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The role of the Lendtech sector in the consumer credit market in the context of household financial exclusion

Abstract

Research background: According to the World Bank (2020), about 60% of adults in developing countries do not use formal financial services. Furthermore, according to the Polish Association of Loan Institutions (2022), about 3 million Poles use loans, most of them obtained online. Among the reasons for more than a decade of growth of interest in the non-bank consumer lending market there are the development of modern technology applications in finance and the establishment of the Lendtech sector.

Purpose of the article: The main goal of the paper is to verify the role played by the Lendtech (LT) sector in the consumer credit market in the context of household financial exclusion. The following research questions were asked: Do credit-excluded households take advantage of LT services and, if so, to what extent? What are the behaviours and preferences of those who use consumer credit offered by LT? Do socio-demographic characteristics determine consumer use of loans offered by LT and, if so, what are they? Is the use of loans offered by LT due to credit exclusion or other factors? What action should be taken by participants in the digital consumer loan market interested in its inclusive direction?

Methods: The paper uses the following methods: critical analysis of the literature, Kruskal-Wallis test, Mann-Whitney test, and nonparametric regression algorithm: k-nearest neighbors, as well as inductive inference methods. The data used is primary in nature and comes from a nationwide survey, September 2022 (CAWI method) of 1,200 Poles, of whom 200 respondents are Lendtech customers. The quota selection applied made it possible to reflect characteristics corresponding to the population of customers of lending institutions registered in BIK databases.

Findings & value added: The article is a pioneering study based on an independent scientific survey, devoted to the Polish LT services market considered in terms of its relationship with one of the types of financial exclusion: credit exclusion. The most important conclusion is that people at risk of credit exclusion find a financing substitute in the LT sector, and thus it plays an important role in reducing financial exclusion, while maintaining the principle of creditworthiness verification.

Introduction

Access to credit is commonly obstructed in the consumer segment. According to the World Bank (2020), approximately 60% of adults in developing countries do not use any formal financial services. At the most basic level, credit constraints may result from a lack of physical access to bank branches or lending institutions. More complex barriers may result from potential borrowers lacking appropriate documentation, failure to meet formal conditions and poor credit history (Pluskota, 2020).

For over a decade, the non-banking consumer loan market has noticeably developed in Poland, catalysed by the restrictive credit regulations of commercial banks that led to overregulation, development in the use of modern technologies in finance and the emergence of the financial technology segment (FinTech), along with the Lendtech segment (lending technology, digital lending) in the case of the loan sector. According to data from the Polish Association of Loan Institutions (2022), about 3 million Poles have taken out loans, most of them obtained online. When it comes to opting to take a loan outside the banking sector, the turning point for consumers may be a feeling of exclusion and a lack of opportunities to build a positive credit history with regular banks. This relates to the concept so-called discouraged borrower syndrome, whereby individuals do not even bother applying for loans because of their conviction that banks will reject them rather than an actual lack of creditworthiness (Kon & Storey, 2003; Chivakul, 2008). Another factor that piques consumer interest in the informal loan sector is the need for quick access to cash, which cannot always be achieved from the regulated market (banks). Therefore, the stereotypical perception of the average loan institution customer as a poorly educated, low-income person living in a smaller town and not using banking services (self-excluded or forcibly excluded by the banking system due to low income and/or bad credit history) should be verified when it comes to the LT segment.

Financial innovation in the form of new delivery channels for products and services has helped to push the boundaries of access to finance and thus boost the number of people who can benefit from external sources of finance. A review of the literature and an analysis of secondary data leads to the conclusion that the topic of non-bank loans (LT) has not yet been widely discussed in the literature. Worthy of note are some studies conducted by Jagtiani and Lamieux (2018) and Zhong and Jiang (2021), who

examined the issue from the perspective of alleviating credit exclusion for communities in underdeveloped areas. In addition, the issue of customer expectations in terms of loan services being met by companies outside the banking sector was raised by Adamek and Solarz (2023). The cited research prompted the authors to verify the popularity of the LT market and its impact on the level of credit exclusion, along with a customer profile description for the LT sector.

The main goal of the paper is to verify the role played by the LT sector in the consumer credit market in the context of household financial exclusion. The following research questions were asked: what are the behaviours and preferences of those who use consumer credit offered by LT? Do credit-excluded households take advantage of LT services and, if so, to what extent? Do socio-demographic characteristics determine consumer use of loans offered by LT and, if so, what are they? Is the use of loans offered by LT due to credit exclusion or other factors? What action should be taken by participants in the digital consumer loan market interested in its inclusive direction?

The paper uses the following methods: critical analysis of the literature, Kruskal-Wallis test, Mann-Whitney test, and nonparametric regression algorithm: k-nearest neighbors, as well as inductive inference methods.

The article consists of five parts. The first presents theoretical considerations on public access to credit products, the LT market, and obstacles blocking access to financing at banks — credit exclusion. The second part presents the methodology of the study, the methods used and a description of the research sample. Selected results of research on the subject are presented, which lead to a discussion on the topic of possible directions of research on obtaining external financing and possible relation (bank-Lendtech) now and in the future. In the conclusion section, the authors seek to answer the research questions related to the impact of LT loans on credit exclusion.

Literature review

Access to credit information and the ability to process information effectively determine how well an institution is able to compete on the credit market. Traditional banks, including local banks, have an advantage when

it comes to lending, based on credit information (relationships and credit information). Yet, research shows that in periods when financial stability has been disrupted, these banks lose their competitive advantage, which facilitates the entry of new entities into the market, as confirmed by the period after the Global Financial Crisis (Agarwal & Zhang, 2020). At that time, banks in many countries were deleveraging, which resulted in a reduction in their lending. On the one hand, this exacerbated credit exclusion and, on the other, it created a niche for new financial intermediaries (Havrylchyk *et al.*, 2019). The close relationship between financial development and its positive impact on the FinTech and BigTech lending market and further financial integration has also been noted by Ozili (2023).

According to the literature, financial exclusion deprives individuals of access to useful and affordable financial products and services that meet their needs, such as the need for transactions, payments, savings, affordable credit, and insurance (Gloukoviezoff, 2006). Caplan *et al.* (2021), in their critical review of literature on the subject of financial exclusion in OECD countries, indicate that many researchers consider access to cheap and appropriate short-term credit and/or loans to be a basic financial product for effective household finance management. Those deprived of access are referred to in the literature as 'credit excluded' (cf. Corrado & Corrado, 2017; Omojolaibi *et al.*, 2019). Researchers from around the world are seeking solutions to this problem, and one way to reduce its scale and severity is to use the potential of FinTechs (Escobar De Nogales, 2018), including FinTech lenders (Odinet, 2017; Katsamakas & Sánchez-Cartas, 2022; Balyuk, 2022).

