Expanding Access to Microfinance: Evidence from the CrediAmigo Natural Experiment in the NE of Brazil

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Outline of presentation

1. Introduction-
   - CrediAmigo, ECI NF
   - Questions Addressed
2. Methodology
   - DiD, PSM, Dose Response Analysis
   - Samples, Treatment, Outcomes
3. Results
4. Conclusions and Policy Implications
Introduction

- High levels of poverty and inequality continue to pose major challenges for Brazil.
  - Spatially uneven development of the Brazilian economy, with the North and NE regions lagging behind
  - High levels of inequality may compromise economic efficiency and growth.
    - Credit and insurance market failures, for example, may prevent poorer households from investing in and contributing to the economy at an optimal level, thereby undermining efficiency and growth.
  - Response of Brazilian Government:
    - Foster the availability of financial services and expand access to microfinance.
    - 1952: Banco do Nordeste do Brasil (BNB)
    - BNB-CrediAmigo program in 1998
CrediAmigo-2

- Offers loans to micro-entrepreneurs for the financing of their working capital and fixed asset needs.
- Loans are collateral-free, but are extended using the solidarity group technique to small groups of 3-5 borrowers who cross-guarantee each other’s loan.
- Loans usually have a 3 month duration.
- First loans are limited to 300 to 1000 Reais (about US$130 – 300), but repeat loans can be up to 4,000 Reais (US$1,700).
- The program initiated with a 5% flat monthly rate, but the interest rate has since decreased to 2%.
  - Interest rates: substantially lower than those charged by informal moneylenders and trade credit providers
- After a borrower has successfully paid back two loans under the solidarity program, the borrower becomes eligible for individual credit, with a loan maturity of up to 6 months.
- Fixed investment credit is also offered, with a maturity of up to 18 months.
Also, as of June 2004, CrediAmigo started offering basic debit accounts to all of its clients.

Client characteristics:
- At the end of 2002, roughly 50% of clients were women;
- 40% of its clients were 35 years old or under.
- 57% percent had reached the primary school level.
- 41% were considered poor, earning between US$1-2 per day.

Largest microfinance institution in Brazil: As of July 2004, the program had 150,083 clients with a loan portfolio of R$88.7 millions (US$27.2 million)
- Its average loan size was only 590 Reais (US$180)
- CA operated mainly in the NE (almost in all municipalities of the NE) in some municipalities in the states of Minas Gerais and Espirito Santos in the SE region.
Unfortunately available data sources make it very difficult to shed light on the impacts of increased access to credit in general and that obtained through CrediAmigo, in particular.

However, we can assess the impacts of increased supply of credit on credit utilization and the impacts of credit utilization on firm performance.

Use a combination of administrative data from the CrediAmigo program and detailed micro-enterprise data surveys on the informal urban economy (ECINF) of the Brazilian National Statistical Institute (IBGE) in 1997 and 2003.
ECI NF-3

- The ECINF collects data on owners of informal enterprises, defined as self-employed or employers with 5 or less employees, in urban areas of Brazil. It did not include: (i) non-agricultural units in the rural areas, (ii) homeless population in urban areas; (iii) people connected to illegal activities, and (iv) domestic workers.

- Sampling for the 1997 and 203 ECINF surveys using 2 stage methodology w/ objective of determining the role and dimension of the informal activities for the Brazilian economy.

- First, IBGE carried out a listing of all households in different enumeration areas randomly selected from a sample frame setting each one of 27 Brazilian states as stratum. Enumeration areas were selected using a probabilistic sample proportional to size on the basis of the urban census enumeration areas. Each one contain on average 300 households. This sort of census in selected enumeration areas intend to identify target micro-economic units.

- Then, on the basis of the listing of micro-economic units, IBGE selected the final sample of units applying a very detailed questionnaire.

- The sample was designed to cover all different type of activity sector such as: manufacturing, construction, trade, lodging and food services, transportation, rendering services, technical and auxiliary services, and others services.
Questions Addressed-4

1. Did overall utilization of credit irrespective of source (formal or informal) increase between 1997 and 2003?

2. Did the increased availability of formal credit (e.g. CA) lead to more utilization of formal credit in the NE region of Brazil?

