariff 2010; Mokhtar et al. 2012).

Stimulated by the Grameen Bank experience, studies of microcredit have developed along quite particular lines, mainly in third world and developing countries. Research focused on microcredit has been carried out, for example, in Nigeria (Njoku and Odii 1991; Arene 1992; Oke et al. 2007), in Malaysia (Roslan and Karim 2009; Nawai and Shariff 2010; Mokhtar et al. 2012; Nawai and Shariff 2012), in Bangladesh (Khandker et al. 1995; Godquin 2004), in South Africa (Reinke 1998), in Ethiopia (Addisu 2006; Brehanu and Fufa 2008), in Tunisia (Baklouti 2013), and in Turkey (Özdemir 2004). Studies in developed countries are rarer, including Copisarow (2000) and Derban et al. (2005) in the UK, Bhatt and Tang (2002) in the US, and Alves (2010) in Portugal.

While microfinance has been studied, in general, as a poverty reduction mechanism and a tool for increased social inclusion, microcredit reveals clear differences not only in the financial services and products provided but also in the main determinants of these loans. In particular, microcredit is not risk free, which can, over time, have a negative impact on its sustainability (Nawai and Shariff 2010; Baklouti 2013). Furthermore, most microfinance institutions (MFIs) depend on funds and subsidies from governments or donors in order to cover their operating and financial costs, which may also influence their sustainability. As the sustainability of MFIs is extremely important so that they rely on loans without relying on funds from third parties, it is important to identify the determinants of viable microcredit programs so that there can be a positive trade-off between the long-term sustainability of MFIs and the successful outreach of their microloan programs.

Portugal is a developed economy of the Eurozone with a moderate income per capita. It has recently experienced a financial hardship with impact at social and unemployment levels. Portugal has extensive experience in supporting social inclusion with formal credit granted to individuals who are seeking to create their own jobs.

The study of the determinants of microcredit repayment is crucial as a way to strengthen the sustainability of microcredit institutions. Moreover, microcredit studies have mostly been conducted in developing countries (there is no study on the impact of the determinants of microcredit repayment in developed countries, to the best of our knowledge). As such, Portugal seems a unique case to study the determinants of microcredit repayment in a developed country that has experienced a recent financial crisis with social and unemployment impacts – scenarios potentially conducive to the development of microcredit.

Given the existence of subsidies and mechanisms to support business creation in advanced economies that are often inexistent in emerging countries, the borrowers in our sample are entrepreneurs who have not been able to obtain credit directly through banks, because the banking institutions usually only grant credit to borrowers who can provide collateral. These entrepreneurs then turned to Portuguese National Association for the Right to Credit (ANDC), which pledges before the Banks to secure the

repayment of the loan, in order to grant entrepreneurs a credit that would not had been granted without the intervention of ANDC.

Finally, the characteristics of the borrowers in our sample are different from those observed in emerging less favored economies, most notably in what concerns: to gender – from an almost full gender balance in our sample when compared with, e.g. Baklouti (2013), who evidences entrepreneurs as being more often male; to the business sector of the projects presented by the entrepreneurs, being the 'services' sector the most important in our sample when compared to mostly agricultural projects presented in developing countries, which benefit from the microcredit mechanism. However, the educational level is quite similar as the low to intermediate level of education among the entrepreneurs prevail in our sample. See, among others, Baklouti (2013), Godquin (2004), Bhatt and Tang (2002) for more information on this differences and similarities.

In view of these characteristics, the main purpose of this study is to ascertain the main determinants of the repayment ability of beneficiaries of Portuguese microcredit programs.

Additionally, using an ordered logit model with four categories – and independent variables based on three main groups of factors that include borrowers' individual characteristics, loan characteristics, and characteristics of business projects implemented by borrowers – it is possible to estimate the ordered logit marginal effects for each of the categories analyzed.

Our results indicate that: education level; marital status; employment status; nationality; and business activity sector are the main factors that influence borrowers' repayment performance in the Portuguese context. They are fairly consistent with, not only, the theoretical arguments put forward in our literature review, but also with the findings of prior empirical research. Additionally, our results indicate that the main repayment determinants are: nationality; followed by education level; marital status; and business activity sector. These results suggest that the relative importance of the microcredit repayment determinants should be considered when developing new microcredit programs.

This paper is divided into six sections. Section one above provides the introduction. The literature review and the main concepts regarding the determinants of microcredit are presented in section two. The research methodology is addressed in section three. The results are presented and discussed in sections four and five, while section six offers the conclusions.

2 Literature review

The terms "microcredit" and "microfinance" are often used as synonyms (Sengupta and Aubuchon 2008), which could give the erroneous impression that they have the same meaning and characteristics. More correctly, microcredit is defined as a financial instrument that adopts an anti-poverty approach based on the strengths of the poor and not on their weaknesses or limitations (Counts 2008). In contrast, microfinance consists of the provision of financial services and products to microbusinesses with low profitability and to the poorest individuals and families who are at risk of social exclusion and who, in turn, do not have access

to, or the resulting benefits of, formal credit (Ledgerwood 1999; Otero 1999). These financial services generally include savings, insurance policies, loans, leasing contracts, money transfers, and other products suitable for the poorest individuals (Ledgerwood 1999; Mokhtar et al. 2012).

In recent years, microcredit programs have grown and developed exponentially in the third world and developing countries. However, recognition of these loans' potential and benefits has been increasing in developed countries (Afonso 2010). From Bangladesh, microcredit has spread to other countries in Asia, Africa, and South America, as well as to developed countries both in Europe and North America. In Portugal, according to Alves (2006), microcredit first appeared through the creation of the ANDC, in 1998.

Microcredit beneficiaries are mostly poor individuals experiencing social and economic exclusion, usually self-employed and with a low-income and without collateral or a substantial credit history (Counts 2008; Ledgerwood 1999; Roslan and Karim 2009). Thus, the inherent characteristics of microcredit beneficiaries can represent a higher risk for the lender. This, in turn, explains the fact that it is almost impossible for these individuals to obtain credit from formal financial institutions, which translates into greater difficulties in accessing traditional credit sources (Von Pischke 1991; Roslan and Karim 2009).

MFIs emerged with the common goal of filling a gap in the financial services sector (i.e., credit and savings), providing funds directed to the poorest and economically excluded individuals, who, in turn, are involved in micro or small business activities (i.e., microenterprises). MFIs provide the amounts needed to create new businesses or to invest in existing ones, in order to alleviate the poverty of loan beneficiaries (Godquin 2004; Nawai and Shariff 2012). Thus, MFIs are different from other financial institutions mainly because their services are directed to the poorest and most disadvantaged groups in the population, that, in addition to not being able to provide collateral, are refused credit for many reasons (Stiglitz 1990).

According to the information given by the Microfinance Information Exchange, MFIs can be commercial banks, credit unions, non-banking financial intermediaries, non-governmental organizations (NGOs), or rural banks (MIX 2011). Most MFIs are NGOs since they are non-profit institutions and their activities are usually funded by third parties, such as governments or donors (Canala 2010; Nawai and Shariff 2010). However, the success of microcredit programs, which has translated into observed high repayment rates, has contributed to the growing number of institutions in the formal financial system that provide microcredit services, mainly in developed countries (Bhatt and Tang 2002; Roslan and Karim 2009; Baklouti 2013).

Commercial financial institutions provide microcredit based on an individual lending approach, without requiring collateral from borrowers, contrary to the majority of MFIs managed by NGOs that have adopted a group lending model, in which collateral is represented by a group of borrowers who are responsible for the loan repayment (Alves 2008; Baklouti 2013).

2.1 Microcredit in Portugal

Although the concept of microcredit is relatively recent in Portugal, it has been attracting more attention from several entities. Currently, a wide range of

organizations act as operators and/or facilitators of microcredit in Portugal, through the promotion and/or provision of microcredit solutions to finance small-scale projects. These entities include, among others, banks and non-banks, such as public institutions, non-profit associations, and cooperatives (Alves 2010).

