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Truth and consequences: Bogus pipeline experiment in informal small business lending

Ulf Römer
Oliver Mußhoff
Ron Weber
Calum G. Turvey

Department für Agrarökonomie und
Rurale Entwicklung
Universität Göttingen
D 37073 Göttingen
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Abstract

The prevention of asymmetric information plays a major role in successful small business lending. The purpose of this research is to determine if small business applicants report their income information correctly when requesting a loan. Therefore, a randomized controlled trial bogus pipeline experiment was set up during a typical cash-flow analysis of a bank for small businesses in the Philippines. Results indicate that loan applicants of the treatment group reported a lower income, an effect which is most pronounced in the lowest income percentile. Moreover, our analyses reveal higher loan delinquencies in the control group.

Keywords: Small business finance; Income reporting; Asymmetric information; Bogus pipeline; Randomized controlled trial

1. Introduction

Asymmetric information is perhaps one of the most studied topics in banking as it combines the issues of moral hazard and adverse selection (Stiglitz and Weiss, 1981). Together with imperfect monitoring and oversight, lenders tend to overemphasize potential losses attributed to Type I errors (providing a loan to an unworthy client), at the expense of having more Type II errors (rejecting a loan to a perfectly good client). Both errors can become costly and lead to inefficiencies in the credit market. This is particularly true for small business lending in developing countries where much of what a potential borrower discloses on a loan application is undocumented and difficult to verify. Nonexistent business documentation combined with multiple options of credit access create ideal opportunities for those inclined to commit fraud.

Since the granted loan amount is tailored to the loan applicant's income, there is an incentive to exaggerate and embellish income or assets in order to improve the chance not only of obtaining the loan, but also to obtain a larger loan amount (Armendáriz and Morduch, 2007). Dishonesty of this type is believed to be widespread in small business lending of developing countries, but has not been well documented yet. Disclosing false information on a loan application can jeopardize loan repayment if a loan is granted based on such information. Thus, the objective of this paper is to investigate whether typical loan assessment procedures applied in small business lending in developing countries are adequate to identify the real income of loan applicants and can hence overcome asymmetric information. Furthermore, this paper investigates whether misreporting on income information leads to higher loan delinquencies.

Identifying the true income of a loan applicant is difficult in the absence of proper business documentation. Indeed, loan applicants could easily misreport figures under standard survey conditions (Karlan and Zinman, 2012), especially if the surveyor is linked to the financial institution. In this situation, experiments designed to analyze sensitive questions might be appropriate. The bogus pipeline (BPL) is an example of an experimental design that is useful in dealing with and obtaining sensitive information (Jones and Sigall, 1971). With the BPL technique, respondents are informed that a "lie detector" is in use during questioning, but in fact, no lie detector is applied. Participants who believe that answers actually will be verified by a lie detector of sorts respond with an increased rate of telling the truth (Roese and Jamieson, 1993).

We set up a randomized controlled trial (RCT) BPL experiment during cash-flow analyses of small business clients of a financial institution operating in the Philippines. Randomly selected loan applicants (treatment group) were informed that their answers would be verified by a lie detector. Their income information and loan delinquencies were compared with loan applicants where the BPL technique was not applied during the cash-flow analyses (control group). Results indicate that loan applicants of the treatment group reported a lower income, an effect which is most pronounced in the lowest income percentile. Moreover, our analyses reveal higher loan delinquencies in the control group.

The remainder of this paper is structured as follows: in the next section, a literature review explains reasons behind loan applicants' misstate of income information and presents the BPL approach as one approach to identify such misstatements. On this basis, our research hypotheses are derived. The experimental setting is presented in section three and our data are discussed in section four. Section five contains the approach of data analysis. After the presentation of results along with a discussion of implications in section six, the paper closes with conclusions in section seven.

2. Literature review and hypotheses

When the first Grameen Bank began operation in Bangladesh in 1983, few people believed that the distribution of loans to informal firms would become a profitable business. Most informal firms do not maintain proper book-keeping practices. Hence, conventional banks, which rely on proper business documentation (Stiglitz and Weiss, 1981), are unable to deal with the asymmetric information when lending to such businesses. Consequently, conventional banks typically deny credit access for informal firms since they cannot judge whether these firms will be able to repay their loans. In this context, banks for small businesses overcome asymmetric information by applying special procedures to assess the credit worthiness of loan applicants. These procedures strongly depend on the honesty of the loan applicants.

