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## Borrower-lender distance and its impact on small business lenders during the financial crisis

### Abstract

In this study, we focus on the relationship between borrower-lender distance, a bank's net interest income, loan size, bank size and the bank's ability to assess credit loss. We hypothesize that borrower-lender distance impacts the banks interest income. Concurrently, bank size and a bank's ability to assess credit loss determines the proximity of the lending relationship. As such, a simultaneous structural relationship is observed where net interest income and borrower-lender distance is endogenous. We analyze this relationship for the time period from 2006 to 2009. To our knowledge, no study has tested whether borrower-lender distance affects bank performance and consequently bank performance affects borrower-lender distance. The purpose of this study is to investigate how distance between bank lenders and their small business borrowers has affected the profitability of the Small Business Administration (SBA) lender during the financial crisis.

**Keywords:** small business credit, lending distance, financial crisis.

**JEL Classification:** G01, G21, G32.

### Introduction

The relationship between small business borrowers and lenders is an important area that deserves research attention as small businesses play a crucial role in the U.S. economy. According to the Small Business Profile Report (2009), small businesses have a huge impact on the nation's net job change. Between the period of 2005 and 2006, 3,598,320 non-farm jobs were created by small businesses<sup>1</sup>. As Laderman (2008) points out, small businesses depend extensively on bank loans to finance their operations and geographic proximity defines the extent to which credit relationships are established.

Research on geographic distance between small business borrowers and banks has taken many dimensions. One strand has focused on the information flow between small businesses and lenders. Small business firms are unable to access public capital markets to meet their financing needs due to the informational opaqueness of their firms. As a result, they resort to private debt financing through regional and community banks according to Petersen and Rajan (1994) and Berger and Udell (1998). These lenders strive to obtain information and ascertain creditworthiness of the business through a relationship-building process. Such information tends to be "soft" information that is obtained due to the geographic proximity between the borrower and the lender (Petersen & Rajan, 1994; Meyer, 1998). However, over time the proximity between small business borrowers and the commercial bank lenders has de-

clined. Hannan (2004) finds that geographic lending distance has increased substantially during the period of 1996 and 2001 and the number of loans made to non-local small business lenders was significant. Findings from Brevoort and Hannan (2006) corroborate with this trend of increased geographic lending distance between borrowers and lender. Both studies attribute innovations such as credit scoring that has increased a bank's ability to assess the creditworthiness of small business borrowers. They find that small banks are less likely to make a loan if the distance between the lender and borrower increases.

A less researched but complementary strand of research focuses on how geographic distance impacts the performance of lending banks. Berger and DeYoung (2001) estimate the cost and profit efficiencies of 7000 U.S. banks from 1993 to 1998. They find a mixed relationship between distance and bank efficiency suggesting that some banks perform better while lending locally while others perform better when they engage in non-local lending. Berger and DeYoung (2006) go on to find that parent banks exercise more control over their branches, thus reducing agency costs over time. As a result, banks are able to geographically expand their lending.

Despite the above studies, to our knowledge, no study has tested whether borrower-lender distance affects the banks performance and consequently, bank performance affects borrower-lender distance. The purpose of this study is to investigate how distance between bank lenders and their small business borrowers has affected the profitability of the Small Business Administration (SBA) lender during the financial crisis. We hypothesize that a simultaneous relationship exists between bank performance and loan distance. As banks lend further, bank income increases. At the same time as banks encounter less losses, they are more likely to lend farther. We estimate how lending distance impacts net interest income and how credit losses impact lending

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<sup>1</sup> Data source: [www.sba.gov/advo/research/data.html](http://www.sba.gov/advo/research/data.html).

distance for an average sample of 57,701 loans made by U.S. commercial banks between 2006 and 2009. We draw on individual-loan data from Small Business Administration's 7(a) loan program. Unlike previous literature, our study focuses on a time period that has greatly impacted small businesses. In 2009, SBA loans were down by 37% compared to 2007<sup>1</sup>. Credit was tight and commercial banks were reluctant to participate in the 7(a) program despite a 75% guarantee from SBA.