The reasons for credit exclusion include: (a) inaccessibility due to a lack of branches in the place of residence, (b) insufficient creditworthiness resulting from low income or debt burden, (c) mismatch between what is offered and what the consumer needs, e.g. high costs, long waiting time for funds (cf. Domańska-Szaruga, 2015; Warchlewska, 2020). The intersection of finance and technology has made credit accessible to previously unbanked customers (Allen *et al.*, 2021). Jagtiani and Lemieux (2018) indicated that loans offered by the FinTech sector contribute to alleviating credit exclusion in areas with a lower density of banking outlets or in areas where economic mechanisms do not function properly locally.

At the same time, in this era of digitisation, the problem of access to credit services is inextricably linked to digital exclusion (Solarz & Adamek, 2022). The inability to take advantage of what credit product providers

offer may result from lack of Internet access or a network with poor data transmission quality. In addition, in the era of sustainable finance (ESG), it is necessary to evaluate the activities of loan institutions in terms of responsible consumer lending, with a view to social and ecological aspects (Deloitte, 2022; Burton, 2020).

Technological innovations in financial services mean that, on the one hand, the model of traditional financial intermediaries is being transformed (Gomber *et al.*, 2020; Bollaert *et al.*, 2021) and, on the other, they create new, changing needs and expectations of consumers with regard to the offer of financial products and services (Hodula, 2022; Babaei *et al.*, 2023). One may notice that the lending structure of modern non-banking entities has evolved into various forms (e.g., in the form of crowdfunding, BigTech services, loans on the LT market), which creates favourable conditions for the development of new business models increasingly supported by data science and artificial intelligence (Cao *et al.*, 2021). This refers in particular to the use of modern technologies to digitise at least some stages of granting a loan. Thanks to these processes, there is an opportunity to extend access to sources of financing for consumers who have so far been affected by credit exclusion. According to Ehrentraud *et al.* (2020), the FinTech sector can support economic growth and reduce exclusion from access to financial services.

Arslanian and Fischer (2019) list the FinTech revolution, along with the emergence of cryptocurrencies and artificial intelligence (AI), among the key areas of innovation that are having a huge impact on the current and future shape of the financial services ecosystem. The UN 2030 Agenda for Sustainable Development (UN-2030-ASD) and the G20 High-Level Principles for Digital Financial Inclusion (G20-HLP-DFI) emphasise the importance of harnessing the potential of FinTech to reduce financial exclusion and income inequality. This thesis is supported, inter alia, by research results by Demir *et al.* (2022) conducted on Global Findex data from 2011, 2014, 2017, on citizens from 140 countries. With the emergence of FinTech and BigTech companies offering alternative loans and credits, competition on the credit market changed (Kowalewski & Pisany, 2022). Adamek and Solarz (2023) presented the specificity of the FinTech lender market in the face of traditional financial institutions and consumer expectations. The literature contains studies on the role of FinTech companies in the provision of credit services — for example, granting and servicing loans (Danisewicz & Elard, 2018; de Roure *et al.*, 2019; Balyuk, 2019; Fuster *et al.*, 2019).

Di Maggio *et al.* (2022) demonstrated how the LT industry uses alternative data to assess creditworthiness. Earlier, Croux *et al.* (2020) also drew attention to these issues (including in the regulatory aspect). Researchers, looking for reasons behind the rapid development of this market, try to identify the motivation for using FinTech services (Ryu, 2018; Swacha-Lech & Solarz, 2021). Opportunities and threats related to the increased popularity of loans from outside the banking sector are also analysed (Waliszewski & Warchlewska, 2022; Haupert, 2022). Inter alia, it has been indicated that consumers may find it too easy to get into debt, which may lead to an uncontrolled increase in liabilities and growing difficulties in their repayment.

An important aspect how the LT sector functions (including in the light of competitiveness in relation to banks) is the extent to which it is regulated. Attention is drawn towards the significant disproportions in the rigours applicable to entities from the banking sector and non-bank entities providing online loans (Vives, 2017; Nguyen *et al.*, 2021). At the same time, the issue is usually viewed through the lens of guaranteeing consumer protection, generating social benefits and ensuring the stability of the entire financial system, although the possibility of ensuring the development of the FinTech market (including the LT segment) are also considered (Ebong & Babu, 2020; Sun *et al.*, 2023).

The type of FinTechs that focus on providing digital loans (FinTech lending) is referred to as LT or FinTech lenders. These are lenders that run the entire loan granting process remotely, without applicants having to contact a bank employee or visit a bank branch (Agarwal & Chua, 2020). In turn, Berg *et al.* (2021) define FinTech lending as lending using technology that improves customer-lender interaction or used to screen and monitor borrowers.

Researchers who analyse the role of LT on the financial market indicate that their services can be both a substitute and a supplement to the loans banks offer. At the same time, Di Maggio and Yao (2021) showed that FinTech lenders gain market share by lending first to higher-risk and then to lower-risk borrowers. Based on an analysis of data obtained from 78 countries between 2013–2019, Hodula (2022) indicates that in less stable and highly concentrated banking sectors FinTech lenders can act as direct competitors to banks and their services can substitute a bank loan, while in less concentrated, more liquid and more stable banking sectors, banks and FinTech lenders tend not to compete for the same clientele and coexist as complementary services. The complementary nature of LT loans has also

been noted by Bazarbash *et al.* (2020): while emphasising their role in filling the credit gap left by traditional lenders. Lendtechs contribute to an increase in total household debt (Li *et al.*, 2022) because, firstly, they supplement the market with quick, easily accessible, low-value short-term loans, thereby reaching a wide range of recipients, and secondly, LT also serves infra-marginal bank borrowers, increasing the circle of potential borrowers (Tang, 2019). Broadening access to loans for credit-excluded consumers, and thus the possibility of increasing consumption and their standard of living, is a positive aspect of LT as observed by Hughes *et al.* (2022) or Yang and Zhang (2022).

Addressing offers of loans to customers with lower income and/or unable to provide proof of earnings as the banks require, and so without sufficient creditworthiness to obtain a bank loan, is undoubtedly a sign that the scale of credit exclusion is being reduced, and here LTs can contribute. In addition, the results of research conducted by Jagtiani and Lemieux (2018) or Zhong and Jiang (2021) in China prove that digital loans solve the problem of lack of access to traditional, brick-and-mortar lenders, which, as mentioned above, is one of the reasons for credit exclusion.

Another extremely important aspect of using digital loans — as emergency funds for managing household finances — has been indicated by Ozili (2018). In turn, Suri *et al.* (2021) empirically prove that convenient, easy access to LT improves financial resilience, thereby reducing the likelihood of loss of financial liquidity in an event where funds need to be obtained quickly for sudden expenses resulting from unfortunate random incidents.

Yue *et al.* (2022) and Agarwal and Chua (2020), in addition to the positives related to the use of digital loans, such as the aforementioned possibility of increasing consumption or smoothing it out over time, also mention an increased risk of falling into a debt trap, which may lead to excessive debt and even credit exclusion. In addition, the literature raises the problem of predatory practices in FinTech lending (Palladino, 2021) or the lack of financial supervision over the operation of these entities (Jagtiani & Lemieux, 2017). Bartlett *et al.* (2022) evaluated whether customer discrimination also applies to loans from the FinTech sector, granted on the basis of a sophisticated algorithmic valuation. At the same time, however, modern technologies are seen as an opportunity to create new credit risk assessment models that will help to screen out opaque

borrowers, such as those with little or no credit history (Branzoli & Supino, 2020). In this context, Burton (2020) even writes about a new digital ecology comprising new digital entrants that use artificial intelligence, machine learning, and data mining. A fourfold framework provides a lens through which the new FinTech debt ecology is analysed: debt repayment, debt reporting, debt accounting, and debt prevention.