The question remains, why would informal firms misreport their actual income levels when applying for a loan? Most likely because the granted loan amount depends on the repayment capacity of the applicant, which typically represents a certain share of the loan applicant's income, i.e., total revenues minus total expenses (Armendáriz and Morduch, 2007; Churchill, 1999). Hence, the higher the income, the higher will be the granted loan amount. Consequently, overstating income levels is a beneficial tactic for loan applicants who are aiming to receive a larger loan amount than their repayment capacity would actually allow. The existence of such form of dishonesty is also supported by the literature on the concept of multiple borrowing (e.g., see McIntosh and Wydick, 2005; Vogelgesang, 2003), which occurs when loan applicants apply with different lenders to receive higher loan amounts in total (Bennardo et al., 2015; Dunn, 2002; McIntosh and Wydick, 2005). The lenders typically do not know about other loans or loan applications of their applicants and cannot adjust the repayment capacity accordingly.

Self-reported income information, such as business and household cash-flows of small firms must be thoroughly evaluated and verified during in-depth loan assessments by lenders (Armendaríz and Morduch, 2000; Churchill, 1999). Hence, the lender's assessment procedures are crucial for correctly assessing income sources, income levels and, consequently, the repayment capacity. Churchill (1999) states that clients applying for a loan might do or say whatever is necessary to attain a loan for the desired amount. Moreover, if lenders fail to properly verify business information from loan applicants, adverse selection and moral hazard might lead to loan delinquencies or even default of loans that were disbursed based on this information.

The likely bias of the misreporting of loan applicants is emphasized in the literature. For instance, Karlan and Zinman (2009) investigate the problem of credit markets with regards to asymmetric information in a field experiment with a South African microfinance institution. Their experiment consists of different combinations of loan offers, allowing for the observance of hidden action and hidden information separately from one another. Results from this experiment provide weak evidence for hidden information, but confirm that hidden action is a reason for default. In a later study, Karlan and Zinman (2012) emphasize the major bias in clients' self-reporting. In their study on the use of loan proceeds, clients are surveyed by independent interviewers both directly and indirectly after receiving their requested loans. For the indirect survey, anonymity was achieved with the use of a list-randomization technique. When comparing the direct and indirect statements, results revealed bias in self-reporting.

Overall, the existing research confirms the presence of asymmetric information in small business lending although it has not yet been thoroughly explored. However, it is generally difficult to investigate individual responses to incentives when the response is unknown. The

BPL technique, pioneered by Jones and Sigall (1971), is one way for investigating such a situation. The BPL technique leads to an increase in the true response rate, which is achieved by telling respondents that the validity of their answers will be verified by a lie detector. This method is commonly used in social sciences to verify answers to sensitive questions where social norms or other factors may result in false responses (Roese and Jamieson, 1993).

The field of economics has frowned upon the use of deceptive techniques for a long time (e.g., Davis and Holt, 1992; Hey, 1991; Ledyard, 1995). In some instances, the use of deceptive methods was outright banned from its publications. The argument behind condemning the use of deception is that experimental participants cannot achieve an autarkic price or economically optimal solution when they lack full information or do not believe the experimental incentives. However, those concerns have been refuted in recent years (Bonetti, 1998). In certain instances, such as a response to food scares or terrorism, it is generally impossible to establish experimental conditions that could mimic real-world circumstances in a controlled situation in which fear can be priced in the market (e.g., Just et al., 2009). For this investigation, we face a similar dilemma: how does one determine the true behavior and intention of a loan applicant who may or may not attempt to be deceptive? Faced with this impasse, we decided to use the BPL technique, and thus follow a psychological rather than an economic approach.

The BPL technique is a harmless and non-intrusive approach to experimentally discover honesty in a real-world, non-laboratory setting of lending. It is important to mention that loan applicants who give honest responses are not affected in any way from this experiment, neither ex-ante nor ex-post. The experimental setting is designed exclusively to reduce fraud, a concept that was shared with the cooperating lender. Furthermore, in response to criticism of this method in the field of economics, our use of real loan applicants should not arouse any suspicion regarding our true intentions. We want to emphasize that our intention is to apply the BPL technique only for this study. We do not intend or recommend its application for the risk assessment of any type of financial institutions.