Three main results emerge from our study. First, the analysis shows that there is a positive and statistically significant relationship between lending distance and bank interest income from 2006 to 2009. However, the loan amount does not affect the lending distance from 2006 to 2009. Second, there is a positive and statistically significant relationship between bank size and distance. Third, there is a positive and statistically significant relationship between lending distance and provision for credit losses. However, in 2009, provision of credit losses was not a statistically significant factor. Our paper is structured as follows. Section 1 discusses the data used in the analysis. Section 2 outlines the hypothesis development. Section 3 provides the methodology. Section 4 reports the results and the final Section concludes.

## 1. Data

We use micro-level loan data from the SBA 7(a) program. Each loan record includes information about the loan that was recorded at the time of loan origination. We were provided with the following information by SBA: date the loan was issued, gross approved loan amount, borrower name, borrower zip code, lending bank's name, lending bank's zip code and the characteristics of the borrower business. We compute the distance between the borrower and the lender by calculating the distance between the centroid of the two zip codes. With the lending bank's name and zip code, we are able to obtain variables indicating the bank's condition and income from the Federal Financial Institutions Examinations Council Call Reports. Net interest income, total assets and provision for credit losses for the lender are obtained from the Call Reports. Table 1 (See Appendix 1) presents the summary statistics for the variables used in the analysis. Figure 1 (See Appendix 2) provides plots based on the summary statistics.

Net interest income increased from 2006 and 2007. It peaked in 2007 and started to decline up to 2009. The same pattern is observed for bor-

rower-lender distance and bank size (proxied by total assets). We see a strong co-movement between net interest income, bank size and borrower-lender distance. Gross approved loan amount remained at about the same level between 2006 and 2007. From 2007 to 2009, it rose steadily. Provision for credit losses rose steadily from 2006 and peaked at 2008. It then began to decline later in 2009.

## 2. Hypotheses development

The SBA 7(a) loan program was designed to provide financing to small businesses that are unable to afford credit through private lending channels<sup>2</sup>. As a result, the SBA 7(a) loan candidate is high-risk as the private lender is unable to differentiate between a good credit opportunity and poor quality credit through screening. SBA, via the 7(a) program, helps to mitigate the adverse selection problem for the participating commercial bank by guaranteeing from 75% or 85% of the loan depending on the loan size. According to the Congressional Budget Office Report (CBO, 2007), commercial bank lenders find it profitable to participate in SBA lending programs. The banks earn about 1.3% on regular 7(a) loans and about 2.5% on Express 7(a) loans. Lending banks earn 70 basis points over Treasury rates on the insured portion of the loan despite the portion being risk-free. Concurrently, the uninsured portion earns about 3.5 percentage points above the Treasury rate. Figure 2 (See Appendix 2) provides the interest rate spreads over the prime rate for SBA 7(a) loans and for all commercial and industrial loans, by cohort. Andrade and Lucas (2009) find that banks participating in SBA loan programs earn a significant rate of interest that exceeds Treasury rates and that large lenders are able to charge higher interest rates due to market power. At the same time, Glennon and Nigro (2005) find based on historical behavior, the credit quality of SBA loans is similar to the loans held by large commercial banks.

One has to keep in mind that numerous factors can affect the lending and credit assessment process. Since small business borrowers are opaque in terms of information, borrower-lender distance can impact bank profitability. DeYoung et al. (2008) find evidence for default-increasing effects of distance. However, in their study, if credit-scoring is performed by the lending bank then default-increasing effect of distance can be mitigated. When credit-scoring is in place lenders tend to expand their lending markets and are able to take on riskier loans. However, one must note that the banks that were identified as "credit-scorers" were the top 200 largest banks. Hence, not much is known about the smaller banks that tend to be community banks that lend regionally.

<sup>1</sup> Source: *The Wall Street Journal*, May 4, 2010, "A Plea for Direct Lending to Small Businesses"

<sup>2</sup> Refer to: <http://www.sba.gov/financialassistance/borrowers/guaranteed/7alp/index.html>

In this study, we focus on the relationship between borrower-lender distance, a bank's net interest income, loan size, bank size and the bank's ability to assess credit loss. We hypothesize that borrower-lender distance impacts the banks interest income. Concurrently, bank size and a bank's ability to assess credit loss determines the proximity of the lending relationship. As such, a simultaneous structural relationship is observed where net interest income and borrower-lender distance are endogenous. We analyze this relationship for the time period from 2006 to 2009.

