Agricultural and Rural Finance Markets in Transition

Credit Risk Evaluation for Loans of Banco Agrario in Colombia

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Introduction

- Only publicly owned bank in Colombia

- Specializes in loans for rural areas and
  agricultural enterprises

- Has branches in nearly 60% of towns, providing
  financial services throughout the country to
  communities with little or no financing
  alternatives

- At least 70% of its loan portfolio is directed towards agricultural activities

-This bank has an important role on the implementation of government's agricultural
and rural strategies in Colombia. It provides financial services throughout the country to
communities with low or no alternatives, and is a key part of the payment system as
cash distribution nationwide, government salaries and government subsidies.

Motivation

- Little has been done to understand probability of default of rural/agricultural loans in emerging economies

- Borrower level data are hard to obtain

- We employ high quality data from international source: major bank, large number of observations

Study objective and contribution

- Objective: Identify factors influencing the probability of default and of loss given default for Banco Agrario loans.

- Contribution
  - Application of Heckman's two-step model employing data from an emerging economy

Data and model (1)

- Data is from of Banco Agrario's personal and commercial loans on June 2006

- 30,987 observations for personal loans
- 72,806 observations for commercial loans

Data and Model (2)

- Heckman's two-step model
  - First step: probit model for probability of default

$$Default = \alpha + \Sigma_{j=1,3}\beta_j Education_{i,j} + \Sigma_{j=2,5}\beta_j Income_{i,j} + \Sigma_{j=1,3}\beta_f Age_{i,j} + \alpha_1 Num\, restructurat\, ions_i$$
$$+ \alpha_2 Term_i + \alpha_3 Hou\sin g_i + \alpha_4 PastDue_i + \alpha_5 Cosi\, gners_i + \alpha_6 Dependents_i$$
$$+ \alpha_7 InitialValue_i + \alpha_8 NFGuarantee_i + e_i$$

  - Second step: regression model for loss given default

Default is dichotomous variable that takes a value of one if the default has occurred, or a zero if one has not. The *Default* variable is regressed against a set of independent variables such as: 1) *Education* refers to the education level of the borrower (Primary, secondary and other type of education, and no report education), 2)*Income* is a dummy variable was created for each range of income, 3)*Age* refers to the age of the borrower, 4) *Number restructurations* is number of time the loan was restructured, 5) *Term* refers to the period of time that covers the life of a loan, 6) *Housing* refers to the housing conditions of the borrower, 7)*Past due* correspond to the number of time the loan was past due, 8) *Cosigners* refers to the number of cosigners of the loan, 9) *Dependents* is the number of person that the borrower takes care off, 10)*Initial Value* refers to the amount the lender lent to the borrower, 11) NFGuarentee, is a dummy that takes the value of one is the guarantee is formal, or zero if not. The last term in Eq.4 refers to the error term. A dummy variables was created for each level of the dichotomous independent variables i.e. there are 3 level of education, 1 correspond to the people that have at least primary education, 2 correspond to the people that have at least secondary education, 3 corresponds to the people that have more than secondary education and 9 correspond to the people that don't report having education.

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Probit Results for the Probability of Default (1)

Explanatory variables	Commercial	Personal
Secondary education	-0.065**	-0.053
Higher education	-0.093**	-0.117**
Education not reported	0.257***	0.015
Income 1-1.5 mil	-0.164**	-0.239**
Income 1.5-2.5 mil	-0.161***	-0.189**
Income 2.5-4 mil	-0.125*	-0.130
Income >4 mil	-0.256***	-0.046
Income not reported	-0.526***	-0.170
Age 30-39	-0.017	-0.088
Age 40-49	0.079*	0.002
Age >50	0.011	-0.140**
Number of restructures	0.426***	0.333**
Term	-0.011***	-0.020***
Rent/family housing	0.283***	0.210***

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Probit Results for the Probability of Default (2)

Explanatory variables	Commercial	Personal	P
Housing not reported	0.337***	0.322	
Months past due	0.35***	0.338***	
Number of cosigners	0.002	0.065*	
Number of dependents	-0.037***	0.021	
Loan initial value	0.000	-0.000***	
Nonformal guarantee	0.166***	0.292***	
Number of obs	72806	30987	
Log likelihood	-8297	-4861	
Pseudo R2	0.551	0.563	