Due to its potential, the BPL has been successfully applied (e.g., see "Twenty years of bogus pipeline research: a critical review and meta-analysis" by Roese and Jamieson, 1993). For instance, Adams et al. (2008) investigate the BPL effect using self-reported cigarette smoking behavior from 801 adolescents. They conclude that all studies assessing smoking patterns should consider incorporating the BPL method. Hanmer et al. (2014) apply the BPL method to identify asymmetric information when investigating the over-reporting of voting in the United States. Their results confirm the capability of the BPL approach to identify asymmetric information as the voter's reporting accuracy increases when the BPL is applied.

In our case, we induce the BPL effect through claiming that a voice stress analyzer is in use during loan assessment conducted by the investigated bank. The idea behind the voice stress analyzer is to detect stress – as a consequence of lying – in the spoken voice when answering questions (Eriksson and Lacerda, 2007). Therefore, all loan applicants in the treatment group were informed that the computer in front of them was there to measure truthful responses through variability in voice patterns. In reality, the visible soundwaves did not actually indicate whether responses were truthful or not. Our expectation is that without the application of the lie detector (control group), the investigated lender is not able to identify the correct income of loan applicants. Hence, our first hypothesis is the following:
H1: "Asymmetric information": Loan applicants report a lower income in the group where the bogus pipeline effect was induced.

Furthermore, it is of interest to see whether a certain distribution exists among income segments. We assume that misreporting is stronger in the lower income segments since these individuals are more likely to be limited by insufficient book-keeping information, whereas loan applicants in the higher income segments are less likely to be credit rationed (Cenni et al., 2015; Weber and Musshoff, 2012). Hence, loan applicants in higher income groups are expected to have fewer incentives to misreport their income. Our second hypothesis is:
H2: "Income segment dependency": Misreporting of income is more pronounced in lower than in higher income segments.

Moreover, asymmetric information can directly affect the repayment performance (Karlan and Zinman, 2009). Therefore, as misreporting can finally increase loan delinquencies and even increase loan default rates (McIntosh and Wydick, 2005), our third hypothesis is the following:
H3: "Loan delinquencies": Borrowers have lower loan delinquencies when the BPL method is applied.

3. Experimental design

The BPL experiment was conducted in collaboration with a bank for small businesses in the Philippines. This bank is a commercial financial institution that operates as a full-fledged bank and offers a wide range of specific saving and loan products, including money transfer solutions. The bank offers only individual loans, i.e. no group loans are granted. The loan approval process of the bank consists of three steps: first, a loan officer explains to the loan applicant the conditions of the loan product that they have applied for and assists them with completing the application form. Second, an in-depth client assessment is carried out with the intent of gaining knowledge about the business, along with personal information about the loan applicant. As part of this in-depth client assessment, a cash-flow analysis is conducted and the provided information

is verified through cross-checking. In the cash-flow analysis, loan applicants were asked to disclose their business revenues and expenses, as well as their household revenues and expenses. An example of the used cash-flow analysis sheet is provided in the Appendix 1. With this information, the applicant's income is calculated by offsetting all cash outflows from cash inflows. These self-reported incomes were collected during the experiment and are the basis for further analysis. In the final step of the cash-flow analysis, the income is used to calculate the repayment capacity for the corresponding loan maturity. In a third step, the loan is either approved or rejected by the branch manager and/or the credit committee (mainly depending on the loan volume considered), and then disbursed upon approval. This assessment process is typical for small business banks dealing with informal firms (Churchill, 1999; Weber and Musshoff, 2012).

The BPL experiment was conducted in eight branches of the investigated bank, all located on Mindanao Island, in the Philippines. The primary data collection took four months in total, from December 2013 until March 2014. Interviews were conducted at the client's business (sometimes their home) or the respective bank branch. Only repeat borrowers were considered for the experiment. Loan applicants were then assigned randomly to control and treatment groups based on the outcome of a coin toss. Thus, our experiment design is a RCT. None of the loan applicants withdrew the application at any time, therefore we can rule out the presence of a self-selection mechanism. The randomization of individuals was carried out in each branch separately. For the control group, a cash-flow analysis was performed as part of the usual loan approval process. For the treatment group, the BPL effect was introduced before the cash-flow analysis was initiated, i.e., loan applicants were told that a voice stress analyzer, commonly referred to as a lie detector (Eriksson and Lacerda, 2007), would be used for the assessment. To further persuade the treatment group, a laptop with a voice-recording program that shows actual soundwaves was presented. A loan officer also translated this assertion into the local dialect to avoid miscommunication. Hence, the sole difference between the control and the treatment group is whether the concept of a lie detector was introduced or not.