The ANDC, founded in 1998, was the pioneer and stimulator of microcredit in Portugal, having been created with the main purpose of replicating the Grameen Bank experience (Alves 2008; ANDC 2015). As a result of its activities, and being a non-profit private institution, the ANDC obtained the status of a public utility (ANDC 2015).

The ANDC acts as a facilitator of microcredit processes, whereby the granting of loans results from partnerships with several banking institutions (i.e., Millenium BCP, Novo Banco, Caixa Geral de Depósitos, and Caixa de Crédito Agrícola) and with the Instituto do Emprego e Formação Profissional (Employment and Professional Training Institute). The ANDC provides microcredit loans that range from €1000 to €15,000. The ANDC does not require collateral from loan beneficiaries, but once the financing process starts, borrowers need to provide a personal guarantee from a guarantor (ANDC 2015).

The total amount of microcredit loans granted between 1999 and 2014 was €11,489,135, and, in 2014 alone, the ANDC was responsible for more than €1.6 million in loans granted, exceeding the previous year's €850,000. Between 1999 and 2014, the association supported a total of 1941 projects, registering, between 2013 and 2014, a growth of 47.8% in the number of projects for which credit was approved—from 115 to 170 projects. The demand for microcredit also increased from 1689 applications to 2119 between 2013 and 2014, which represents an increase of 25% (ANDC 2014). As such, microcredit has gained a reputation in Portugal as an important financial instrument for the promotion of self-employment and entrepreneurship.

2.2 Determinants of microcredit repayment

The literature about the determinants of microcredit repayment is quite sparse, and it focuses mainly on third world and developing countries. Nonetheless, previous research has found similar patterns regarding factors, and explanatory variables can be grouped into three major characteristics: borrower; loan; and business project characteristics.

Regarding the individual characteristics of borrowers, among the most important are the borrower's age (Khandker et al. 1995; Reinke 1998; Özdemir 2004; Addisu 2006; Brehanu and Fufa 2008; Roslan and Karim 2009; Baklouti 2013) and gender (Roslan and Karim 2009; D'Espallier et al. 2011; Mokhtar et al. 2012; Nawai and Shariff 2012; Baklouti 2013). Other important characteristics are the borrower's income (Reinke 1998; Oke et al. 2007), occupation (Njoku and Odii 1991), household size (Njoku and Odii 1991), education level (Njoku and Odii 1991; Arene 1992; Reinke 1998; Bhatt and Tang 2002), marital status (Baklouti 2013; Wongnaa and Awunyo-Vitor 2013), and poverty level (Oke et al. 2007).

Concerning loan characteristics, the most relevant factors are: loan amount (Njoku and Odii 1991; Arene 1992; Oke et al. 2007; Roslan and Karim 2009; Mokhtar et al. 2012; Nawai and Shariff 2012; Baklouti 2013); asset size (Arene 1992; Njoku and Odii 1991); and repayment period (Njoku and Odii 1991;

Ledgerwood 1999; Chaudhary and Ishfaq 2003; Dinh and Kleimeier 2007; Roslan and Karim 2009); loan interest rate (Njoku and Odii 1991; Özdemir 2004); low transaction costs (Bhatt and Tang 2002; Oke et al. 2007); repayment methods (Mokhtar et al. 2012); time that elapses between the application for and the granting of loans (Oke et al. 2007); and borrowers' credit history (Baklouti 2013). Last, regarding project/business characteristics one can find several studies (Chaudhary and Ishfaq 2003; Mokhtar et al. 2012; Roslan and Karim 2009). The list of determinants presented below in this paper resulted from a review of the theory and empirical evidence provided by the main studies of repayment, as well as data from the ANDC's database.

2.2.1 Borrowers' individual characteristics

Age The borrowers' age influences the repayment of loans, although there are different perspectives about the effect this variable has on repayment. Focusing on data from a South African microfinance institution, Reinke (1998) concludes that younger borrowers are significantly more likely to default, mainly because they tend to continue to search for new job opportunities and to have greater employability compared with older borrowers. In addition, older borrowers are less likely to default because of their more extensive and relevant work experience obtained in previous jobs or businesses, which benefits their own firm.

Furthermore, compared to younger borrowers, older borrowers are more risk averse due to their social and personal characteristics, appearing more self-aware, responsible, and cautious throughout the microcredit process. They have also access to greater wealth obtained throughout their life (Boyle et al. 1992; Özdemir 2004; Addisu 2006; Brehanu and Fufa 2008; Roslan and Karim 2009; Baklouti 2013).

However, because of their characteristics, younger borrowers present a lower risk of default because they are more dynamic. They can perform more technical and innovative functions—more efficiently and effectively—than older borrowers (Brehanu and Fufa 2008; Oladeebo and Oladeebo 2008), especially in agricultural activities. Compared to older borrowers, younger individuals are less likely to default because they are more determined, independent, and knowledgeable (Roslan and Karim 2009; Baklouti 2013).

Based on these considerations, the following hypotheses are formulated:

> **Hypothesis 1:** Ages under 25 and more than 45 years old have a positive effect on repayment;
> **Hypothesis 2:** Ages between 25 and 45 years old have a negative effect on repayment.

Gender Most of the literature shows that female borrowers have higher repayment rates than male borrowers (Khandker et al. 1995; Hunte 1996; Chirwa 1997; Reinke 1998; Chaudhary and Ishfaq 2003; Derban et al. 2005; Dinh and Kleimeier 2007; Papias and Ganesan 2009; Roslan and Karim 2009; D'Espallier et al. 2011; Mokhtar et al. 2012; Baklouti 2013; Idoge 2013; Wongnaa and Awunyo-Vitor 2013). This is despite the fact that, in developing countries, most women are poorer than men, as

they usually endure more social pressure and discrimination, which contributes to the general assumption that women are a higher credit risk (Khandker et al. 1995; Bhatt and Tang 2002). Nonetheless, MFIs encourage more women to participate in their microcredit programs as these organizations have observed that, not only is lending to women less risky than lending to men, but also women are more highly motivated and they use loans more appropriately than men do. As a result, Khandker et al. (1995) concludes that women are a lower credit risk than men are.

Taking into account 350 MFIs in 70 countries, D'Espallier et al. (2011) show that MFIs with a higher percentage of female clients have lower portfolio risk, fewer write-offs, and fewer provisions, which, in turn, elevate their repayment performance. D'Espallier et al. (2011) further report that the effect of gender on repayment is stronger for NGOs, individual-based lenders, and regulated MFIs.

Researchers believe that women are more self-aware, cautious, and financially disciplined than men, which has a positive influence on their loan repayment ability (Reinke 1998; Özdemir 2004; Mokhtar et al. 2012; Wongnaa and Awunyo-Vitor 2013). Demirgüç-Kunt et al. (2008) relate women's more cautious investment with their avoidance of moral hazard risk. Sharma and Zeller (1997) confirm that repayment rates are higher for female borrowers because women tend to choose lower risk projects.

Focusing on data from the agricultural sector, Papias and Ganesan (2009) observe that women are better able to manage their income within their family environment and, therefore, are more committed to their business investments. In addition, loans to women may contribute to increasing their economic empowerment and promoting a culture of financial discipline and hard work ethic, which, in turn, contributes to higher loan repayment rates (Khandker et al. 1995; Roslan and Karim 2009).

> **Hypothesis 3** tests the impact of gender on the microcredit repayment rates. It is expected that Female gender has a positive influence on repayment.

Education level Based on the literature, borrowers' education level is expected to have a positive influence on their loan repayment performance (Arene 1992; Bhatt and Tang 2002; Oke et al. 2007; Oladeebo and Oladeebo 2008; Umamuefula et al. 2012; Wongnaa and Awunyo-Vitor 2013; Pasha and Negese 2014). Bhatt and Tang (2002) claims that the level of borrowers' education has a positive effect on repayment rates. For Bhatt and Tang (2002), microentrepreneurs in the US need a higher education level so that they can understand complex information, maintain accurate business records, and carry out cash-flow analyses, in order to make better and more profitable business decisions more easily. Besides having a higher level of knowledge and skills, entrepreneurs with more education may also have a better chance of finding part-time jobs, which can produce an extra source of income to use for repaying loans, especially if their business does not succeed.