Research methods

In order to achieve the adopted research objective, the following research questions were formulated: Do credit-excluded households take advantage of LT services and, if so, to what extent? What are the behaviours and preferences of those who use consumer credit offered by LT? Do socio-demographic characteristics determine consumer use of loans offered by LT and, if so, what are they? Is the use of loans offered by LT due to credit exclusion or other factors? What action should be taken by participants in the digital consumer loan market interested in its inclusive direction?

The data used is primary in nature and comes from a nationwide survey, September 2022 (CAWI method) of 1,200 Poles, of which 200 respondents are LT customers. The quota selection applied made it possible to reflect characteristics corresponding to the population of customers of lending institutions registered in Credit Information Bureau databases. The basic characteristics of the research sample and the subsample of LT customers are presented in table 1. It should be noted that both populations are too similar in terms of questions asked in the metric to be used in a study using machine learning. However, they were used as a benchmark to compare them with models based on financial exclusion questions. The models were estimated using the k-nearest neighbors (KNN) method, and so questions were asked regarding financial exclusion (Table 2).

The paper uses the following methods: Kruskal-Wallis test (Kruskal & Wallis, 1952), Mann-Whitney test (Mann & Whitney, 1947), the k-nearest neighbors' nonparametric regression algorithm, as well as inductive inference methods.

Non-parametric tests were used due to the heterogeneity of the studied groups in terms of socio-demographic variables (sex, education,

material status). Their goal was to verify the impact of the discussed socio-demographic variables on the determinants for using a particular LT (Table 3). In the event of a significant difference, one may note that a given element was rated higher/lower by respondents from a given group. Significance was taken as $\alpha = 0.05$.

Regarding the k-nearest neighbors method, the set of data (of all explanatory variables) with appropriate labels (dependent variables) is divided into a training and testing group. The training group is used to prepare the model, which will then try to predict the label of each observation from the testing group. This is done by placing each object in a certain space and comparing it to its k-nearest neighbors. The test object is labeled depending on the labels of the neighbours. The accuracy of the model is estimated based on the number of correctly assigned labels in the testing set (Zhang *et al.*, 2017).

The KNN machine learning classification helped check whether the selected set of features was able to correctly classify each of the respondents into one of two groups (customers, non-customers). KNN classification is a supervised machine learning method where all labels (e.g. client/non-customer) of the explanatory variables are known. By using the explanatory variables in the learning trial, we can classify observations based on the characteristics of each label (variable), whereas the testing trial helps check whether the explanatory variables correctly classify variables to labels by comparing the result of the algorithm with the reality. We use explanatory variables to test whether a given person is or is not a LT customer. This means that if the explanatory variables have the ability to classify (high KNN algorithm score), then the explanatory variables differ in their respect.

Due to the disproportionate size of both groups, the following research algorithm was adopted. A random sample (a simple draw without exchange) of 200 non-customers was added to the group of 200 LT customers. The KNN algorithm was calculated based on the new population thus created (75% of the observations — the training group, 25% — the testing sample), for the given explanatory variables (Table 4) for k = 20 (the root of the sample size). This procedure was repeated five thousand times. The procedure was adopted as follows to compensate for the small sample of LT customers obtained in the study and to avoid overfitting the model. Each of the models, both in the group of socio-demographic data and financial exclusion, contains combinations of three variables. This number

was selected for both families of models on the basis of principal component analysis. In both groups, more than 75% of the variability was explained by the three main components. A total of eight models were created, four each for both socio-demographic factors and financial exclusion factors. Combinations of factors such as age, level of education, gender and income level were checked to see if they influence LT leanings, while in terms of financial exclusion the following impact was tested: historical interest in LT, number of simultaneously repaid liabilities, occurrence of repayment problems in the past, occurrence of loan refusal in the past.

Therefore, a decision was taken to use multi-factor models. Furthermore, such a choice facilitates observation on how the explanatory variables perform in different situations.

In order to achieve the objective set, the research questions presented in the introductory part of the article were asked.

Results

Characteristics of LT and non-LT customers as people seeking a source from which to finance their needs

In terms of the behaviour and preferences of people taking consumer loans offered by the LT market, customers of the non-bank loan market were discovered to have more liabilities (over 20% of respondents at the time of the study had three or more liabilities to repay, excluding mortgages) than customers who had only taken consumer loans in banks (Fig. 1)[1]. Respondents were also asked how they coped when additional household expenses occured that had not been budgeted for. Online loan customers were found to be more likely to incur additional liabilities from various sources, while non-LT customers primarily preferred to use their savings, reduce expenses or work more hours. A comparable and relatively high percentage of respondents from both groups indicated instalment purchases as a way of dealing with the situation (38–39%).

The LT market is not perceived as a final source of external capital, but as a quick and available source of financing (Fig. 2) and means of covering unexpected expenses or reluctance to postpone consumption for the future

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[1] The number of people with credit obligations in both subgroups was different. Among LT customers it was 66%, and among non-LT customers it was 29%.

(Fig. 3). The role of the LT sector in reducing financial exclusion results from the issue itself. Credit exclusion as a component of financial exclusion arises from the desire to incur debt. One cannot say that someone is credit excluded unless they have actually applied for a loan. It should be noted that non-LT customers are more likely to decide not to take out a loan even if they cannot make ends meet. Consumer approach to credit obligations turned out to be complex, as respondents who look down on non-bank loans would not be willing to take advantage of such services even in a situation of financial difficulties in everyday life (Fig. 4).

LT customers clearly had more problems with timely repayment of loans/bank loans taken out in various forms (including credit cards) than people who did not use online loans (Fig. 5). Over 60% of respondents from this group indicated that they had experienced such problems in the past, while less than 20% of non-LT consumers mentioned a similar scenario. In addition, customers active on the non-bank loan market were more often turned down when applying for a loan (Fig. 6).

Most often, the need to get into debt results from a situation where short-term expenses exceed household income. The natural step for a household in a time of short-term budget imbalance is to take from future income. Banks are the primary source of loans. On the other hand, techno-logical innovations and opportunities have resulted in the growth of the non-bank loans sector. The majority of customers in the LT sector have had their application for a bank loan rejected at least once (Fig. 6).

The reason for bank loan refusals was usually insufficient income, as well as bad credit history and arrears, and having too many other credit obligations (Fig. 7). However, in the case of non-LT customers, low earn-ings were much more relevant than the other two reasons (57% of reasons for refusals versus 40% for LT clients).