4. Data

The raw dataset collected during the BPL experiment from December 2013 until March 2014 consists of 243 cash-flow analyses, i.e., 118 control and 125 treatment observations. For the analysis of the primary data, outliers were evaluated and eliminated using standard regression techniques[1]. Therefore, Cook's distance d_i for each loan applicant i was estimated. A loan

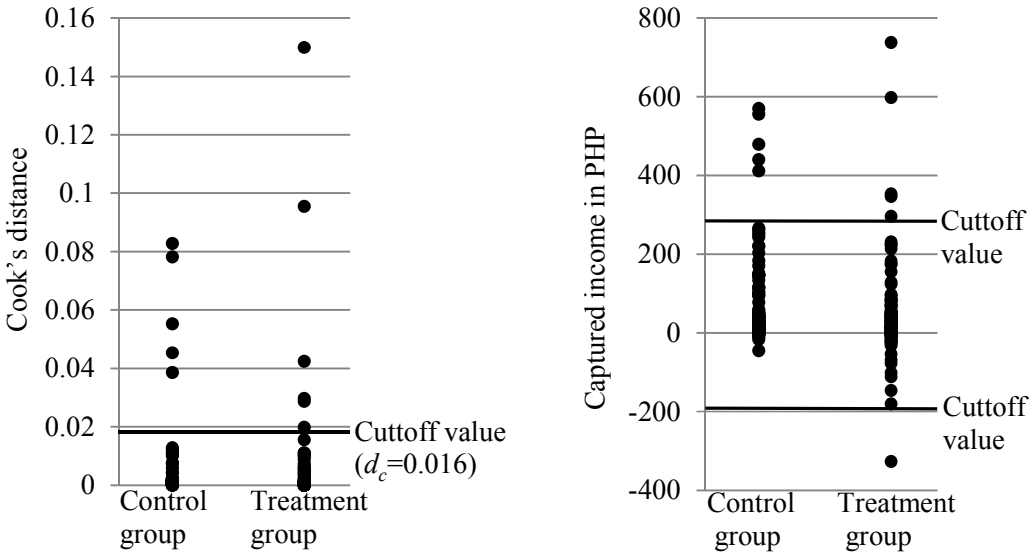
[1] The main results are not qualitatively different when including the outliers in the analysis.

applicant was excluded from the analysis when $d_i > d_c$, whereby d_c denotes the cutoff threshold suggested by Bollen and Jackman (1990):

$$d_c = \frac{4}{n} = \frac{4}{243} = 0.016 \quad \text{(III-1)}$$

Where n is the number of observations. This threshold was exceeded by 11 outliers, as depicted in Figure 1, where the control group indicates 5 exclusions and the treatment group indicates 6 exclusions. The left half of the figure shows the calculated d_i values, while the right half of the figure shows applicants' incomes to give an overview of the excluded income levels. After the cleaning process, the dataset consists of 232 clients, i.e., 113 control and 119 treatment observations.

Figure 1: Outlier detection using Cook's distance and affected income level



In addition to the primary data collected during the cash-flow analyses, demographic and loan characteristic details of the loan applicants were extracted from the management information system (MIS) to further complement the sample. The final repayment information was extracted from the MIS on May 2015. Table 1 shows the descriptive statistics of the control and treatment group. Of particular note is the demographic feature age that varies slightly between groups, with 41.8 and 44.5 years in the control and treatment group, respectively. Gender is a feature that is nearly the same with 23.8 and 22.7 percent men in the control and in the treatment group, respectively. The average income in the control group of 50,391 PHP equals about 1,145 USD and in the treatment group it amounts to 28,810 PHP, equaling 655 USD (1 USD = 44 PHP). Loan delinquency is presented as a categorical variable indicating if a granted loan had at least 30 or 90 days in arrears.