3. Did formal credit simply displace credit from other sources, such as credit from friends and relatives, product suppliers etc)?

4. What is the impact of credit utilization on the profitability of microenterprises?
   - DID analysis and PSM analysis using 2003 ECINF

5. Annex: Where profits higher in municipalities where CA had higher penetration/presence? “Dose response analysis”
Q1-Q3: Effects of Increased access on Utilization of Credit (by source)

- Estimated impacts of based on the difference-in differences (DID) estimator.
- Bias is additive and time invariant
- Regression model estimated:

\[ Y(i,t) = \beta_0 + \beta_T T + \beta_R D2003 + \beta_{TR} (T \times D2003) + \sum_{k=1}^{K} \theta_k X_k (i,t) + \eta(i,t) \]
\[ \text{DID} = \beta_{TR} = \]

\[
\beta_{TR} = \left[ E(Y \mid T = 1, D2003 = 1, X = \bar{X}) - E(Y \mid T = 1, D2003 = 0, X = \bar{X}) \right] - \\
\left[ E(Y \mid T = 0, D2003 = 1, X = \bar{X}) - E(Y \mid T = 0, D2003 = 0, X = \bar{X}) \right].
\]
The DID estimator

\[ Y_1 - Y_0 \]

Impact

t = 0

t = 1

time
Outcomes

- **Overall credit:**
  - Used any credit last 3 mo = 1 if $V4331=3$ or 5, =0 otherwise

- **Utilized credit last 3 mo &**
  - Source 1 = friends and relatives, $V4332=1$
  - Source 2 = private/public banks, $V4332=2$
  - Source 3 = suppliers (fornecedores), $V4332=3$
  - Source 4 = other persons/firms $V4332=4/5$
Samples, Treatment, & Covariates

SAMPLE A: Full sample
- $T=1$ if microE in municipalities of NE and MG and ES covered by CA, $=0$ otherwise (comparison: all other municipalities not covered by CA)

SAMPLE B: Sample of NE states only: some munic in NE not covered by CA
- $T=1$ if microE in a municipality of NE where CA operates/has clients, $=0$ otherwise (comparison: all other municipalities in NE not covered by CA)

SAMPLE C: Sample of SE states only: CA in SE only in some munic of MG and ES
- $T=1$ if microE in a municipality of SE where CA operates/has clients, $=0$ otherwise (comparison: all other municipalities in SE not covered by CA)

- ECINF is a sample $\rightarrow$ a municipality in ECINF 1997 not necessarily appear in 2003
- Issue: treat municipalities as repeated cross-sections or focus on panel of municipalities that appear in both 1997 and 2003.
- Other covariates ($X$): Binary vars: for age group, male, education 2nd, more than 2nd, born in this municipality, is the boss, age started working, microE at home, has exclusive own installation, origin of initial capital borrowed, no needed, partners works in the business, business works all months, has fixed customers, not registered.
<table>
<thead>
<tr>
<th>Sample</th>
<th>1997</th>
<th>2003</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample A: Full sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In both survey years</td>
<td>752</td>
<td>916</td>
<td>1,668</td>
</tr>
<tr>
<td>CrediAmigo (T=1)</td>
<td>314</td>
<td>345</td>
<td>659</td>
</tr>
<tr>
<td><strong>Sample B: NE region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In both survey years</td>
<td>351</td>
<td>378</td>
<td>729</td>
</tr>
<tr>
<td>CrediAmigo (T=1)</td>
<td>308</td>
<td>335</td>
<td>643</td>
</tr>
<tr>
<td><strong>Sample C: SE region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In both survey years</td>
<td>123</td>
<td>163</td>
<td>286</td>
</tr>
<tr>
<td>CrediAmigo (T=1)</td>
<td>6</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