According to Chaudhary and Ishfaq (2003), the higher their education level, the greater borrowers' ability is to understand the terms and conditions of loans, as well as other types of contracts, projects' viability, and the benefits of adopting new techniques and technologies that contribute to increasing firms' productivity.

Brehanu and Fufa (2008), focusing on data from the Ethiopian agricultural sector, report that education increases farmers' ability to access, process, and use relevant information from different sources, resulting in increased income.

Addisu (2006) shows that the higher the education level of microentrepreneurs, the higher their loan repayment ability is, especially for those who have a college degree. According to the cited author, borrowers with higher education levels tend to plan and evaluate their business better before applying to microcredit programs. In addition, they utilize technical know-how obtained along their academic path, which contributes to greater advantages in the beginning and throughout the management of their businesses. In contrast, borrowers with less education tend to use loans for other purposes than their business, which can compromise their ability to repay.

Focusing on data from the Tunisian Microfinance Bank, Baklouti (2013) analyzing three education levels—low, intermediate (i.e. vocational education and training), and high (i.e. graduate and higher)—concludes that borrowers with an intermediate education level have lower levels of project risk compared to borrowers with a university degree or higher education level. However, microentrepreneurs with low education levels have a higher probability of defaulting on loans compared with those who have higher education levels.

Thus, **Hypothesis 4** is as follows: Education level has a positive influence on repayment.

Marital status According to Baklouti (2013), the importance of marital status stems from this being considered a sign of borrowers' responsibility, trustworthiness, and maturity. Baklouti (2013), Carling et al. (1998; 2003), and Vogelgesang (2003) report that married borrowers tend to repay loans more quickly than single borrowers do. Nonetheless, Dinh and Kleimeier (2007) and Wongnaa and Awunyo-Vitor (2013) claim a higher default rate for married borrowers because they tend to have a larger family, which helps to increase the likelihood they have to spend a large part of their income on household expenses, limiting their ability to repay the full loan amount.

Thus, it is important to understand how the marital status may affect the microcredit repayment rates, through the following hypotheses:

Hypothesis 5: Married status has an effect on repayment.
Hypothesis 6: Committed status has an effect on repayment.
Hypothesis 7: Single status has an effect on repayment.
Hypothesis 8: Divorced status has an effect on repayment.
Hypothesis 9: Separated status has an effect on repayment.
Hypothesis 10: Widowed/widowered status has an effect on repayment.

Nationality The literature offering empirical evidence of the impact of borrowers' nationality on microcredit repayment rates is scarce or non-existent. However, the variable of nationality was included in this study in order to determine whether it affects borrowers' repayment performance. In Portugal, foreign-born citizens also have access to microcredit. According to Dias et al. (2009), this is a common situation in

other European countries since this financial instrument includes specific financial products that immigrants need for making investments and running businesses.

Based on a study of Swedish mainstream bank credit programs, Bos (2010) concludes that immigrants, despite having higher activity rates than native-born citizens do, are less likely to obtain bank credit. This discrepancy is particularly strong for immigrants from Africa.

After studying foreign-born citizens' access to Portuguese banking services, Dias et al. (2009) state that what is more significant than nationality is the characteristics and stereotypes associated with immigrant status, such as higher mobility, which can translate into a higher risk of default. In addition, several characteristics hamper foreigners' relationships with banks, namely, poor language skills, a lack of documentation needed to reside legally in Portugal, and cultural barriers that may help label them as risks as borrowers.

> Thus, **Hypothesis 11** is as follows: Portuguese nationality has a positive influence on repayment.

Employment status Employment status indicates whether borrowers have another paid occupation besides their business, which translates into an alternative source of income. For this reason, the present study seeks to investigate whether borrowers' employment status influences loan repayment performance.

The literature suggests that an extra-business source of professional income influences borrowers' repayment capacity. That is, those who have another paid occupation tend to have a higher chance of repayment and/or high repayment rates (Mashatola and Darroch 2003; Vogelgesang 2003; Brehanu and Fufa 2008; Ojiako and Ogbukwa 2012; Idoge 2013; Wongnaa and Awunyo-Vitor 2013).

For Vogelgesang (2003), if loan payments are too high or if their business's income is lower than expected, borrowers have greater difficulty repaying loans. In these cases, borrowers need to have alternative sources of income.

Given that the agricultural sector is characterized and influenced by seasonality, according to Brehanu and Fufa (2008), alternative income in agricultural activities helps farmers repay loans even when harvests are poor and the repayment period coincides with times of low agricultural prices. After focusing on the Ghanaian agricultural sector, Wongnaa and Awunyo-Vitor (2013) also conclude that income from other non-agricultural activities has a positive impact on borrowers' repayment rate.

Based on these considerations, **Hypothesis 11** claims that an extra-business source of professional income has a positive influence on repayment.

2.2.2 Loan characteristics

Loan size The literature that discusses determinants of repayment in microfinance also indicates that loan size has a significant impact on borrowers' repayment capacity. Therefore, MFIs must set a minimum and maximum limit for the loan amount granted so that this meets the beneficiaries' needs but the amount does not jeopardize their ability to repay the full loan. The definition of an appropriate loan

size depends entirely on borrowers' debt capacity, which is defined by the loan's purpose and by the borrower's ability to repay the loan without difficulty or delays (Ledgerwood 1999). According to Baklouti (2013), the variable of loan size reflects borrowers' intention, risk aversion, and/or self-assessment of repayment ability.

Similarly, some authors argue that, the larger the loan, the lower borrowers' repayment rates are (Njoku and Odii 1991; Sharma and Zeller 1997; Carling et al. 1998; Copisarow 2000; Chaudhary and Ishfaq 2003; Jacobson and Roszbach 2003; Godquin 2004; Mokhtar et al. 2012). In the case of large loans, a greater tendency and incentive exists for borrowers to use a part of the loan for other purposes, such as personal consumption and non-productive activities (Njoku and Odii 1991; Chaudhary and Ishfaq 2003; Van Gool et al. 2012). For Mokhtar et al. (2012), the larger the loan size, the higher the probability of default is, especially for borrowers caught in a cycle of low cash flow. For instance, Chaudhary and Ishfaq (2003) argue that, the higher loan amounts are, the stricter the terms and conditions attached to loan contracts need to be (e.g., higher interest rates), which is likely to create difficulties for borrowers during the loan repayment process. With an increase in credit limits, borrowers have greater difficulty fulfilling the obligations of loan contracts, including using personal funds (Sharma and Zeller 1997; Brehanu and Fufa 2008). Sanctions or incremental penalties applied when borrowers do not comply with their obligations also contribute to greater difficulty repaying loans. In these cases, the larger the loan amount, the greater the cost associated with loan default is, which has a negative impact on borrowers' ability to repay the loan (Brehanu and Fufa 2008; Sharma and Zeller 1997).

In direct contrast, some authors conclude that large loans contribute to an increase in borrowers' repayment rates (Arene 1992; Jiménez and Saurina 2004; Addisu 2006; Oke et al. 2007; Oladeebo and Oladeebo 2008; Roslan and Karim 2009; Nawai and Shariff 2012; Umamuefula et al. 2012; Baklouti 2013; Idoge 2013). According to Jiménez and Saurina (2004), credit institutions are more cautious when granting higher loans. Oladeebo and Oladeebo (2008) report that, the larger loan is, the larger the amount that the borrowers' business has available for investment needs to be, which could lead to a greater capacity for adopting new technologies that enhance firms' ability to generate income. This, thus, contributes positively to larger loans' full repayment. Roslan and Karim (2009) state that smaller loan sizes are often insufficient, imposing limits that can create cash-flow problems for borrowers and affect their business, which, in turn, contributes to higher default rates. Papias and Ganesan (2009) argue that borrowers who obtain larger loans have a better chance of benefiting from economies of scale.

Nawai and Shariff (2012) indicate that larger loans help borrowers generate enough funds to finance their business, allowing them to achieve higher profits and raise their business's profile. Umamuefula et al. (2012) contends that loan size is positively related to repayment rate, which suggests that larger amounts allow borrowers to make larger investments with the potential for higher rates of return. They also claim that about 75% of microcredit beneficiaries indicate that their loan size is inadequate and insufficient. In Portugal, based on a survey of 595 beneficiaries of the ANDC microcredit program, Silva (2014) reports that they also indicate that the available microcredit loan size is too limited for their business.