Table 1:Descriptive statistics

Variable	Description	Control group Mean	Treatment group Mean
Age	Age of loan applicant in years	41.8	44.5
		(9.4)	(9.0)
Approved	1 if application was approved; 0 otherwise	67.2 %	65.5 %
Branch: 1	1 if applicant is from branch 1; 0 otherwise	12.4 %	8.4 %
2	1 if applicant is from branch 2; 0 otherwise	10.6 %	12.6 %
3	1 if applicant is from branch 3; 0 otherwise	23.0 %	16.0 %
4	1 if applicant is from branch 4; 0 otherwise	2.7 %	3.4 %
5	1 if applicant is from branch 5; 0 otherwise	6.2 %	16.0 %
6	1 if applicant is from branch 6; 0 otherwise	18.6 %	18.5 %
7	1 if applicant is from branch 7; 0 otherwise	13.3 %	15.1 %
8	1 if applicant is from branch 8; 0 otherwise	13.3 %	10.1 %
Gender	1 if applicant is male; 0 otherwise	23.8 %	22.7 %
Income	Captured monthly income in PHP	50,391	28,810
		(67,496)	(63,629)
Loan delinquency[a]:			
30 days	1 if one installment is in arrears for at least 30 days; 0 otherwise	21.1 %	9 %
90 days	1 if one installment is in arrears for at least 90 days; 0 otherwise	10.5%	6.4 %
Previous loan amount	Loan amount in PHP the applicant received before this study	51,903 (63,611)	46,008 (53,669)
Current loan amount[a]	Loan amount in PHP the applicant received after this study	67,900 (89,500)	55,600 (68,400)
No. previous loans	Number of previous loans granted	3.1	3.1
		(1.4)	(1.3)
Number of observations		113	119

Notes: [a]Only observed if a loan was granted. For respective variables, standard deviations in parentheses.

5. Approach to Data Analysis

We apply a two-step approach to investigate each of our hypotheses. In the first step, we investigate H1 "Asymmetric information" with the Wilcoxon-rank-sum test, H2 "Income segment dependency" with the Kolmogorov-Smirnov statistic, and H3 "Loan delinquencies" with the Chi-square test. In the second step, we control for effects of additional variables to enhance robustness. For H1 and H2, an ordinary least squares (OLS) and quantile regression is performed, respectively. The quantile regression addresses the non-normal distribution of variables and considers different quantiles, which allow us to observe income segment effects in an effort to verify H2 (Koenker and Bassett, 1978). For H3, a probit model is applied, which addresses the binary structure of a loan default.

The baseline OLS model for the second step investigation of H1 is as follows:

$$I_i=\alpha+\beta b_i+\boldsymbol{\gamma l1}_i+\boldsymbol{\delta c}_i+u_i \qquad \text{(III-2)}$$

In equation (III-2), I_i indicates the income of client i and α is the intercept, β represents the parameter, and the dummy variable b_i indicates the BPL effect, which has a value of 1 for the treatment group and 0 for the control group. Furthermore, $\boldsymbol{l1}_i$ is a vector of loan characteristics not containing the current loan amount, and $\boldsymbol{c}_i$ is a vector of client characteristics. Both vectors contain a quadratic form of age and loan amount. $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ are parameter vectors. Finally, u_i is the error term.

The quantile regression model for the second step investigation of H2 looks as follows:

$$I_i=\alpha_\tau+\beta_\tau b_i+\boldsymbol{\gamma}_\tau \boldsymbol{l1}_i+\boldsymbol{\delta}_\tau \boldsymbol{c}_i+u_{i\tau} \quad \text{(III-3)}$$

Where α_τ is the intercept at a given quantile τ. The quantile regression was performed for the 25th, 50th, and 75th quantiles.

The probit model for the second step investigation of H3 looks as follows:

$$D_i=\alpha+\beta b_i+\boldsymbol{\gamma l2}_i+\boldsymbol{\delta c}_i+u_i \quad \text{(III-4)}$$

Where D_i denotes a binary latent variable that indicates whether the loan applicant i had at least 30 or 90 days in arrears on a single loan installment. In contrast to $\boldsymbol{l1}_i$, $\boldsymbol{l2}_i$ is a vector of loan characteristics which contains the current loan amount instead of the previous loan amount.

6. Results and discussion

The results of the Wilcoxon-rank-sum test demonstrate that clients report a significantly lower income in the treatment group than in the control group (Wilcoxon-rank-sum z=2.212, P=0.03). Furthermore, the variable BPL effect in Table 2 is significant in the OLS regression and at the 50th quantile (the median) when controlling for other variables, e.g., previous loan amount. The negative coefficient of this variable in the OLS regression and at the 50th quantile confirms that clients in the treatment group report a lower income than those in the control group. Thus, the first and the second step confirm H1 “Asymmetric information”.