Notes:
IBGE 2003 and 1997 ECINF surveys and administrative data from the CrediAmigo program.
<table>
<thead>
<tr>
<th>Sample</th>
<th>Difference in difference estimates of the utilization of credit from different sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private or sources</td>
</tr>
<tr>
<td></td>
<td>Any one source</td>
</tr>
<tr>
<td></td>
<td>Friends &amp; relatives</td>
</tr>
<tr>
<td></td>
<td>Public Banks</td>
</tr>
<tr>
<td></td>
<td>Own Suppliers</td>
</tr>
<tr>
<td></td>
<td>Others (persons or firms)</td>
</tr>
<tr>
<td>Sample A: Full sample</td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td>0.012* 0.002 0.015*** -0.004 0</td>
</tr>
<tr>
<td></td>
<td>[0.007] [0.003] [0.004] [0.003] [0.002]</td>
</tr>
<tr>
<td>Sample B: NE region</td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td>0.014 -0.005 0.018** 0.002 -0.001</td>
</tr>
<tr>
<td></td>
<td>[0.013] [0.006] [0.008] [0.006] [0.002]</td>
</tr>
<tr>
<td>Sample C: SE region</td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td>0.001 0.014** 0.011 -0.001 -0.023</td>
</tr>
<tr>
<td></td>
<td>[0.030] [0.006] [0.019] [0.012] [0.016]</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in brackets
*significant at 10%; ** significant at 5%; *** significant at 1%
Source: Tables A.1, A.2, and A.3 in Annex
DID estimates based on LPM
Municipalities with CA in NE, MG, ES vs all others

- Overall utilization of credit (independently of source) increased by 1.2%
- Utilization of formal credit (source 2) as primary source increased by 1.5%
DID estimates (LPM): NE only
munic w/ CA vs munic in NE w/o CA

- No significant impact on overall utilization of credit (independently of source)
- Utilization of formal credit (source 2) as primary source increased by 1.8%
- CA credit does not appear to replace credit from suppliers (source 3) as primary source.
No significant impact on overall utilization of credit (independently of source)

No effect on formal credit or credit from suppliers

No significant increase in the use of formal loans in the municipalities of the SE region covered by CrediAmigo

But a significant increase in the utilization of credit from friends and relatives. This suggests that the CrediAmigo loans in the municipalities of north Minas Gerais and north Santo Espirito may simply “leak-out” to other micro-entrepreneurs that are not direct members of the solidarity group borrowing the money.
Q4a: Impacts on Profits

Need to take into account of the substantial cost of living differences over time and across space (urban and metropolitan areas) of Brazil

1. Use national index (NI) of prices (profits/NI), and
2. Spatial price indices (World Bank)

We investigate whether the profits of microenterprises in the municipalities where CrediAmigo operated also increased

Profits (during the month of October) are estimated as the difference between revenues and expenditures in the same month, where revenues are defined as the sum of the value of sales of own product, resale of merchandise, provision of services and other receipts and expenditures are the sum of expenditures on inventories (primary material and items for resale), labor costs (e.g. salaries), contributions to Social Security (INSS, FGTS), electricity, water and telephone, rental of property, machines and equipment, vehicles, gasoline, repair and maintenance services, other services received, taxes, financial expenditures, and other expenditures.
Table 3 – Difference in difference estimates of the profits of micro-enterprises (in municipalities with CrediAmigo vs. enterprises in municipalities without CrediAmigo)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Profits</th>
<th>TR $\hat{\beta}_{TR}$</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample A: Full sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td></td>
<td>68.069**</td>
<td>Robust standard errors in brackets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[32.528]</td>
<td>*significant at 10%; ** significant at 5%; *** significant at 1%</td>
</tr>
<tr>
<td><strong>Sample B: NE region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td></td>
<td>54.642</td>
<td>Source: Tables A.1, A.2, and A.3 in Annex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[76.943]</td>
<td></td>
</tr>
<tr>
<td><strong>Sample C: SE region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\beta}_{TR}$</td>
<td></td>
<td>352.427**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[139.395]</td>
<td></td>
</tr>
</tbody>
</table>
DID estimates: profits etc
Munic w/ CA in NE, MG, ES vs all othr using NI & Spatial P index

- Significant increase in profits on average in municipalities where CA operates (in Sample A and C)
- in the NE (sample B): positive effect but not significant (large st. error)
  - Significant increase in re-sales of merchandize and expenditures for restocking merchandize
Q4b: Impacts on Profits
Propensity Score Matching (PSM)