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Probit Disaggregated Results for the Probability of Default

- Data were disaggregated by time to maturity of the loan

	Total	< 1 year	1-2 years	2-3 years	3-4 years	4-5 years	> 5, 5-6 years	> 6 years
Personal	30987	1998	1137	3101	19679	3540	1532	
Comercial	72806	4213	3316	3632	3576	5617	32531	19921

Probit Disaggregated Results for the Probability of Default on Commercial Loans

- Commercial loans – significant variables

  – For shorter loan terms: secondary education, income not reported, number of restructurations, housing not reported, and cosigners

  – For longer loan terms: age>50 and number of dependents

  – The other significant variables were similar for shorter and longer term loans

  – The coefficients for the disaggregated models have the same sign to the coefficients for the aggregated model

Probit Disaggregated Results for the Probability of Default on Personal Loans

- Personal loans – significant variables

  – For the longer loan terms: education no reported, age>50

  – For shorter loan terms: income 1-5-2.5 Income not reported, loan initial value were significant

  – The other significant variables were similar for shorter and longer term loans

  – The coefficients for the disaggregated models have the same sign to the coefficients for the aggregated model

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Heckman Results for the Loss Given Default (1)

Explanatory Variables	Commercial	Personal
Secondary education	-0.039	-0.020
Higher education	-0.061	-0.033
Education not reported	-0.005	-0.009
Income 1-1.5 mil	0.005	0.027
Income 1.5-2.5 mil	-0.070	0.015
Income 2.5-4 mil	-0.071	0.001
Income >4 mil	-0.001	-0.002
Income not reported	0.128	-0.027
Age 30-39	-0.022	0.012
Age 40-49	-0.035	0.007
Age >50	-0.041	-0.013
Number of restructures	-0.009	0.125***

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Heckman Results for the Loss Given Default (2)

Explanatory Variables	Commercial	Personal
Term	-0.001	-0.004***
Rent/family housing	-0.008	-0.012
Housing not reported	-0.045	0.020
Months past due	0.010	0.001
Number of cosigners	-0.023	-0.156***
Number of dependents	0.008	-0.001
Loan initial value	0.000	-0.000*
Nonformal guarantee	-0.132	-0.330***
Number of obs	72806	30987
Censored obs.	67713	27389
Uncensored obs.	5093	3598
Lambda	0.069***	-0.017

Heckman Disaggregated Results for the Probability of Default for Commercial Loans

- Commercial loans - significant variables

  – Shorter loan terms: Loan initial value, housing not reported, age>50, rent/family housing, month past due, cosigners, income not reported, non formal guarantee,

  – Longer loan terms : Secondary education, number of re-structures, rent/family housing, month past due, cosigners, income not reported, non formal guarantee,

  – Even though not significant for the model with all observations, some variables become significant for the models by loan term

  – Rent/family housing, months past due, cosigners, income not reported, and non-formal guarantee

Heckman Disaggregated Results for the Probability of Default for Personal Loans

  – For the longer term loans: income 1-5-2.5 Income 2.5-4, Income not reported and number of cosigners were significant

  – For shorter term loans: Months past due, and term were significant

  – The other significant variables were similar for shorter and longer term loans

  – The signs of the coefficients for the disaggregated data were generally the same as those with the whole data

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Summary results

- Main factors affecting probability of default for commercial loans are: education, income, num of restructures, term, housing, number of dependents and non-formal guarantee.

- Main factors affecting probability of default for personal loans are: higher education, lower incomes, age>50, num of restructures, term, cosigners, and loan initial value.

- No factors affect aggregated LGD for commercial loans, only a few for personal loans like term, num of restructures, number of cosigners, and non-formal guarantee.

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Conclusions

- Banks need to understand risk factors and demographic variables affecting loan repayments.
- Major banks need to comply with the New Basel Capital Accord.
- Adoption of the Basel principles would lead to improved risk and capital management.

Future Work

- With data for multiple years, estimate transition probability matrices for Banco Agrario loans.
- Estimate capital needs for Agrario to cover expected and unexpected losses.