Table 2: Estimation results of income for OLS and quantile regression with 25th, 50th and 75th quantiles

Variable	OLS[a]	25th quantile	50th quantile	75th quantile
Age	5,566	649.18	898.55	2,695
	(3,310)	(1,570)	(1,832)	(4,055)
Age^2	-59	-5.56	-5.23	-25.28
	(37)	(17.46)	(20.37)	(45.09)
BPL effect	-19,534*	-12,857**	-9,443*	-7,102
	(7,983)	(3,786)	(4,418)	(9,778)
Branch 1	-19,089	-4,964	13,858	-13,148
	(20,132)	(9,549)	(11,142)	(24,662)
2	-37,258	-20,980*	11,700	-13,543
	(19,939)	(9,458)	(11,035)	(24,425)
3	-24,393	-6,307	22,464*	-3,440
	(19,230)	(9,121)	(10,642)	(23,556)
4	6,244	3,944	36,381**	-9,814
	(26,581)	(12,608)	(14,711)	(32,561)
5	-21,206	-4,633	10,260	-11,875
	(19,205)	(9,109)	(10,248)	(23,525)
6	-42,569*	-14,588	17,627	-19,583
	(18,516)	(8,783)	(10,629)	(22,682)
7	-43,126*	-23,312**	4,058	-13,949
	(17,939)	(8,509)	(9,928)	(21,975)
Gender	-9,314	-1,034	891.45	-277.43
	(9,674)	(4,589)	(5,354)	(11,850)
Previous loan amount	0.87**	0.32**	0.91**	1.4**
	(0.23)	(0.11)	(0.12)	(0.28)
Previous loan $amount^2$	-1.84e-06*	-1.99e-07	-1.53e-06**	-2.96e-06**
	(7.85e-07)	(3.72e-07)	(4.34e-07)	(9.61e-07)
No. previous loans	-7,809*	-1,951	-3,722*	-6,068
	(3,258)	(1,545)	(1,803)	(3,991)
Intercept	-53,081	2,092	-29,095	-26,809
	(71,794)	(34,054)	(39,733)	(87,944)
Number of observations	232	232	232	232

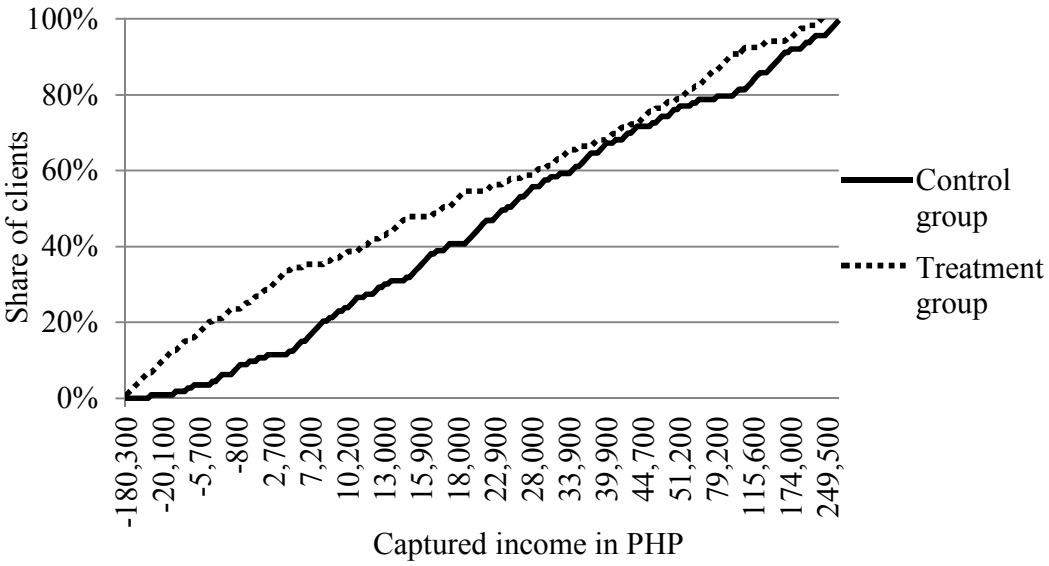
Notes: [a]R^2= 0.2744. *, ** indicate a significance level at 5%, and 1% respectively. For all coefficients, standard errors in parentheses.