Hypothesis 13 tests the impact of loan size on the microcredit repayment rates**.** As such, it poses that a relationship exists between loan size and loan repayment.

Repayment period This variable measures the maturity of loans in months (Dinh and Kleimeier 2007). The time in which the full amount of loans has to be repaid is one of the most important variables in microfinance. Those MFIs that can adjust this variable to their clients' needs have a greater chance of registering higher repayment rates in their portfolio (Ledgerwood 1999). In the present study one expects that loan maturity influences repayment rate. However, some authors offer different perspectives on the—positive or negative—impact that this variable has on borrowers' repayment performance.

Ledgerwood (1999) shows that, on one hand, shorter repayment periods can be negative for borrowers, as they may not have generated enough revenue yet to face their first loan payments. On the other hand, longer repayment periods may be negative for borrowers as they cannot qualify for new loans without having repaid the full amount of their current debts. Roslan and Karim (2009) also conclude that, the longer the repayment period, the higher the chance of default is, observing that repayment periods greater than business planning cycles can be harmful to borrowers.

For Chaudhary and Ishfaq (2003), shorter periods can have a negative impact on loan repayment as businesses may take some time to produce a significant return on investment. A longer repayment period, in contrast, can cause borrowers to reroute their income to serve purposes unrelated to their business, resulting in a reduced capacity to repay the full loan amount.

However, based on a group of MFIs in Bangladesh, Godquin (2004) concludes that loan duration has a positive impact on the repayment process, increasing borrowers' likelihood to repay the full loan amount, especially for large amounts. After examining data on 16 community development finance institutions in the UK, Derban et al. (2005) argue that an increase in repayment periods may also reduce the amounts to be paid regularly during the repayment process, making loans more manageable for borrowers, which may be reflected in higher repayment rates. In the agricultural sector, longer repayment periods allow a larger part of investments made by farmers to produce enough return to repay loans fully, within established deadlines (Njoku and Odii 1991).

Recent literature also discusses the impact of the time to the maturity of a loan on the probability of fully repaying it. Empirical evidence shows that the repayment rate improves as borrowers get closer to the loan limit (Mirpourian et al. 2016).

Based on aforementioned considerations, **hypothesis 14** contends that a relationship exists between the loan period and loan repayment.

2.2.3 Project/Business characteristics

Borrowers' repayment performance can also be influenced by their business activity sector, that is, different types of projects have different levels of risk and profitability (Roslan and Karim 2009). According to Fisher (1939), Clark (1940) and Fourastié

(1954), economies can be divided in three sectors: primary; secondary; and tertiary. The primary sector comprises activities linked to nature, such as agriculture, livestock, hunting, forestry, and fishing. The secondary sector includes manufacturing industrial activities, such as construction and energy production, while the tertiary sector is linked to activities, such as services, trade, tourism, transport, and financial products.

Besley and Coate (1995) argue that the agricultural sector is the most uncertain and with the highest default rates. Chaudhary and Ishfaq (2003) and Mokhtar et al. (2012) conclude that borrowers whose business comprises agricultural activities, livestock, and fishing face major difficulties in repaying loans because their business income tends to be volatile due to the variability of weather conditions, markets, and prices.

Roslan and Karim (2009) show that businesses of the service sector havw a lower chance of defaulting on loans compared to businesses involved in production activities. Mokhtar et al. (2012) also conclude that borrowers whose main activities include agriculture, livestock, and fishing are more likely to encounter problems in the microcredit loan repayment process.

In contrast, Van Gool et al. (2012) suggest that agriculture is often assumed to be the safest sector for loans due to greater social control and low volatility. In Baklouti's (2013) study, the agricultural sector has the highest repayment rate, about 98.8%, with the service sector having the highest chance of default.

Thus, it is important to understand how the project/business characteristics may affect the microcredit repayment rates, through the following hypotheses:

Hypothesis 15: The primary sector influences repayment.
Hypothesis 16: The secondary sector influences repayment.
Hypothesis 17: The tertiary sector influences repayment.

3 Methodology

3.1 Empirical model

The dependent variable (R) of this study identifies the final status of borrowers' microcredit process, specifically regarding loan repayment as shown in the different final categories registered by the ANDC. According to the categories defined by the ANDC, the final status of borrowers' microcredit process comprises four situations:

- Repaid with loan guarantee funds ($R = 0$): situations in which the ANDC applied their guarantee fund due to loan default
- Overdue ($R = 1$): loans that were not repaid within the contractual period but for which the possibility still remains that they will be repaid later
- Repaid ($R = 2$): full repayment of loans within the agreed repayment period
- Repaid in advance ($R = 3$): full repayment of loans before the repayment period ended

The independent or explanatory variables were divided into three groups: variables inherent to borrowers' individual characteristics; loan characteristics; and businesses/project characteristics. In this study, there were nine explanatory variables:

- Six in the group of borrower characteristics, namely, age (AGE), gender (GEN), education level (EDUC), marital status (MSTA), nationality (NAT), and employment status (EMPL)
- Two in the group of loan characteristics, namely, loan amount (AMNT) and loan period (PERI)
- One for businesses/project characteristics, namely, activity sector (SECT)

As we wanted not only to study the impact but also the effect of the different categories (of marital status, age and business activity sector) on repayment we tested a hypothesis for each value that each variable can take (instead of testing one hypothesis for each variable). As such, we tested two hypotheses for age, six for marital status and three for business activity sector.

Tables 1 and 2 show the explanatory variables associated with each research hypothesis, their definition, categories, and, whenever possible, the expected sign of the relationship.

This paper uses an ordered logistic regression (OLR) with a dependent variable with four discrete meaningful sequential ordered categories. Both logistic regression and ordered logistic regression differ with calculations of probabilities. Logistic regression assigns probabilities that a variable will take on a specific value (normally 0 or 1), while ordered logit assigns probabilities that values will fall below a certain threshold. Based on the four qualitative responses of the final status of borrowers' microcredit process, the dependent variable falls into one of four categories – repaid with loan guarantee funds (R = 0) to repaid in advance (R = 3) – it is possible to claim that the logistic regression is less desirable than the OLR because this one accommodates the four categories (Amemiya 1981; Greene 2012).

3.2 Sample

The sample data were obtained from the ANDC, the main microcredit institution in Portugal. The data initially comprised a sample of about 2060 microcredit processes managed by ANDC, in the period spanning from 1999 to 2015, containing the information provided while always maintaining borrowers' anonymity. The data about these microentrepreneurs and their microcredit processes includes age, gender, education level, marital status, nationality, employment status, loan amount, interest rate, loan repayment period, business/project activity sector, and the final repayment situation of the microcredit process.

Subsequently, some microcredit processes were found to be missing information, or the data did not follow the initially defined assumptions. Therefore, the data obtained was first filtered, excluding, among other aspects, the interest rate and still on-going microcredit processes (i.e., still to be credited). This filtering resulted in a final sample of 752 borrowers, which was judged representative of the study universe of all microcredit loans granted in Portugal.