### 3. Methodology

We propose a model that relates a bank's net interest income ( $lnii$ ) to borrower-lender distance and gross loan approval amount ( $IDistance$  and  $lAppvGross$ ). Simultaneously, borrower-lender distance depends on bank size as measured by total assets ( $lta$ ) and provision for credit loss ( $lpcl$ ). We use a natural log transformation of the variables in the regression analysis. The model is expressed as:

$$\begin{aligned} lnii_{it} &= \beta_{0it} + \beta_{1it}IDistance + \beta_{2it}lAppvGross + \varepsilon_{1it} \\ IDistance_{it} &= \beta_{3it} + \beta_{4it}lta + \beta_{5it}lpcl + \varepsilon_{2it} \end{aligned} \quad (1)$$

We will take equation (1) to be the full system. In this case,  $lnii$  and  $IDistance$  are endogenous variables while  $lAppvGross$ ,  $lta$  and  $lpcl$  are exogenous instrumental variables. In this system, there are 6 structural parameters and 8 reduced form parameters. Hence, it is an over-identified system. For an over-identified system, Zellner and Theil (1962) recommend that a three stage least squares method of estimation (3SLS) of the parameters be used to analyze a simultaneous equation system to ensure that the estimation of the coefficients of the over-identified system is efficient. According to Greene (2003), a simultaneous system of equations can be formulated as follows:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_M \end{bmatrix} = \begin{bmatrix} Z_1 & 0 & \dots & 0 \\ 0 & Z_2 & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \dots & Z_M \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_M \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_M \end{bmatrix} \quad (2)$$

where  $Z$  is a matrix of all instrumental variables used. The 3 stage least square estimator is given as:

$$\hat{\beta}_{3SLS} = \left[ \hat{Z}'(\Sigma^{-1} \otimes I) \hat{Z} \right]^{-1} \hat{Z}'(\Sigma^{-1} \otimes I) y, \quad (3)$$

where  $\Sigma$  is the asymptotic variance-covariance matrix. The estimation is performed for each of the years from 2006 to 2009.

### 4. Results

Table 3 (See Appendix D) provides the results for the three stage least squares estimation. As both dependent and independent variables are in natural log form, the coefficients are interpreted as elasticity coefficients. We find that a 1% increase in borrower-lender distance results in 3.14% increase in net interest income in 2006. In 2007, this increase in net interest income drops to 2.5%. In 2008, the increase drops further to 2.162% during the height of the crisis. In 2009, we find that the impact of borrower-lender distance on net interest income regains strength and a 1% increase in distance raises net interest income by 2.643%. We find that net interest income increases as distance increases for the entire period. This implies the greater the borrower-lender distance, the more lucrative the loans. Two potential reasons for this are: when borrowers are further away, banks are unable to obtain "soft" information. It is likely that banks assess borrower creditworthiness by using more stringent procedures such as credit-scoring. Hence, the credit quality is likely to be better when the borrower is located further away. Alternatively, borrowers further away maybe charged higher interests due to lack of soft information and hence, increasing a bank's net interest income.

We find that the parameter estimate on gross loan approval amount was not statistically significant for all the four years. This implies that the loan amount itself did not explain any changes in net interest income between 2006 and 2009. This could be due to the fact that informational opacity related to soft-information remains the same regardless of the amount borrowed. Hence, banks are likely to price the distance-related risk as opposed to loan-amount related risk.

We also study how bank size impacts borrower-lender distance. As bank size increases, lenders are more likely to lend further away. In 2006, a 1% increase in bank size resulted in a 0.285% increase in borrower-lender distance. However, in 2007 and 2008, this number declined to 0.208% and 0.236%, respectively. In 2009 as banks received infusions of capital, the number rose to 0.371%. One possible explanation for this is: bigger banks have more resources to evaluate the creditworthiness of the borrowers. Smaller community and regional banks have less resources to devote to credit-scoring models to evaluate their lenders.