This result shows that the client assessment procedures applied by the investigated bank to assess the income level of loan applicants lack the screening abilities to overcome asymmetric information. Changing the incentives for clients would necessitate developing a new lending strategy. However, screening efforts could be better managed by implementing incentives for loan officers. In this context, Cole et al. (2015) find that positive volume-based incentives – which favor high acceptance rates – lead to low screening efforts, whereas incentives that reward performance and penalize loan defaults lead to greater screening efforts. This could improve the screenings quality of loan officers and such incentives can easily be incorporated into existing loan assessment procedures.

The empirical distribution functions are shown in Figure 2. In Figure 2 the income is shown on the abscissa while the total percentage of clients that fall within the respective income

sector is displayed on the ordinate. Significant differences are only observed in the lower income segment (Kolmogorov-Smirnov D=0.2127, P<0.01), indicating that only loan applicants falling in the lower income segment misreport their incomes. This finding is also supported by the results of the quantile regression (Table 2). For the variable BPL effect, the coefficients are all negative but only significant at the 25th and 50th quantile. Furthermore, the magnitudes of this variable decrease with increasing income. Hence, we can confirm our second hypothesis H2 "Income segment dependency", based on the first and the second step of the investigations.

Figure 2: Empirical distribution functions of control and treatment groups



Our results indicate that loan applicants of different income segments behave differently. Consequently, asymmetric information is not constant, but depends instead on the income segment that a loan applicant belongs to. This result might add to the discussion of mission-drift (e.g., see Mersland and Strøm, 2010) in informal business finance. Mission-drift describes circumstances in which banks for small businesses successively focus on wealthier (and better documented) loan applicants that require relatively higher loan amounts, while neglecting poorer loan applicants. When poorer clients overstate their income, the risk assessment per borrower becomes more time intensive and relatively costly, especially for small potential loan amounts. This behavior might partly explain the incompatibility between profitability and outreach (serving poorer clients) which was observed in the debate of mission-drift by Cull et al. (2007) and Hermes et al. (2011).

When looking at the repayment performance, the treatment group is outperforming the control group at 30 days in arrears (Chi-square=4.42, P=0.04); this is also supported by the result of the probit model presented in Table 3. However, when considering 90 days in arrears (Chi-

square=0.84, P=0.36), no significant difference is found. This is also supported by the results presented in Table 3. Overall, this shows that loan delinquency in the control group are higher than in the treatment group with regard to arrears of medium length. Hence, based on the first and the second step investigations, we can confirm our third hypothesis, H3 "Loan delinquencies".

Table 3: Probit estimation results for 30 and 90 days in arrears

Variable	30 days in arrears	90 days in arrears
Age	0.30	0.28
	(0.17)	(0.20)
Age^2	-3.73e-3	-3.35e-3
	(1.99e-3)	(2.42e-3)
BPL effect	-0.69*	-0.41
	(0.29)	(0.32)
Gender	0.20	0.13
	(0.32)	(0.37)
Income	-2.49e-6	-1.86e-6
	(2.34e-6)	(2.4e-6)
Current loan amount	-3.68e-5	1.03e-5
	(7.23e-6)	(2.40e-6)
Current loan $amount^2$	7.90e-12	-4.80e-11
	(2.40e-11)	(4.10e-11)
No. previous loans	-0.17	-0.03
	(0.11)	(0.13)
Intercept	-6.03	-6.85
	(3.46)	(4.34)
Number of observations	154	154

Notes: * indicate a significance level at 5% . For all coefficients standard errors in parentheses.

Asymmetric information cause loan delinquency and therefore creates additional costs to the bank. In this context, the bank is not only confronted with direct costs, i.e., loan losses, but also with indirect costs resulting from increased monitoring or restructuring overdue clients. Given the loan delinquencies of the control group at 30 days (odds ratio=3.32), the investigated bank invests relatively more efforts for monitoring and restructuring for the control group than for the treatment group. This additional effort might be the reason why no difference in long-term repayment performance, i.e. 90 days in arrears, is found. Accurate evaluation of the repayment capacity is thus indispensable for the bank to successfully avoid loan losses as well as increased monitoring and restructuring costs.

Given the dependency between loan amount and income, it is not surprising that our estimation results in Table 2 reveal a highly positive relation. However, the causality might not be that a high previous loan amount leads to a high income, but rather the opposite. Given a stable income or a modest increase (Hermes, 2014), a high income in the past would lead to a large loan amount in the past and the income today would simply remain more or less the same.