3.3 Estimation methodology

Through an analysis of ordinal dependent variables, estimation methods apply the ordering of categories, providing almost equal results if the categories comprise an

Table 1 Explanatory variables and hypotheses: definition, category, and expected sign

Variable	Symbol	Definition of variables	Hypotheses	Category	Expected sign
Age	AGE	This is the age of borrowers at the grant date of the microcredit. The variable was defined according to Baklouti's (2013) predictions and conclusions. Thus, three groups were delineated:[a] - Younger borrowers (under 25 years old) - Older borrowers (more than 45 years old) - Middle-aged borrowers (between 25 and 45 years old)	**H1**: Ages under 25 and more than 45 years old have a positive effect on repayment.	1 for younger and older borrowers and 0 for middle-aged borrowers	(+)
			H2: Ages between 25 and 45 years old have a negative effect on repayment.	1 for middle-aged borrowers and 0 for younger and older borrowers	(−)
Gender	GEN	This includes male or female gender.	**H3**: Female gender has a positive influence on repayment.	1 for female and 0 for male	(+)
Education level	EDUC	This comprises the academic degree that borrowers indicate in their application form in the ANDC microcredit program. Based on the education level categories defined by Addisu (2006) and Baklouti (2013), as well as on the data provided by the ANDC, this variable was divided into three categories: - Lower education levels (primary education) - Intermediate education levels (high school)	**H4**: Education level has a positive influence on repayment.	2 for higher education, 1 for intermediate education, and 0 for lower education	(+)

Table 1 (continued)

Variable	Symbol	Definition of variables	Hypotheses	Category	Expected sign
		- Higher education levels (university)			
Marital status	MSTA	This is the marital status of borrowers at the time they handed in their application to the ANDC microcredit program. According to the sample obtained, six categories are possible: married, committed, single, divorced, separated, and widower/widowered.	**H5**: Married status has an effect on repayment.	1 for married borrowers and 0 for others	(+)
			H6: Committed status has an effect on repayment.	1 for committed borrowers and 0 for others	(+)
			H7: Single status has an effect on repayment.	1 for single borrowers and 0 for others	(−)
			H8: Divorced status has an effect on repayment.	1 for divorced borrowers and 0 for others	(−)
			H9: Separated status has an effect on repayment.	1 for separated borrowers and 0 for others	(−?)
			H10: Widowed/widowered status has an effect on repayment.	1 for widower/widowered borrowers and 0 for others	(−)

(+) = positively associated with borrowers' repayment rate; (−) = negatively associated with borrowers' repayment rate

[a] age and age^2 as continuous variables

Table 2 Explanatory variables and hypotheses: Definition, category, and expected sign

Variable	Symbol	Definition of variables	Hypotheses	Category	Expected sign
Nationality	NAT	This is Portuguese or non-Portuguese nationality.	**H11**: Portuguese nationality has a positive influence on repayment.	1 for Portuguese citizens and 0 for foreigners	(+)
Employment status	EMPL	According to the employment status indicated by borrowers on their application form, this variable is divided up to take into account if there is a source of extra income or not. As such, there are borrowers with extra-business professional income and borrowers without this.	**H12**: An extra-business source of professional income has a positive influence on repayment.	1 for paid occupations and 0 for unpaid occupations	(+)
Loan amount	AMNT	This concerns the loan amount granted to microcredit beneficiaries.	**H13**: A relationship exists between loan amount and loan repayment.	In euros	(−)
Loan period	PERI	This comprises the period, in months, in which the total amount of loans has to be repaid.	**H14**: A relationship exists between loan period and loan repayment.	In months	(+)
Business activity sector	SECT	Portuguese micro firms belong to different economic sectors, and their activity is classified according to the Statistical Classification of Economic Activities in the European Community (NACE) code. This variable corresponds to the NACE sector in which the microcredit project/business was involved. It is divided into three categories:- Primary sector (agriculture, livestock, hunting, forestry, and fishing) - Secondary sector (manufacturing activities, construction, and energy production) - Tertiary sector (trade, tourism, transportation, and financial activities)	**H15**: The primary sector influences repayment.	1 for the primary sector and 0 for others	(±)
			H16: The secondary sector influences repayment.	1 for the secondary sector and 0 for others	(+)
			H17: The tertiary sector influences repayment.	1 for the tertiary sector and 0 for others	(+)

(+) = positively associated with borrowers' repayment rate; (−) = negatively associated with borrowers' repayment rate

order from highest to lowest or vice versa (Agresti 2007). Thus, since this study sought to evaluate the relationships between an ordinal response variable and several explanatory variables, an ordered logistic regression model was applied as defined by the following equation:

$$\ln\left(R_j^{'}\right) = \ln\left(\frac{\pi_j(x)}{1-\pi_j(x)}\right) = \\ = \alpha_j - \beta_1 \times AGE - \beta_2 \times GEN - \beta_3 \times EDUC - \beta_4 \times MSTA - \beta_5 \times NAT - \beta_6 \times EMPL - \beta_7 \times AMNT \\ - \beta_8 \times PERI - \beta_9 \times SECT \quad (1)$$

where j=categories of the explained variable (0, 1, 2, and 3); β= coefficient of the explanatory variables; and R= the dependent variable represented by four ordered categories.

In addition to the estimated coefficients, the analysis also gave the odds ratio values for each independent variable, which are the proportional odds ratios of the ordered logit model presented in this paper. The odds ratio complements the information provided by the coefficients of the independent variables, comparing the relative odds of exposure of borrowers' repayment performance based on the exposure of each independent variable.

We expect loan repayment to be influenced by variables such as age, loan amount or loan period, among others. However, as we have only one observation for each entrepreneur for each variable, and since the information regarding loan repayment was obtained at the end of the project, we do not expect bidirectional causality problems.

4 Results

A descriptive analysis was based on the collected data on 752 microcredit processes.

Table 3 contains the descriptive statistics for the hypotheses formulated for each explanatory variable and the Pearson's chi-square test (χ^2). In regard to Hypothesis 1 and 2 (H1 and H2), the sample is composed mostly of younger and older borrowers. Concerning gender (H3), borrowers are mostly female. Education level (H4) results indicate that most borrowers have an intermediate level of education, specifically a high school education. Relative to marital status—Hypotheses 5, 6, 7, 8, 9, and 10—the sample comprises, mainly, single borrowers. The variable nationality (H11) shows that most borrowers have Portuguese nationality. As for employment status or Hypothesis 12, unpaid extra-business activities characterize the majority of the sample. The average loan amounts granted is about €6076.90, and the average repayment period is approximately 40 months. As for the business activity sector—Hypotheses 15, 16, and 17—most activities fall within the tertiary sector. Finally, regarding the final repayment status, loans are mostly repaid within the agreed repayment period.

The Pearson's chi-square test (χ^2) can be used to verify whether a relationship exists between any two categorical variables. Table 4 shows that education level (H4) has a statistically significant relationship with loan repayment, at a 5% significance level. There is also a statistically significant relationship between single marital status and loan repayment (H7) and between employment status and borrowers' repayment performance (H12).

Table 3 Descriptive analysis and chi-square values of hypotheses

Variables	Hypotheses	N	Average	Median	Std. Dev.	Min.	Max.	χ^2 Value	*p* value
Age	H1	752	0.327	0	0.470	0	1	2.2705	0.518
	H2	752	0.673	1	0.470	0	1	2.2705	0.518
Gender	H3	752	0.505	1	0.500	0	1	1.2953	0.730
Educational level	H4	752	0.666	1	0.705	0	2	16.1157	0.013
Marital status	H5	752	0.247	0	0.432	0	1	4.6499	0.199
	H6	752	0.048	0	0.214	0	1	4.4269	0.219
	H7	752	0.493	0	0.500	0	1	7.5336	0.057
	H8	752	0.169	0	0.375	0	1	2.1134	0.549
	H9	752	0.028	0	0.165	0	1	1.2726	0.736
	H10	752	0.015	0	0.120	0	1	1.5631	0.668
Nationality	H11	752	0.945	1	0.227	0	1	5.1503	0.161
Employment status	H12	752	0.424	0	0.495	0	1	7.3241	0.062
Loan amount	H13	752	6076.896	6000	2178.751	1000	12,500	§	§
Loan period	H14	752	40.298	36	6.086	15	60	§	§
Business activity sector	H15	752	0.027	0	0.161	0	1	2.6096	0.456
	H16	752	0.150	0	0.358	0	1	5.3129	0.150
	H17	752	0.823	1	0.382	0	1	5.4174	0.144
Y (Repayment)		752	1.789	2	0.574	0	3		

H1 (middle-age = 0; younger and older = 1), H2 (younger and older = 0; middle-age = 1), H3 (male = 0; female = 1), H4 (low = 0; intermediate = 1; high = 2), H5 (others = 0; married = 1); H6 (others = 0; committed = 1); H7 (others = 0; single = 1); H8 (others = 0; divorced = 1); H9 (others = 0; separated = 1); H10 (others = 0; widowed = 1); H11 (foreign citizens = 0; Portuguese nationality = 1); H12 (unpaid occupation = 0, paid occupation = 1); H13 (euros); H14 (months); H15 (others = 0; primary sector = 1); H16 (others = 0; secondary sector = 1); H17 (others = 0; tertiary sector = 1)