The activity of respondents in the non-banking market may be related to knowledge of the names of institutions offering buy-now-pay-later products (Figures 8 and 9). The most popular entities offering deferred payments include Allegro Pay (97%), PayPo (69%), Revolut (65%).

If the bank refuses to grant a loan, the consumer may decide not to bor-row money or look for an alternative source of financing, depending on the need to take out money. Therefore, the next stage of the study was to check how consumers cope in the event of a refusal (Fig. 10). It should be noted that more than three times as many non-LT customers borrowed money from family or friends. On the other hand, more than half decided to bor-

row from a loan institution. It can therefore be concluded that for most LT clients it was their first choice when it came to finding an alternative source of financing.

The competitiveness of LT on the loan market results from its widely perceived accessibility, particularly in terms of ease and speed of applying, fewer formalities, as well as the real possibility of obtaining financing. It should be emphasised that LTs grant relatively smaller sums than banks, hence the possibility of a better assessment of the debtor's ability to repay. The end result is a low percentage of rejected applications (Fig. 11). Among the respondents who had applied for LT loans, more than 75% were accepted. The high acceptance rate may result from a less restrictive approach to assessing creditworthiness. This is confirmed by the fact that LT customers had more significant problems paying their liabilities than non-LT clients (cf. Fig. 6). Over 60% of LT customers had problems paying off their debts.

A different approach to creditworthiness assessment algorithms, resulting in an increased number of applications accepted, may be one of the determinants of LT debt — the consumer, having been refused a loan by a bank, will submit an application to a non-bank loan institution as a next step. However, LT may be chosen due to other factors. Figure 12 shows the main reason for selecting LT as a source of financing needs. The results of the study show that the main determinant is accessibility, while only 22.5% of customers use LT services because they were rejected by the bank.

Non-parametric tests (Kruskal-Wallis test, Mann-Whitney test) showed that socio-demographic data: sex, education, material status among LT customers did not significantly differentiate the determinants of using a particular LT (Table 3). However, it is worth adding that LT services are most often used by respondents aged 25–34 and 35–44 years old, employed on a contract for an indefinite period and earning in the range of PLN 2,001–4,000 gross per month. Interestingly, LT sector customers had a higher share of people with secondary and higher education than among those who do not take out online loans. This could indicate that the stereotypical perception of customers from the non-banking sector as people with poor knowledge (including financial knowledge), and therefore unaware of the consequences of debts with institutions outside the regulated market, should now be abandoned. The largest group not using non-banking services comprised people aged 65+ (Table 1).

The significance of financial exclusion vs socio-demographic as a determinant of debt in the LT sector

In order to verify the significance of the role played by LT in the sector, a KNN machine learning model was used. Its purpose was to classify customers and non-customers. If the model, using factors related to financial exclusion, is able to classify correctly into the given groups — i.e., if a person manifesting signs of financial exclusion is classified as an LT client — then it can be assumed that LTs play an important role in reducing financial exclusion, while maintaining the rules of creditworthiness verification.

Table 4 presents the overall effectiveness of the models divided into two groups. The first contains models based on socio-demographic variables, the second on questions related to financial exclusion. The results presented are the average of five thousand trials expressed as a percentage — i.e., how often the models correctly classified customers and non-customers into their respective groups. The minimum and maximum results for each of the simulations are also presented. The smaller the difference between these values, the more stable the models are and less susceptible to random sampling. The standard deviation in the simulations (expressed in percentage points) is also given, as well as the effectiveness of the model itself in correctly classifying LT customers as LT customers. The point of dividing the models into two families should be noted. The models of the first family, containing socioeconomic data, set the benchmark for our research on financial exclusion. We assume that exclusion variables better distinguish LT customers from non-customers. The model results are as follows: models that use variables related to financial exclusion achieved better results than models relying on socio-demographic variables. They had a higher overall average among LT customers and a lower standard deviation, which indicates more stable and accurate models. Models for socio-demographic variables achieved an average success rate of 65%. The most effective model featured explanatory variables such as age, education and income. Financial exclusion models hit an average effectiveness of over 80%. The most effective model was model 2.2, which consisted of the following explanatory variables: history of interest in LT, number of simultaneously repaid liabilities, occurrence of repayment problems in the past.

It should be noted that the best results were achieved by models featuring a variable related to customer interest in the LT sector itself. However, even without it, the model based solely on data related to financial exclu-

sion achieved better results than any model built with socio-demographic variables. The model's accurate classification of LT customers also means that customers affected by financial exclusion may well find a substitute for financing in the LT sector.

It is therefore clear that both families of models are effective in predicting LT leanings[2]. However, family models of financial exclusion show significantly greater precision and these variables also describe LT clients much better than socioeconomic variables.

The variables in the socio-demographic models did not offer such an accurate prediction.

Discussion

The conducted analyses form part of the research on non-banking entities on the financial market that offer financial products and services to customers via online channels. The results obtained by the authors seem to be in line with the hypothesis put forward by Buchak *et al.* (2018), which indicates the key importance of technological changes in the process of the growing popularity of the online non-bank loans market. Jagtiani and Lemieux (2018) pointed out that millennials are an expanding group of consumers along with small business owners who report the need for credit. Thanks to their fascination with modern technology, they may feel more comfortable incurring liabilities online than by applying for a loan from a traditional bank. Similarly, in this study, the respondents considered the most common reasons for using LT: quick access to loan capital (53% of responses) and simple procedures (50%), rather than, for example, failure to obtain a loan from another source (22.5% of responses). The results of the authors' own research are therefore in line with Adamek and Solarz (2023) as to the main factors for the adoption of digital loans offered by the LT sector — namely, the perceived usefulness of the service. These authors, using the TAM (Technology Acceptance Model) model, considered the simplification of the necessary formalities and shortening the time needed to obtain money to be the most useful feature related to taking out LT loans — 76.43% of those questioned by them.

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[2] Assuming a random division of each variable into two categories as a benchmark, the expected value of effectiveness is 50%, therefore any result above this limit should be considered good.

At the same time, while analysing all the research material, another issue emerged, also mentioned in the literature — i.e., whether entities from the LT segment compete with banks for the same customers (Buchak *et al.*, 2018), or if they instead satisfy a demand for credit from people who cannot be satisfactorily handled by banks (Tang, 2019). The authors of this article, based on their own research, provide evidence that both of the above-mentioned theses are true in relation to the Polish respondents. This is because the 200 surveyed who have taken LT loans include both credit-excluded people (62.5% of whom were refused a bank loan) as well as those who have never experienced difficulties in obtaining a bank loan (29% of respondents). Therefore, it can be concluded that for the former, LT may substitute bank loans, while for the latter it will be complementary. A similar observation is made in a study by Di Maggio and Yao (2021), who analysed the development of the LT digital loan sector and additionally indicated that over time, the share of customers with a higher risk of insolvency decreases among total borrowers.