Interestingly, there is no significant difference in the reported income between female and male loan applicants. Despite a lack of consistency in the literature relating to gender-specific

truthfulness when applying for loans, our results are similar to Childs (2012) who finds no gender-specific differences in those that disclose false information when the incentive to lie is high enough.

Moreover, the negative coefficient for no. previous loans indicates that the income decreases with an increasing number of loans that have been received by the applicant in the past. This effect is significant in the OLS regression and for the 75th quantile in the quantile regression. Extended lender-borrower relationships are found to reduce information asymmetries (Beck et al., 2013; Berger and Udell 1995; Cornée et al., 2012; Turvey et al., 2014). Recently, Cenni et al. (2015) found that long-term relations between loan officer and applicants counteract credit restrictions and Petersen and Rajan, (1994) report a lower probability to be volume rationed. Being volume rationed is generally considered to be an incentive to misreport income. Our results indicate that longer term lender-borrower relationships might increase the screening ability of the bank (Chang et al., 2014; Puri et al., 2011) or the truthfulness of the borrowers. Considering such interdependencies is, however, beyond the scope of this paper.

7. Conclusion

Loan applicants not only desire loan approval, but often also seek a potentially large loan amount (Armendáriz and Morduch, 2000). Misreporting, especially overstating income, is in the best interest of clients aiming to receive larger loan amounts than their actual income would allow. The objective of this paper is to experimentally investigate whether typical loan assessment procedures applied in individual small business lending in developing countries are adequate to identify the real income of loan applicants and are thus able to overcome asymmetric information. In order to do so, a RCT BPL field experiment was conducted with loan applicants of a bank for small business in the Philippines. Therefore, clients of a treatment group were informed before a regular loan assessment that their answers were to be verified by a voice stress analyzer, commonly referred to as a lie detector. Clients in the control group underwent the regular loan assessments.

Our results indicate that loan applicants of the treatment group report significantly lower income levels than loan applicants in the control group. This result shows that loan assessment procedures of the investigated bank are not adequately designed to verify the income information provided by loan applicants. Consequently, the incentive for the clients to misreport defeats the screening abilities of the bank. Second, our results show that overstating income is most pronounced in the lowest income segment. This suggests that loan applicants from different income segments do not have the same interests when seeking credit, and thus behave differently. Third, asymmetric income information can cause loan delinquency. The loan applicants of the treatment group show significantly higher loan delinquencies at 30 days in arrears than those in

the control group. This underlines the importance of capturing accurate income information from loan applicants and implementing strong assessment methods.

These findings are interesting considerations when designing future risk-management tools for banks for small businesses. However, the challenge is to identify misreporting in the first place. Future research could begin with these findings and further investigate how risk assessment procedures of MFIs could be better adapted to low income sectors without charging high risk premiums or completely denying credit access. Additional research is needed to validate our results and ideally give a broader perspective in relation to country or region-specific behavior. Furthermore, future research could elaborate on personal characteristics, i.e., recently married or social status, in an effort to further explain misreporting behaviors.

Appendix 1: Cash-flow analysis sheet

Applicant's name:					
Description of the business:					
	Daily	Weekly	Semi–mo.	Monthly	Totals
Income from sales					
Business 1					
Business 2					
Business 3					
Total business income (A)					
Business expenses					
Raw materials/purchases					
Business 1					
Business 2					
Business 3					
Salaries/wages					
Electricity and water					
Rent					
Transportation/fuel					
Firewood					
Other/miscellaneous					
Total business expenses (B)					
Regular household income					
Salaries					
Pensions					
Remittances from family members					
Other					
Total household income (C)					
Household expenses					
Food					
Education and school allowance					
Electricity/water/telephone					
Fuel/transportation					
Salaries/wages					
Cell phone load					
Insurance					
Installment					
Other					
Total household expenses (D)					
Add: miscellaneous expenses _% (E)[a]					
Net income (A–B+C–E)					
Debt capacity analysis					
Estimated amount of debt service					
Adjusted debt capacity rate: _%[a]					
Maximum loan entitlement for _mo.[a]					

Note:[a] Figures are bank specific.

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1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Lehrstühlen zu den folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

Georg-August-Universität Göttingen
Department für Agrarökonomie und Rurale Entwicklung
Platz der Göttinger Sieben 5
37073 Göttingen
Tel. 0551-39-4819
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