The hypotheses concerning AMNT and PERI were not included in the correlation test because they are continuous and non-categorical variables

Table 4 Description of the sample based on the determinants and repayment categories

	Concluded with guarantee (0)			Overdue (1)			Repaid (2)			Repaid in Advance (3)		
	Average	Std. Dev.	Min|Max	Average	Std. Dev.	Min|Max	Average	Std. Dev.	Min|Max	Average	Std. Dev.	Min|Max
Age	34.792	9.735	20 | 56	35.066	10.792	18 | 59	36.181	10.631	18 | 72	36.154	13.515	18 | 58
Gender	0.438	0.501	0 | 1	0.540	0.502	0 | 1	0.506	0.500	0 | 1	0.539	0.519	0 | 1
Educational level	0.563	0.580	0 | 2	0.605	0.634	0 | 2	0.670	0.717	0 | 2	1.231	0.725	0 | 2
Marital status	1.896	1.016	0 | 5	1.671	0.999	0 | 4	1.720	1.207	0 | 5	1.692	1.109	0 | 3
Nationality	0.875	0.334	0 | 1	0.947	0.225	0 | 1	0.951	0.216	0 | 1	0.923	0.277	0 | 1
Employment status	0.313	0.470	0 | 1	0.329	0.473	0 | 1	0.447	0.498	0 | 1	0.308	0.480	0 | 1
Loan amount	5712.473	2052.75	1010.69 | 10,564	7111.22	2215.322	1000 | 10,000	5927.665	2121.582	1000 | 12,500	8435.385	2263.318	5000 | 12,500
Loan period	38.75	5.097	36 | 48	42.263	6.174	30 | 48	40.013	6.054	15 | 60	48	0	48 |48
Business activity sector	1.896	0.309	1 | 2	1.868	0.411	0 | 2	1.781	0.476	0 | 2	1.769	0.599	0 | 2
	$N = 48$			$N = 76$			$N = 615$			$N = 13$		

The explanatory variables in this table are represented by categories, namely: GEN (male = 0; female = 1); EDUC (low level = 0; intermediate level = 1; high level = 2); MSTA (married = 0; committed = 1; single = 2; divorced = 3; separated = 4; widowed = 5); NAT (foreigner citizen = 0; Portuguese citizen = 1); EMPL (unpaid "extra-business" occupation = 0; paid "extra-business" occupation = 1) and SECT (primary sector = 0; secondary sector = 1; tertiary sector = 2)

Age (AGE), loan amount (AMNT) and loan period (PERI) are continuous variables

There are no statistical significant differences between categories 0 (concluded with guarantee) and 2 (Repaid) for the mean values of AGE, LOAN AMOUNT and LOAN PERIOD

There are statistically significant differences between categories 1 (overdue) and 2 (Repaid) for the mean values of LOAN AMOUNT and LOAN PERIOD

There are statistically significant differences between categories 1 (overdue) and 3 (Repaid in Advance) for the mean values of LOAN AMOUNT and LOAN PERIOD

There are statistically significant differences between categories 2 (Repaid) and 3 (Repaid in Advance) for the mean values of LOAN AMOUNT and LOAN PERIOD

Other characteristics of the sample are presented in Table 4.

Regarding the final repayment status of the 752 microcredit processes, 48 (6%) loans were repaid with loan guarantee funds, 76 (10%) were overdue, 615 (82%) were repaid, and 13 (2%) were repaid in advance (see Table 4). Table 4 gives detailed information about the sample, in particular regarding the explanatory variables and different defined categories, which include the final repayment status. Regarding this final status, 615 loans were repaid within the agreed period. However, there were 124 borrowers who defaulted or had difficulties during the loan repayment process.

Although a continuous variable, age (AGE) was classified in this study as categorical (following, e.g., Baklouti 2013). The average age is quite similar for the different categories of the dependent variable. Concerning gender (GEN), the number of male borrowers is larger than females only in the category comprising microcredit processes repaid with loan guarantee funds. Regarding education level (EDUC), most borrowers had attended or were attending high school. As for marital status (MSTA), most borrowers were single. In regard to nationality (NAT), the sample is composed mainly of borrowers with Portuguese nationality, as shown in Table 4. As for employment status (EMPL), the sample includes a greater number of borrowers who did not have another extra-business source of income.

The amounts granted (AMNT) varied between €1000 and €12,500, with the highest average (€8435.39) related to microcredit processes in which loan repayment had been made in advance, before the repayment period finished. In contrast, the lowest average of the amount granted was €5712.47, being associated with microcredit processes repaid with loan guarantee funds (i.e., defaults). As for repayment period (PERI), this varied between 15 and 60 months, with the lowest average of 39 months corresponding to the final repayment status of default (i.e. repaid with loan guarantee funds). Notably, all the 13 loans repaid in advance had a repayment period of 48 months. Regarding the business activity sector (SECT), the sample is mainly composed of microenterprises of the tertiary sector.

The ordered logistic regression (OLR) results are shown in Table 5. Of the nine explanatory variables, five are statistically significant: education level (EDUC); marital status (MSTA), nationality (NAT); employment status (EMPL); and business activity sector (SECT). The existence of the nine models is justified as there are hypotheses that were formulated based on the same variables but with different categories—as is the case of age (AGE), marital status (MSTA), and business activity sector (SECT)—as we wanted to test these different categories on repayment. As such, those variables and the hypotheses could only be included one at a time in the applied regression. Moreover, it was necessary to estimate the coefficients of the variables used to test more than one hypothesis. Notably, the signs of the coefficients of the other remaining variables stay the same in all the proposed models in which a given variable is calculated. The Prob>chi2 indicator is always lower than 0.05, indicating that all the coefficients presented in the models are always different from zero.

Regarding the p value, education level is the main factor that influences borrowers' repayment performance. The next most important factors are marital status, employment status, nationality, and business activity sector.

The ordered logit model assumes that the distance between each category of the outcome is proportional or equivalent (i.e., proportionality assumption). Violating this assumption may influence conclusions. Since this assumption is often violated in

Table 5 Estimation results of borrower repayment performance: OLR model

		Model 1			Model 2			Model 3			Model 4			Model 5
Var.	Hyp.	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.
Age	H1	−0.02840	0.972004	−0.14				−0.02598	0.9743534	−0.13	−0.01474	0.9853702	−0.07	−0.07075
	H2				0.02840	1.028802	0.14							
Gender	H3	0.08572	1.089504	0.45	0.08572	1.089504	0.45	0.10168	1.107029	0.53	0.06285	1.064872	0.33	0.06623
Educational level	H4	0.39875	1.489959	2.72*	0.39875	1.489959	2.72*	0.40745	1.50298	2.78*	0.39722	1.487685	2.72*	0.33800
Marital status	H5	0.51550	1.674477	2.18**	0.51550	1.674477	2.18**	0.52234	1.685974	2.20**	0.52677	1.69345	2.22**	
	H6													−0.27073
	H7													
	H8													
	H9													
	H10													
nationality	H11	0.66200	1.938674	1.71***	0.66200	1.938674	1.71***	0.64706	1.909919	1.67***	0.62195	1.862562	1.61	0.57437
Employment status	H12	0.38645	1.47174	1.95***	0.38645	1.47174	1.95***	0.37669	1.457448	1.90***	0.37686	1.457701	1.90***	0.42719
Loan amount	H13	−0.00008	0.9999207	−1.53	−0.00008	0.9999207	−1.53	−0.00008	0.9999176	−1.59	−0.00010	0.9999036	−1.85***	−0.00007
Loan period	H14	0.01606	1.016193	0.89	0.01606	1.016193	0.89	0.01761	1.017761	0.97	0.01962	1.019812	1.08	0.01466
Business activity sector	H15										0.93200	2.539571	1.32	
	H16	0.50102	1.650398	1.70***	0.50102	1.650398	1.70***							0.50881
	H17							−0.59938	0.5491531	−2.16**				
/cut1		−1.31621			−1.2878			−1.85049			−1.36990			−1.55976
/cut2		−0.22988			−0.20148			−0.76272			−0.28514			−0.47870
/cut3		5.60470			5.63310			5.08764			5.53923			5.32042
Number of observations		752			752			752			752			752
LR chi2(9)		22.59			22.59			24.50			21.49			17.97
Prob > chi2		0.0072			0.0072			0.0036			0.0106			0.0355
R2		0.0234			0.0234			0.0254			0.0223			0.0186