Finally, we examine if provision for credit loss impacts the lending distance. We find that when banks expect a higher level of credit loss the following year, they were more likely to lend further away. This is related to the results found in Figure 4 (See Appendix E). The loans that were further away bring in more interest income. This suggests that a level of geographic diversification is taking place. From 2006 to 2008, the borrower lender distance increased as the provision for credit loss increased. We see that a 1% increase in

provision for credit loss resulted in an increase in lending distance in the following year by 0.0233%, 0.155% and 0.173%, respectively from 2006 to 2008. However, the response of lending distance to provision in credit loss dropped drastically in 2009. Provision for credit losses is not statistically significant during the financial crisis.

The above analysis has some limitations. The main limitation is due to the unavailability of interest rate on each specific loan. The net interest income is lender specific and not specific to the small business loan. We assume that there is a comovement between the net interest income earned on SBA loans and the overall net interest income. This can be clarified by obtaining SBA loan-specific interest income data from the lender.

### Policy implications and conclusions

This study finds that that the greater the borrower-lender distance, the more net interest income the bank earns. As provision for credit loss increases, banks tend to lend further away. We also find that

bigger banks are more likely to lend further away than smaller banks. This study shows that distance is not a deterrence to lending. Bigger banks possibly lend further away as they are likely to have more resources to adopt credit-scoring instruments to assess the credit quality of loans. Collection of “hard information” through credit scoring promotes loans to be made further away. As banks expect to face more credit losses, they are more likely to lend further away in order to benefit possibly from geographic diversification to earn higher net interest income.

Our study proposes that regional and small community banks should be able to access low cost credit scoring tools. This will enable small banks to effectively assess credit quality and lend further away. For future research, we plan on obtaining SBA loan-specific interest income data from the lender. We would also like to employ a longer time-series that will allow us to examine a pre and post crisis period. Also, we plan to incorporate the credit scoring aspect to evaluate its impact on borrower-lending distance pre and post financial crisis.

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### Appendix A.

Table 1. Small business loans – 7(a) loan program, 2006-2009: descriptive statistics

Year	Variable	Mean	St. Dev.	Min	Max
2006	Net interest income (in 10,000's)	797,809	1,015,393	-96	2,687,541
	Approval gross	132,633	261,638	100	2,000,000
	Distance (miles)	668	737	0	7,323
	Total assets (in 10,000's)	28,858,841	38,972,489	819	108,413,043
	Provisional credit loss (in 10,000's)	769	10,174	-2,192	344,000
Number of observations			79,149		

Table 1(cont.). Small business loans – 7(a) loan program, 2006-2009: descriptive statistics

Year	Variable	Mean	St. Dev.	Min	Max
2007	Net interest income (in 10,000's)	920,719	1,106,398	19	3,080,300
	Approval gross	135,592	271,297	100	2,450,000
	Distance (miles)	730	775	0	7,726
	Total assets (in 10,000's)	33,317,778	42,234,499	765	118,283,252
	Provisional credit loss (in 10,000's)	1,898	28,608	-561	1,068,600
Number of observations		80,342			
2008	Net interest income (in 10,000's)	670,275	1,115,109	0	3,623,500
	Approval gross	188,392	324,835	500	2,000,000
	Distance (miles)	556	707	0	6,230
	Total assets (in 10,000's)	24,257,487	41,768,443	1,370	137,501,299
	Provisional credit loss (in 10,000's)	6,901	84,715	-138	2,083,200
Number of observations		45,002			
2009 (until October)	Net interest income (in 10,000's)	288,217	702,898	24	3,013,400
	Approval gross	217,131	345,580	1,000	2,050,000
	Distance (miles)	328	561	0	4,845
	Total assets (in 10,000's)	10,886,024	26,071,427	891	138,359,720
	Provisional credit loss (in 10,000's)	5,601	79,328	-93	2,353,859
Number of observations		26,311			

Appendix B.