Another topic raised in this area is the issue of earlier refusals from banks to grant credit to customers who later take out loans via the online channel (Baeck *et al.*, 2014). This study also indicated that more LT customers had had negative experiences with regard to credit decisions issued by banks than non-LT customers. Another issue that clearly resonates throughout the scientific discourse concerns difficulties repaying credit obligations (Buchak *et al.*, 2018) and the increased risk of falling into a debt trap as a result of improved access to the credit market (Yue *et al.*, 2022). Such problems were also clearly observable among some of the respondents in this study, who had taken out loans via the online channel. Moreover, the answers received help outline the mechanism behind spiralling debt, where a key role is played by arrears in debt repayment and excessive liabilities, which contributes to banks refusing to grant credit, which in turn leads to further debts incurred by the need to cover higher expenses. The authors of the article share an opinion put forward by Cao *et al.* (2021) that in the near future new generation FinTechs — so-called Smart FinTechs, supported by data science techniques and artificial intelligence (DSAI) — may emerge. Thanks to complex quantitative methods or analyses based on personalised data, they will be able to reliably evaluate the potential borrower's ability to repay and spot the early symptoms of late debt repayment.

In addition, new financial technologies are seen as important enablers for the development of society, modern economies (Cao *et al.*, 2021) and the financial market, including improving access to external sources of finance (Bollaert *et al.*, 2021). An important role is also attributed to them in the context of financial inclusion which underpins sustainable development (Arner *et al.*, 2020). Folwarski (2021) proves that digital innovations in banking have a positive impact on the financial and digital inclusion of society in EU countries and points out the small amount of research and data available on the FinTech sector. Similarly, Ozili (2023) sees a mutual relationship between financial inclusion and the digital transformation of the loan market, although the Polish market was not included in the data he analysed from several countries.

The conclusions presented in this article, derived from our own research, concerning people manifesting symptoms of financial exclusion and who are also LT clients, therefore contribute, to filling the identified research gap and expanding knowledge on the role of the LT sector considered from the perspective of financial exclusion. The article represents an original combination of results of previous research on the topic — on the one hand, the consequences of changes taking place in financial markets caused by digitisation, and on the other hand, the significant socio-economic problem that is financial exclusion. The results obtained by the authors, due to their thought-provoking, interdisciplinary nature, may inspire researchers from many countries to pose further questions and research hypotheses. In addition, they may be a valuable source of information about borrowers' behaviour and preferences for regulators as well as banks and non-banking LT institutions.

Conclusions

The main conclusion to be drawn from the conducted research is that people prone to credit exclusion find substitute financing in the LT sector, and so this plays an important role in reducing financial exclusion, while maintaining the principle of creditworthiness verification. In addition, the results of the the authors' own research made it possible to answer their research questions:

– Do credit-excluded households take advantage of LT services and, if so, to what extent?

The econometric models used for the purposes of the authors' own research, taking into account variables related to financial exclusion, achieved impressive results (over 70% accuracy), which proves that among the 200 clients of the LT sector, many are credit excluded. Of the variables taken into account, the most important are: history of interest in LT, number of simultaneously repaid liabilities, occurrence of repayment problems in the past, occurrence of loan refusal in the past. 62.5% of people taking LT loans were turned down by regular banks for reasons usually including insufficient income (40%), as well as bad credit history and arrears (26%) as well as having taken out too many other loans (24%).

– What are the behaviours and preferences of those who use consumer credit offered by LT?

The research has revealed that non-bank loan customers have more liabilities (over 20% of the respondents had three or more liabilities to repay, not including mortgage loans) than customers who only took out consumer loans from banks. In addition, LT customers clearly had more frequent problems with timely debt repayment than people who did not use online loans (60% of responses in the case of the former versus 20% in the case of the latter). Moreover, the majority of LT sector clients (63%) have been rejected for a bank loan at least once.

– Do socio-demographic characteristics determine consumer use of loans offered by LT and, if so, what are they?

Non-parametric tests (Kruskal-Wallis test, Mann-Whitney test) showed that socio-demographic data among LT customers did not significantly differentiate the determinants for using a particular LT. These features, however, made it possible to create a statistical profile of LT customers: male, aged 25–37, with higher education, a member of a three-person household, whose average monthly income ranges between PLN 2,001–4,000.

– Is the use of loans offered by LT due to credit exclusion or other factors?

It has been proven that the competitiveness of LT on the consumer loan market results not only from its inclusive nature towards people who lack creditworthiness, but also from what may be widely understood as accessibility, manifested as simplicity of application, remote service or the speed of obtaining financing.

–   What action should be taken by participants in the digital consumer loan market interested in its inclusive direction?

In terms of application, the results help formulate recommendations addressed to all groups active on the digital consumer loans market and interested in its inclusive direction of development. LT companies, aware of the profile and needs of their potential customers as specified in this article, can conduct promotional campaigns more effectively and, above all, better adapt their offer to the recipient. In this context, it is worth recalling that many LT clients were refused a bank loan, mainly due to problems with arrears on previous debts or low income. Therefore, it would be worth considering the inclusion of cheap, automated, digitally provided debt repayment insurance — InsurTech — in the event of a drop in income. The results also prove that LT customers are more likely to have problems with proper debt management than borrowers at traditional financial institutions, which makes it necessary for the state to protect this group of consumers by ensuring financial education and appropriate legal regulations. These solutions aim to boost credit inclusion, which means both ensuring consumer protection as well as stability of operation and development of LT digital loan services, as it has a major impact on filling the gap in household budgets and the liabilities that may be incurred in the event of temporary financial difficulties. The third group of participants in the digital consumer loans market are potential LT customers, on whose attitude and openness to the use of financial innovations its future depends. Changes in the socio-economic environment require consumers to independently develop their own digital skills.

Studies of the literature and the results yielded testify that this article marks an important contribution to scientific research. Because it is a pioneering study based on independent surveys, devoted to the Polish LT market considered in terms of its relationship with credit exclusion, it opens a discussion on the role and importance of the LT sector on the consumer credit market, both nationally and internationally. The data presented in a report published by the European Banking Authority (2022) prove that the digital loans market in the European Union is developing rapidly, and Poland, in terms of its value calculated at EUR 266.85 million, ranks first among Central and Eastern Europe EU member states.

The research results presented in the article could have been affected by limitations and problems arising from the assumptions adopted by the authors or the research methods used. The CAWI technique was used to

conduct the survey, which requires respondents to fill in the questionnaire independently, which poses the risk that the content of the questions is misunderstood and untruthful answers are given. This problem may result from low public awareness of how the LT sector works, as it is a novelty on the Polish financial services market. In addition, there were limitations regarding the research methods used and the possibility of using some variables (e.g. a problem may have arisen from similarity between both samples and too much variability being explained by individual variables). Although the data mining methods used helped achieve the assumed research goal, other methods of empirical data analysis should be used in the future.