Table 5 (continued)

		Model 1			Model 2			Model 3			Model 4			Model 5
Var.	Hyp.	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.
Log-likehood		−471.4074			−471.4074			−470.4503			−471.9570			−473.7168
Brant Test	chi2	16.22			16.22			15.25			14.62			19.98
	$p > \text{chi2}$	0.300			0.300			0.361			0.263			0.131
	df	14			14			14			12			14

	Model 5		Model 6			Model 7			Model 8			Model 9		
Var.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z
Age	0.9316929	−0.35	−0.04437	0.9566012	−0.22	−0.08126	0.9219555	−0.40	−0.06557	0.9365345	−0.32	−0.06666	0.9355151	−0.33
Gender	1.068473	0.35	0.02894	1.029358	0.15	0.0457	1.046748	0.24	0.05827	1.060001	0.30	0.06810	1.070475	0.36
Educational level	1.402139	2.35**	0.43810	1.549766	2.95*	0.34809	1.416362	2.42**	0.34461	1.411434	2.39**	0.33759	1.401564	2.35**
Marital status														
	0.7628247	−0.61												
			−0.59498	0.5515727	−2.97*									
						0.36159	1.435606	1.32						
									0.44649	1.562823	0.71			
												0.19847	1.219507	0.22
nationality	1.776013	1.49	0.68224	1.978299	1.76***	0.58000	1.786041	1.51	0.58743	1.799365	1.53	0.60012	1.822328	1.56
Employment status	1.532944	2.15**	0.34859	1.417074	1.75***	0.41446	1.513556	2.10**	0.40753	1.503108	2.06**	0.41547	1.515077	2.10**
Loan amount	0.9999311	−1.33	−0.00008	0.9999246	−1.46	−0.00007	0.9999341	−1.27	−0.00007	0.9999299	−1.36	−0.00007	0.999931	−1.33
Loan period	1.014767	0.81	0.01766	1.017822	0.98	0.01467	1.01478	0.81	0.01663	1.016773	0.92	0.01574	1.01586	0.87

Table 5 (continued)

	Model 5		Model 6			Model 7			Model 8			Model 9		
Var.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z	Coef.	Odds Ratio	z
Business activity sector														
	1.663317	1.73***	0.47056	1.600894	1.60	0.49815	1.64566	1.69***	0.51174	1.668193	1.74***	0.49575	1.641732	1.68***
/cut1	−1.55976		−1.675396			−1.48127			−1.45672			−1.48061		
/cut2	−0.47870		−0.58661			−0.40043			−0.37600			−0.40044		
/cut3	5.32042		5.280531			5.412807			5.425841			5.39709		
Number of observations	752		752			752			752			752		
LR chi2(9)	17.97		26.63			19.44			18.15			17.67		
Prob > chi2	0.0355		0.0016			0.0217			0.0335			0.0392		
R2	0.0186		0.0276			0.0201			0.0188			0.0183		
Log-likehood	−473.7168		−469.389			−472.9805			−473.6291			−473.8699		
Brant Test	19.98		15.01			15.20			14.63			14.63		
	0.131		0.377			0.365			0.263			0.263		
	14		14			14			12			12		

***, ** and * symbolize significance levels of 10, 5 and 1% respectively. Complementing this information, we also provide the Z scores

Statistical significance patterns are similar when: a) using logs instead of levels in the continuous variable – loan amounts (AMNT); b) using a continuous version of the variable age, jointly with the inclusion of squared age. Tables with these results are available from the authors upon request

The nine models were defined based on the existence of the different categories of the following variables: models 1 and 2 for age (AGE), models 5, 6, 7, 8 and 9 for marital status (MSTA), and models 3 and 4 for business activity sector (SECT)

practice, it is necessary to test if this assumption holds, which can be done using a Brant test. Therefore, in the present study, in order to test whether the proportional odds assumption holds, a Brant test was used, the results for which are presented in Table 5. As the variables loan size (H13) and repayment period (H14) are continuous variables, they were not included in the Brant test. Based on the values presented in Table 5 for each model, the conclusion was reached that the parallel regression assumption was not violated since the *p* value is always greater than 0.05. This indicates that the influence of each categorical independent variable is proportional across each category of the dependent variable.

To complement our analysis with a more commonly used binary model, the results obtained when applying a logit regression are shown in Table 6 (only applied to model 1). However, as the statistical significance patterns are similar when comparing the regression results of OLR and Logit models, the discussion of results will focus on the model that allows a more detailed discussion – OLR.

Table 6 Estimation results of borrower repayment performance: Logit model

		Model 1	
Var.	Hyp.	Coef.	z
Age	H1	−0.00256	−0.01
	H2		
Gender	H3	0.06426	0.751
Educational level	H4	0.34421	2.24**
Marital status	H5	0.55098	2.13**
	H6		
	H7		
	H8		
	H9		
	H10		
Nationality	H11	0.73228	1.87***
Employment status	H12	0.45388	2.14**
Loan amount	H13	−0.00013	−2.31**
Loan period	H14	−0.00195	−0.10
Business activity sector	H15		
	H16	0.66081	1.93***
	H17		
Intercept		1.17823	1.58
Number of observations		752	
LR chi2(9)		27.57	
Prob > chi2		0.0011	
Pseudo R2		0.0409	
Log-likehood		−322.881	

***, ** and * represent symbolize significance levels of 10, 5 and 1%, respectively. Complementing this information, we also provide the Z scores

5 Analysis and discussion of results

The analysis and discussion of results are presented below by analyzing each variable according to borrowers' individual characteristics and loan and business/project characteristics.

5.1 Borrowers' individual characteristics

5.1.1 Age

The results show that H1 and H2 are not statistically significant. The present results are different from those obtained in other studies (Boyle et al. 1992; Reinke 1998; Özdemir 2004; Addisu 2006; Brehanu and Fufa 2008; Roslan and Karim 2009; Baklouti 2013). As mentioned previously, Reinke (1998) found that younger borrowers have a higher chance of defaulting as they tend to continue to search for new job opportunities and do not give first priority to their business. Older borrowers have a lower chance of having difficulty repaying their loan because of their more extensive work experience from previous jobs or businesses, increased risk aversion, and greater wealth accumulated during their life.

5.1.2 Gender

The results also show that gender is not statistically significant. Based on D'Espallier et al.'s (2011) research, a stronger effect of the variable gender was expected, especially because the ANDC is a non-profit organization whose microcredit loans are granted in the form of individual loans. The results contradict the idea that female borrowers represent a higher credit risk for MFIs than male borrowers do, as found by Khandker et al. (1995).

5.1.3 Education level

As shown by the results for Model 1, education level is a statistically significant variable, at a level of confidence of 99%. This is confirmed by H4's odds ratio of approximately 1.49. Thus, the higher borrowers' education level, the higher their ability is to repay their loan, which agrees with findings in the literature (Arene 1992; Bhatt and Tang 2002; Addisu 2006; Oke et al. 2007; Oladeebo and Oladeebo 2008; Umamuefula et al. 2012; Baklouti 2013; Wongnaa and Awunyo-Vitor 2013; Pasha and Negese 2014) as the higher the education level, the more prepared borrowers are to understand complex information, maintain business records, and carry out cash-flow analyses in order to make the most advantageous and profitable business decisions more easily.

5.1.4 Marital status

The results in Table 5 support the conclusion that H5 and H7, both related with marital status, are statistically significant. From the signs of their coefficients, H5

clearly indicates, at a confidence level of 95%, that being married (i.e., having a spouse) has a positive influence on borrowers' repayment performance. Conversely, H7 indicates, at a confidence level of 99%, that single status has a negative influence on repayment performance. The results are confirmed by the odds ratio, which demonstrates that single borrowers have higher odds of defaulting.