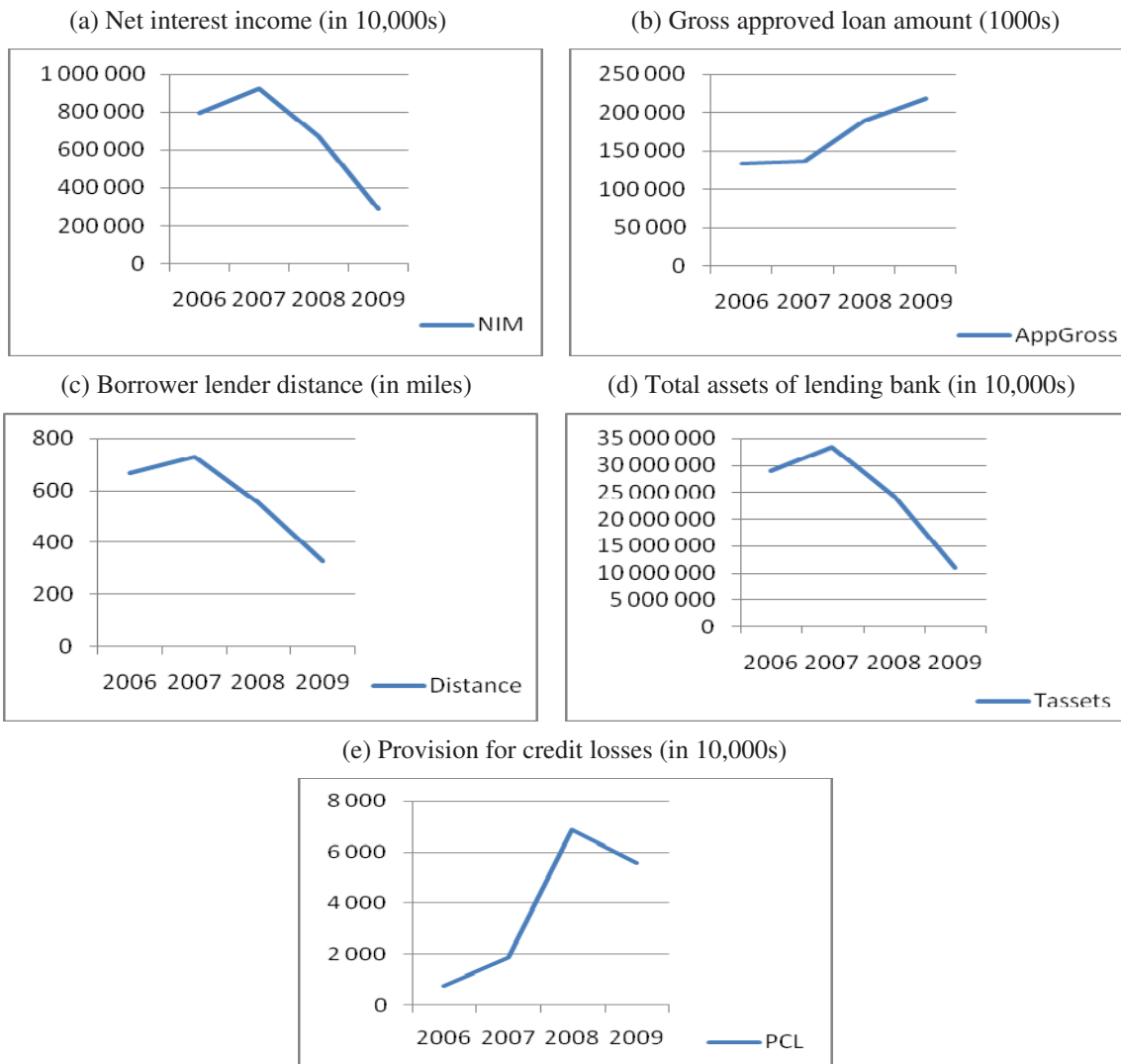
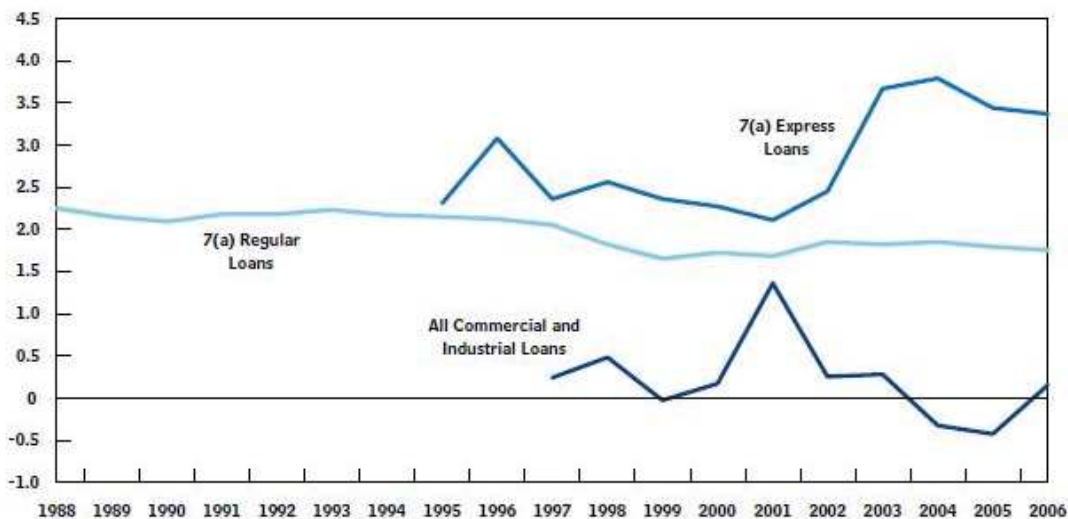