The results and discussion offer some directions for further research. Undoubtedly, one would be the need to probe further and try to answer whether digital loans offered by LT and/or other alternative forms of indebtedness pose a greater threat or offer an opportunity for people prone to debt arrears — i.e., at risk of financial exclusion. With this assumption in mind, research should be conducted on a selected target group. Another direction of research could be to identify the reasons for the lack of interest in LT services that might constitute a barrier to the development of this sector. The research results showed that there is a large group of respondents who are wary of non-bank loans and would not be willing to take advantage of such services even in the event of financial difficulties in everyday life. Identification and assessment of adoption factors for digital loan services is, in the authors' opinion, an important direction of research, both from a theoretical and practical point of view. In addition, the problem of financial exclusion, including credit exclusion, in individual countries around the world differs in scale and premises; hence, it would be worth examining the role played by the LT sector in the area of financial inclusion internationally.

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Annex

Table 1. Socio-demographic factors divided into non-LT clients and LT clients (%)

Variable	LT clients (n=200)	non-LT clients (n =1000)
Women	47.5	52,5
Men	52.5	47.7
Age – 18-24	17.5	8.3
Age – 25-34	35.5	16.6
Age – 35-44	26.0	20.3
Age – 45-54	12.5	16.0
Age – 55-64	5.5	15.9
Age – 65 +	3.0	22.9
Education – secondary	5.5	12.1
Education – vocational	9.0	22.9
Education – high school	45.0	37.9
Education – university	40.5	27.1
Income per person – less than 2000 PLN	17.5	27.1
Income per person – 2001-4000 PLN	48.5	48.0
Income per person – 4001-6000 PLN	24.0	10.5
Income per person – more than 6000 PLN	9.5	6.4
Income per person – no answer	0.5	8.0
Number of people in the household – 1	4.5	11.0
Number of people in the household – 2	14.0	26.6
Number of people in the household – 3	36.5	29.5
Number of people in the household – 4	29.5	21.5
Number of people in the household – 5 and more	15.5	11.4

Table 2. List of model groups with variables

A group of features	Variables in the group	Scale
Model 1 group Socio-demographic variables	- Age (A) - Sex (S) - Education (E) - Income (I)	- Quotient - Nominal (binary) - Nominal (4 step) - Nominal (5 step)
Model 2 group Variables related to financial exclusion	- History of interest LT (H) - Number of simultaneously repaid liabilities (L) - Occurrence of repayment problems in the past (P) - Occurrence of loan refusal in the past (R)	- Nominal (4 step) - Nominal (6 step) - Nominal (6 step) - Nominal (6 step)

Table 3. Results of nonparametric tests

	Sex	Education	Material status
Test type	Mann-Whitney test	Kruskal-Wallis test (df=3)	Kruskal-Wallis test (df=3)
Speed of obtaining a loan	4337.5 (0.106)	0.993 (0.803)	4.805 (0.308)
Lack of formalities	4374.5 (0.129)	2.332 (0.506)	4.371 (0.358)
Available 24/7 (convenience)	4275 (0.076)	2.555 (0.465)	9.170 (0.570)
Accessible at home/work (convenience)	4612 (0.350)	1.724 (0.632)	4.597 (0.331)
No collateral required	4715.5 (0.501)	0.236 (0.972)	1.433 (0.838)
Low costs compared with competitors	4889.5 (0.809)	0.871 (0.832)	9.477 (0.0502)
User-friendly application	4282 (0.693)	1.156 (0.764)	3.513 (0.476)

Note: *p-values in parentheses

Table 4. List of models – analysis of results

Model components	Medium accuracy	Max	Min	S	Percentage of correctly classified LT customers
Model 1.1	65.40%	79%	51%	4.41	62.0%
Model 1.2	65.70%	81%	49%	4.46	62.9%
Model 1.3	66.00%	81%	48%	4.50	63.0%
Model 1.4	60.00%	76%	44%	4.80	58.0%
Model 2.1	73.13%	87%	58%	4.12	69.0%
Model 2.2	89.05%	97%	77%	2.88	87.4%
Model 2.3	87.44%	97%	67%	3.78	83.4%
Model 2.4	87.53%	98%	69%	3.67	89.6%

Note: Model 1.1 A+S+E Model 1.2 A+S+I; Model 1.3 A+E+I; Model 1.4 S+E+I; Model 2.1 L+P+R; Model 2.2 H+L+P; Model 2.3 H+P+R; Model 2.4 H+L+R