- Also estimated impact of credit on profits using a comparison group selected using the method of PSM
- Used data from ECI NF 2003
- Estimated impact on profits (in 1997 prices) using PSM
  - \( T_1 = 1 \) if used credit from any source, comparison = no credit at all
  - \( T_2 = 1 \) if used credit from formal bank, comparison = no credit at all or credit from other sources except formal banks
  - \( T_3 = 1 \) if used credit from formal bank, comparison = no credit at all
- SAMPLE A: All municipalities with CA in the NE and MG, ES
- SAMPLE B: All municipalities with CA in the NE
## Table 4: The Impacts of Credit on the profits of micro-enterprises

<table>
<thead>
<tr>
<th>Sample A: All</th>
<th>T1=1</th>
<th>T2=1</th>
<th>T3=1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59.47</td>
<td>208.65</td>
<td>196.3</td>
</tr>
<tr>
<td></td>
<td>[1.16]</td>
<td>[2.69]</td>
<td>[2.52]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample B: NE only</th>
<th>T1=1</th>
<th>T2=1</th>
<th>T3=1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>49.35</td>
<td>193.8</td>
<td>181.1</td>
</tr>
<tr>
<td>Notes:</td>
<td>[0.96]</td>
<td>[2.49]</td>
<td>[2.32]</td>
</tr>
</tbody>
</table>

Notes:
- Method used: PSM (kernel matching)
- Sample A: All municipalities with CA in the NE and MG,ES
- Sample B: All municipalities with CA in the NE
- T1=1 if used credit from any source, comparison= no credit at all
- T2=1 if used credit from formal bank, comparison= no credit at all or credit from other sources except formal banks
- T3=1 if used credit from formal bank, comparison= no credit at all
- t-values in brackets [.]
### Table 5: The Impacts of Credit on the number of employees in the micro-enterprise

<table>
<thead>
<tr>
<th></th>
<th>T1=1</th>
<th>T2=1</th>
<th>T3=1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample A: All</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>[3.34]</td>
<td>[4.31]</td>
<td>[4.16]</td>
</tr>
<tr>
<td><strong>Sample B: NE only</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>[3.3]</td>
<td>[4.29]</td>
<td>[4.14]</td>
</tr>
</tbody>
</table>

**Notes:**
- Method used: PSM (kernel matching)
- Sample A: All municipalities with CA in the NE and MG,ES
- Sample B: All municipalities with CA in the NE
- T1=1 if used credit from any source, comparison= no credit at all
- T2=1 if used credit from formal bank, comparison= no credit at all or credit from other sources except formal banks
- T3=1 if used credit from formal bank, comparison= no credit at all
t-values in brackets [.]
Conclusions

1. Did overall utilization of credit irrespective of source (formal or informal) increase between 1997 and 2003?
   ✓ Overall utilization of credit (independently of source) increased by 1.2%

2. Did the increased availability of formal credit (e.g. CA) lead to more utilization of formal credit in the NE region of Brazil?
   ✓ Utilization of formal credit (source 2) as primary source increased by 1.5%
Conclusions

3. Did formal credit simply displace credit from other sources, such as credit from friends and relatives, product suppliers etc)?
   ✓ No

4. What is the impact of credit utilization on the performance of microenterprises?
   ✓ Firms that used formal credit appear to have higher profits on average than firms who don’t.
   ✓ Firms that use formal credit appear to have a significantly higher number of employees.
End
Annex following
Q5: “Dose-Response” Analysis at municipality level

- Where profits higher in municipalities where CA had higher penetration or presence?
- Key vars from 2003 ECI NF and CA admin data aggregated to municipality level & merged w/ RGDP, pop and Bolsa Familia data at municipality level
Q5-cont’d: “Dose-Response” Analysis at municipality level

- Dose = \ln(\text{# of CA clients in municipality: CA admin data})/(\text{# of microE in municipality using ECINF expansion factors})
Lhs = mean profits of microE

Dose Response Function

Confidence Bounds at .95 % level
Dose response function = Linear prediction
Lhs=mean # of employees

Dose Response Function

Confidence Bounds at .95 % level
Dose response function = Linear prediction
Lhs=prob of invest formal credit

Dose Response Function

E[creditformal(t)]

Dose Response Function = Linear prediction

Confidence Bounds at .95 % level
Lhs=prob of repay debt w/ formal credit