Fig. 1. Plot of variables based on descriptive statistics 2006-2009

### Appendix C.

(Percentage points)



Note: Interest rate spreads over the prime rate for all commercial and industrial loans are for loans made by commercial banks in amounts between \$100,000 and \$999,999.

\*Source: Congressional Budget Office Report (2007) based on data from the Small Business Administration and the Board of Governors of the Federal Reserve System. This figure was also cited in Andrade and Lucas (2009).

**Fig. 2. Interest rate spreads over the prime rate for SBA 7(a) loans and for all commercial and industrial loans, by Cohort 1988-2006\***

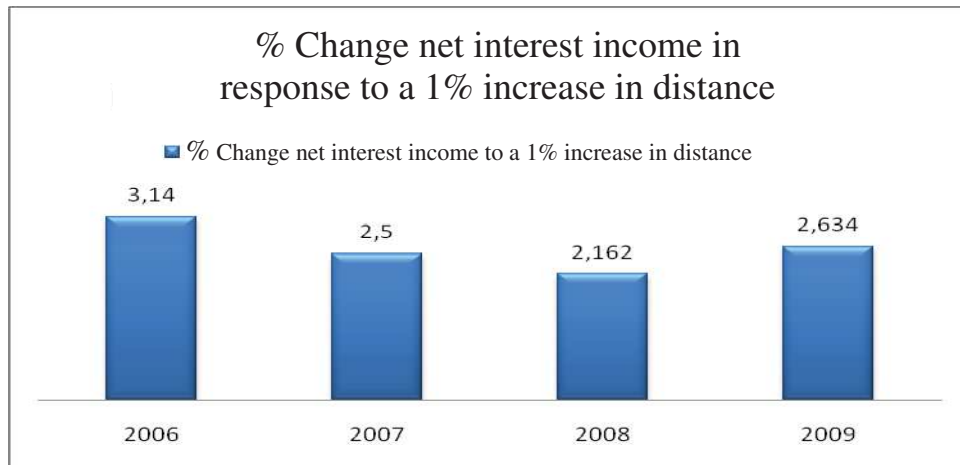
### Appendix D.

Table 3. Results of 3 stage least for 2006-2009.