These results are consistent with Baklouti's (2013) and Vogelgesang (2003) findings that show that single borrowers tend to be less responsible than married ones do. Likewise, the present results also reinforce Carling et al. (1998) and Jacobson and Roszbach's (2003) results, which demonstrate that married borrowers tend to repay loans faster.

The results shown in Table 5 contradict Dinh and Kleimeier (2007) and Wongnaa and Awunyo-Vitor's (2013) research, which supports the conclusion that married borrowers have a higher default rate, as they have more dependent children. One possible explanation for these divergent results might be that Portugal has one of the lowest birth rates in the world.

5.1.5 Nationality

According to Model 1's results in Table 5, nationality has a statistically significant positive coefficient, at a significance level of 0.10, which confirms H11. Based on the odds ratio of 1.94, Portuguese borrowers can be said to have higher odds of repaying loans without particular difficulty or defaulting, compared with foreign borrowers. This may be explained by the fact that many foreigners are in a more difficult financial situation, being characterized by higher labor vulnerability, as well as facing linguistic and cultural barriers that, in turn, can contribute to a more difficult relationship with credit institutions (Dias et al. 2009).

5.1.6 Employment status

Model 1's results (see Table 5) show that employment status (EMPL) has a positive coefficient that is statistically significant, at a significance level of 0.10, which confirms H12. When the odds ratio is taken into account, extra-business income has a positive influence on borrowers' repayment performance, as they are more easily able to repay their microcredit loan, which is in accordance with certain literature (Mashatola and Darroch 2003; Vogelgesang 2003; Brehanu and Fufa 2008; Ojiako and Ogbukwa 2012; Idoge 2013; Wongnaa and Awunyo-Vitor 2013).

5.2 Loan characteristics: loan size and loan period

As shown in Model 1 in Table 5, loan size (AMNT) and Repayment period (PERI) are not statistically significant in explaining borrowers' repayment performance.

5.3 Business/Project characteristics

Based on the results shown in Table 5, H16 and H17 are shown to be statistically significant at the 0.10 to 0.05 significance level, respectively. Thus, the secondary sector (H16) positively influences borrowers' repayment performance, a finding

further supported by a positive odds ratio. These results are in agreement with Roslan and Karim (2009), who state that loan repayment can be influenced by the business sector of microenterprises because of the different levels of risk associated with different types of projects. Moreover, the present results confirm Baklouti's (2013) conclusion that tertiary sector (i.e., services) projects have a higher probability of defaulting on loans.

The primary sector's effect, represented by H15, is not statistically significant, which might be due to the small number of microenterprises from this sector included in the sample. However, the coefficient is positive, as was the case in Baklouti (2013) and Van Gool et al.'s (2012) studies.

5.4 Ordered logit marginal effects

As this ordered logit model has a dependent variable with four meaningful sequential ordered categories, it was calculated the marginal effects on the categories of the dependent variable provoked by changes in independent variables. This gives an important and differentiated information when compared with traditional logistic models widely used on microcredit repayment literature.

The results of marginal effects applied to the ordered logit model 1, and limited to the statistically significant variables, are:

(a) an increase in the education level:

- decreases the probability of the microcredit beneficiaries fall in the repaid with loan guarantee funds ($R = 0$) and overdue ($R = 1$) repayment categories by 2 and 3%, respectively;
- augments the probability to fall in the repaid ($R = 2$) and repaid in advance ($R = 3$) categories by 5 and 1%, respectively;

(b) an increase in the marital status (from other status to a married marital status):

- decreases the probability of the microcredit beneficiaries fall in the repaid with loan guarantee funds ($R = 0$) and overdue ($R = 1$) repayment categories by 3 and 4%, respectively;
- augments the probability to fall in the repaid ($R = 2$) and repaid in advance ($R = 3$) categories by 5 and 1%, respectively;

(c) an increase in the nationality variable (from foreigners to Portuguese citizens):

- decreases the probability of the microcredit beneficiaries fall in the repaid with loan guarantee funds ($R = 0$) and overdue ($R = 1$) repayment categories by 5 and 6%, respectively;
- augments the probability to fall in the repaid ($R = 2$) and repaid in advance ($R = 3$) categories by 10 and 1%, respectively;

(d) for an unit increase in the employment status (from unpaid occupations to paid occupations):

- decreases the probability of the microcredit beneficiaries fall in the repaid with loan guarantee funds (R = 0) and overdue (R = 1) repayment categories by 2 and 3%, respectively;
- augments the probability to fall in the repaid (R = 2) and repaid in advance (R = 3) categories by 4 and 1%, respectively;

(e) for an unit increase in the business activity sector variable (from others to a secondary sector):

- decreases the probability of the microcredit beneficiaries fall in the repaid with loan guarantee funds (R = 0) and overdue (R = 1) repayment categories by 2 and 4%, respectively;
- augments the probability to fall in the repaid (R = 2) and repaid in advance (R = 3) categories by 5 and 1%, respectively.

These results can also be confirmed through the odds ratios of the aforementioned variables.

6 Conclusions

The above-discussed results indicate that education level, marital status, nationality, employment status, and business activity sector have a significant impact on borrowers' repayment performance. Education level has a positive influence on repayment performance, namely, the more extensive the academic qualifications of borrowers are, the better able they are to repay loans. Regarding marital status, the results show that single borrowers are less able than married borrowers to repay their microcredit loans. The nationality of borrowers has a significant impact on microcredit repayment, with Portuguese nationality having a positive influence on borrowers' repayment performance. In terms of employment status, extra-business sources of professional income have a positive effect on borrowers' ability to repay loans. As for business sector, the secondary sector has a positive impact on repayment processes, whereas the tertiary sector contributes negatively to borrowers' repayment performance. Therefore, while loan characteristics are not significant in explaining the determinants of microcredit repayment, borrower and business characteristics are.

This research's contribution is twofold. The first and most important is implications for those involved in academic and business activities to do with microcredit and social entrepreneurship, while the second contribution is to microcredit support institutions.

Although borrowers' needs have been addressed in emerging countries as if they were alike all over the world, there are differences that need to be explored to ensure an understanding of how contextual differences across countries, loan conditions, and project/business characteristics might influence microcredit beneficiaries. As mentioned previously, Portugal has MFIs and credit institutions that monitor borrowers closely. *Vis-à-vis* other developing or less developed countries, the differences in such practices might be substantial.

The characteristics of projects/businesses' activity sector lead to some particular results: manufacturing activities make positive contributions to microcredit repayment,

while service activities negatively affect microcredit repayment. This may be explained by the small crafting activities provided by the former, while the provision of services is apparently a riskier activity as there is plenty of alternative supply, which presents a complementary perspective vis-à-vis emerging economies.

Another important aspect is related to the fact that as opposed to what is quite common in less developed economies there is a gender balance in our sample, although there are no statistically significant differences in what pertains loan repayments.

Future research could usefully study other factors related to borrower, loan, and project/business characteristics, such as number of dependents, household income, and credit history, which may include information on defaults on previous loans. Other characteristics of interest are borrowers' microcredit information regarding possible current loans in other credit institutions, the difference between requested and granted loan size, possible multiple sources of microentrepreneurs, and loan interest rates and grace periods. Further factors to study could include opportunity or transaction cost, which comprises the period between the microcredit application and the granting of the loan; geographical proximity between borrowers' businesses and MFIs; borrowers' business revenue; the number of microenterprise owners; and contact frequency between MFIs and borrowers. Moreover, it is important to pave the way for new research comparing microcredit borrowers from developed and developing countries in order to understand some specificities that tend to be overlooked when analyzing emerging or developed countries independently.

This study has several limitations, but the most significant is related to the fact that the empirical evidence given in the literature focuses mainly on microcredit programs of less favored countries—where MFIs have adopted the group lending method—and on microenterprises whose activities fall within the agricultural sector. The present research was based on an individual lending approach used with mainly industrial and service microenterprises in Portugal, which makes it difficult to make direct comparisons with research done in less developed countries.

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