Figure 1. Number of outstanding liabilities divided between non-LT clients and LT clients
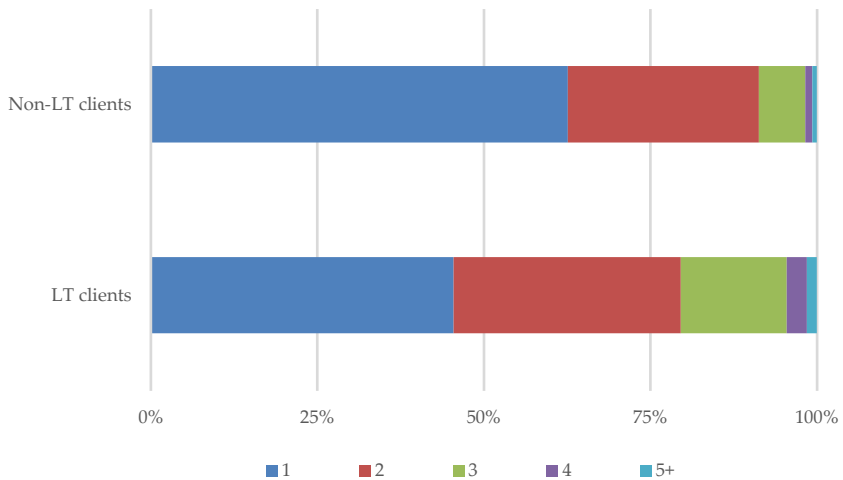
Figure 2. Reasons for using LT services
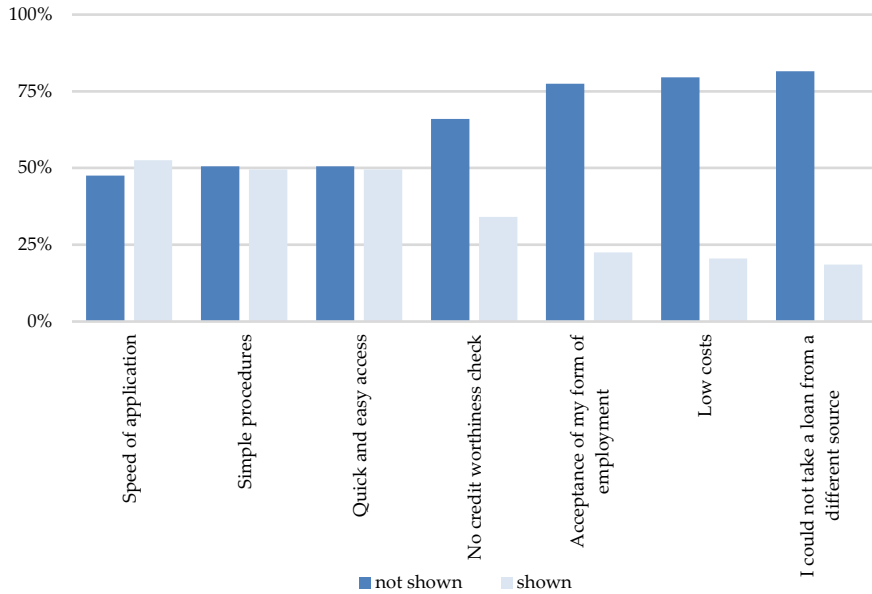
Figure 3. Reasons for debt divided between LT clients and non-LT clients
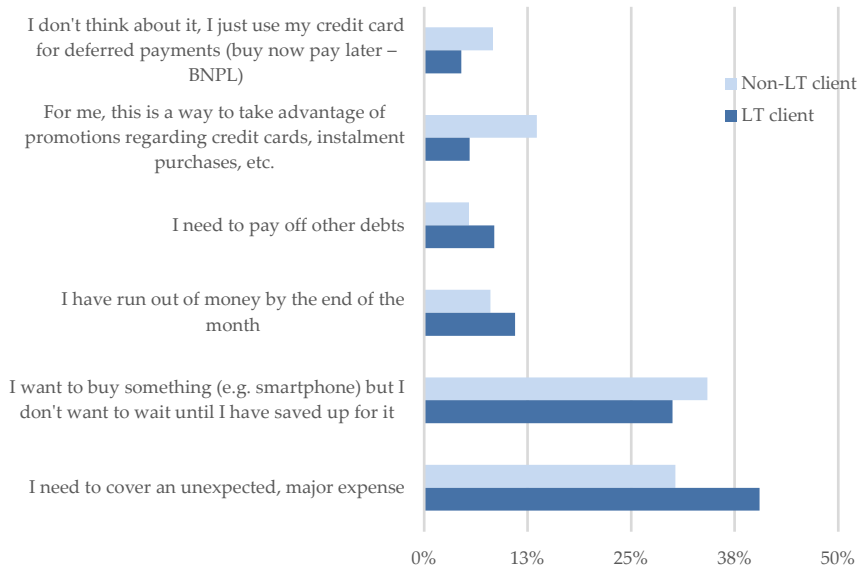
Figure 4. How difficult would it be for you to borrow money if you had to make ends meet (1 – very easy, 10 – very difficult)
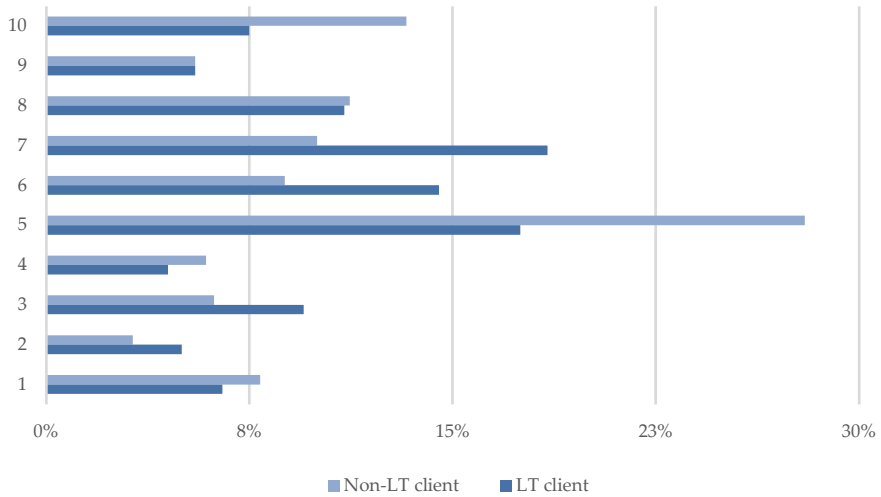
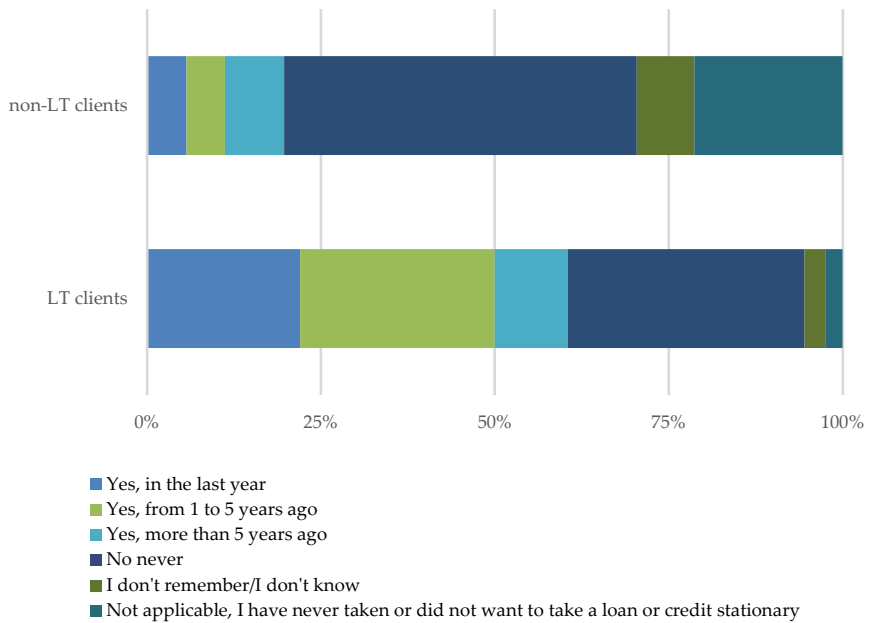**Figure 5.** Problems with debt repayment among non-LT clients and LT clients

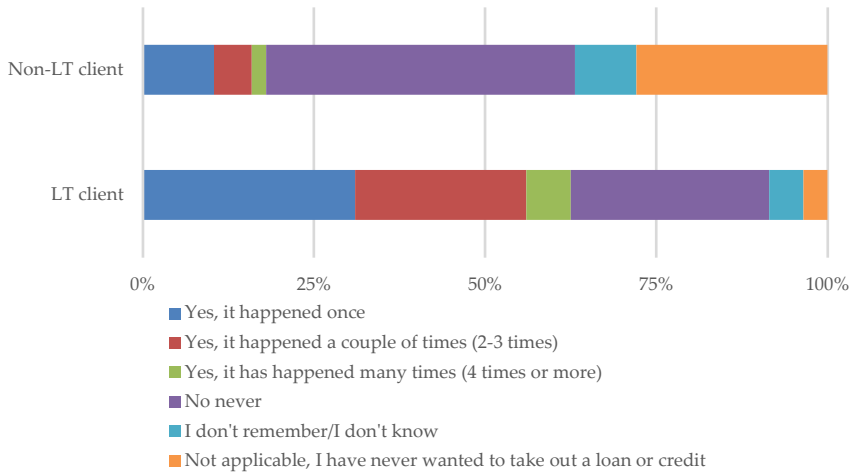**Figure 6.** The number of bank loan refusals divided between non-LT clients and LT clients