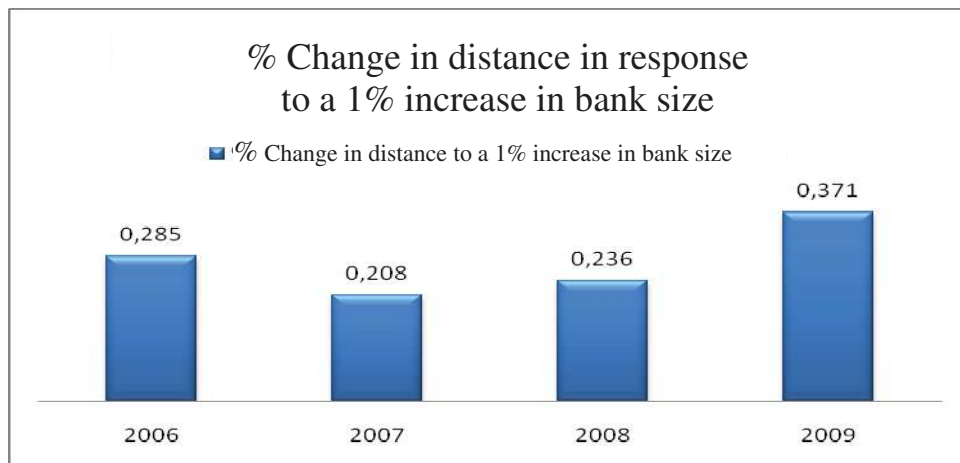
	Independent variables (natural log)			
	<i>IAppvGross</i>	<i>IDistance</i>	<i>Ita</i>	<i>Ipcl</i>
<b>Dependent variables (natural log)</b>				
<b>2006</b>				
Net interest income				
<i>Inii</i>	-0.0078	3.14**		
Distance				
<i>IDistance</i>			0.285**	0.0223**
<b>2007</b>				
Net interest income				
<i>Inii</i>	0.00063	2.500**		
Distance				
<i>IDistance</i>			0.208**	0.155**
<b>2008</b>				
Net interest income				
<i>Inii</i>	0.0023	2.162**		
Distance				
<i>IDistance</i>			0.236**	0.173**
<b>2009</b>				
Net interest income				
<i>Inii</i>	-0.0611	2.643**		
Distance				
<i>IDistance</i>			0.371**	0.00547
Legend:				
Gross approval amount	<i>IAppvGross</i>			
Borrower-lender distance	<i>IDistance</i>			
Total assets	<i>Ita</i>			
Provision of credit losses	<i>Ipcl</i>			

Note: \*\* Indicates parameters are statistically significant at the 5% level of a 2-tailed test.

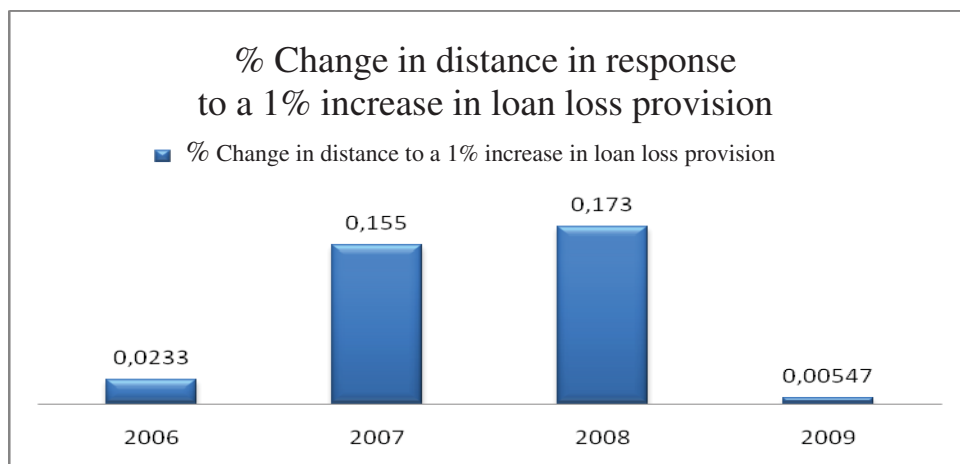
## Appendix E.



**Fig. 4.** Plot of elasticity parameter estimates showing the percentage in net interest income due to a 1% increase in distance.



**Fig. 5.** Plot of elasticity parameter estimates showing the percentage in lending distance due to a 1% increase in bank size.



**Fig. 6.** Plot of elasticity parameter estimates showing the percentage in lending distance due to a 1% increase in loan loss provision.