Figure 7. Reasons for bank loan refusals divided between non-LT clients and LT clients
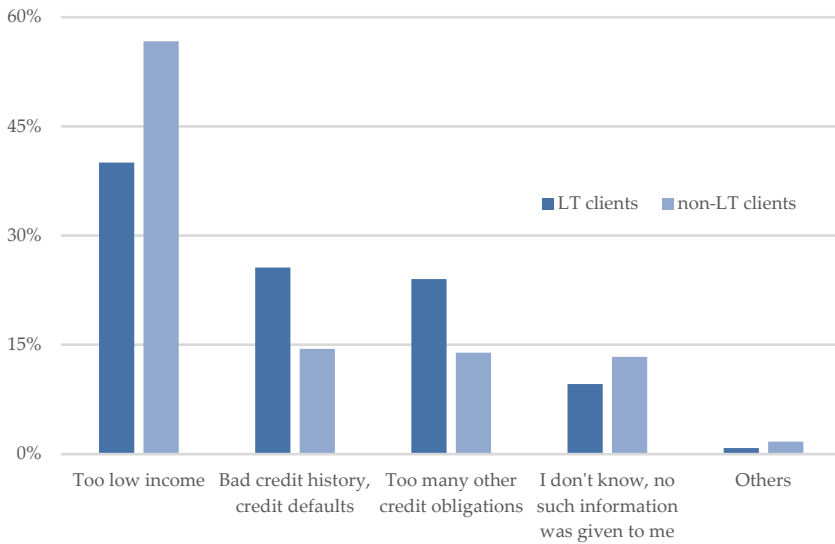
Figure 8. Knowledge of the BNPL market among non-LT clients and LT clients
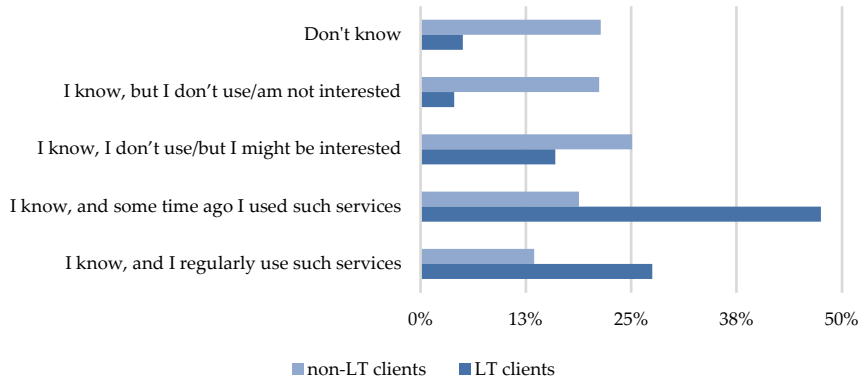
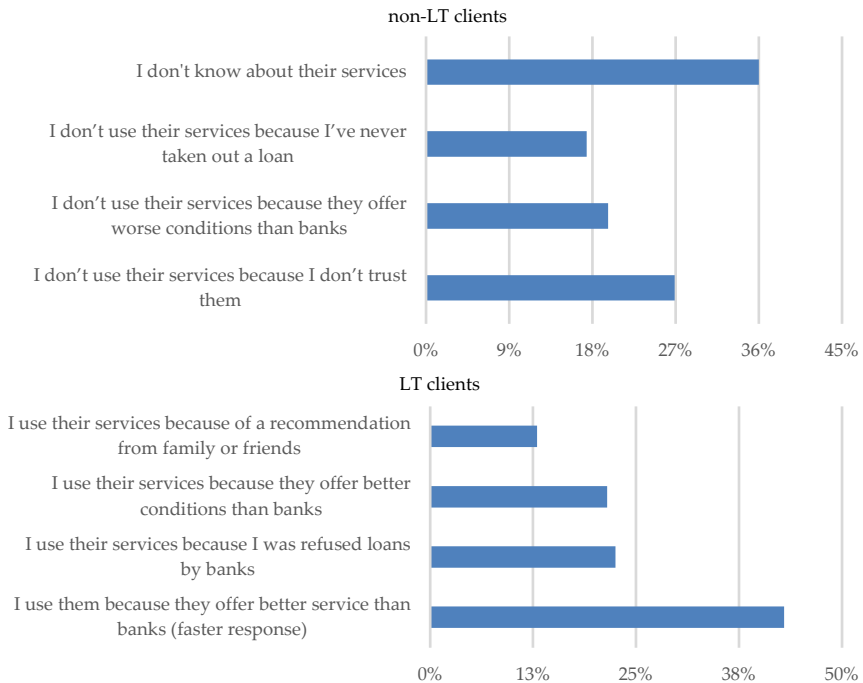**Figure 9.** Opinion on LT companies expressed by LT clients and non-LT clients

Figure 10. How to deal with a bank's refusal to grant a loan/credit as indicated by non-LT clients and LT clients
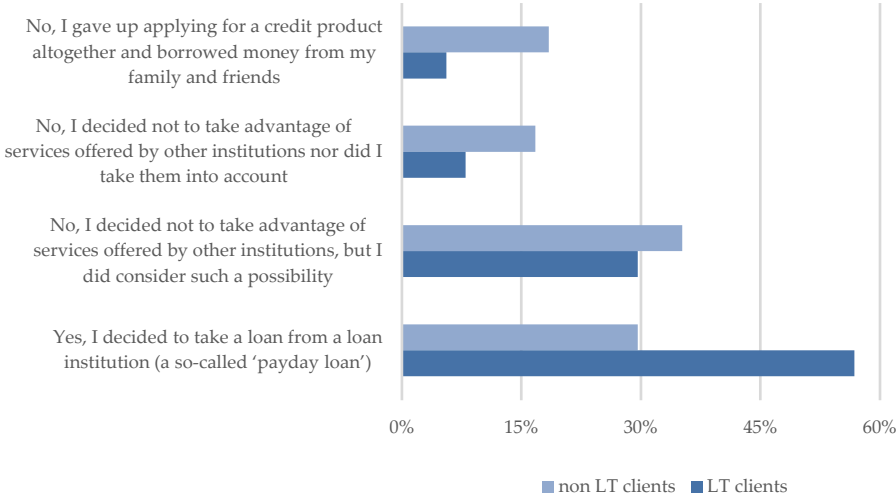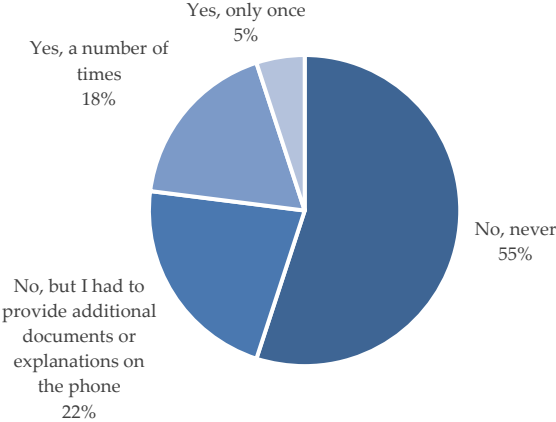

Figure 11. Number of loan refusals received in LT

Figure 12. Main determinants for using LT services