

# COVID-19 and Local Market Power in Credit Markets

Thiago Silva

Banco Central do Brasil

Sergio Souza

Banco Central do Brasil

Solange Guerra

Banco Central do Brasil

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*Disclaimer:* The views expressed in this paper are those of the authors and do not necessarily reflect those of the Banco Central do Brasil.

# Motivation

- ▶ Pandemics impact regions, economic sectors, and economic agents differently
  - ▶ Some sectors may become strengthened while others may experience severe losses (Siu and Wong [2004], del Rio-Chanona et al. [2020])
  - ▶ Region-specific effects depend on the pre-pandemic conditions, the sectoral composition and structure of the economy, and the quality of institutional settings (Muggenthaler et al. [2021], Çolak and Özde Öztekin [2021])
  - ▶ Pandemics can accelerate trends and cause structural changes (Pamuk [2007] and Clark [2016], Barro and Ursúa [2008], Fornasin et al. [2018] and Rao and Greve [2018])
  - ▶ Market power of financial and non-financial firms can increase or decrease (Bloom et al. [2021] and Kenney and Zysman [2020])

# Research question: has COVID-19 affected bank market power?

- ▶ Financial crises impact the market power of banks (Cubillas and Suárez [2018], Efthymou and Yildirim [2014], and Berger and Bouwman [2013])
- ▶ The COVID-19 crisis and financial crises...
  - ▶ share similarities: reduction in growth rates, increase in unemployment, reduction in revenues, and bankruptcy of firms
  - ▶ but also have particularities: “debt as a cause” vs. “debt as a short-term mitigator”
- ▶ Financial systems were undergoing a heavy process of digitalization (Philippon [2020])
  - ▶ Social distancing: impact differently remote and face-to-face transactions
  - ▶ Banks with more developed IT infrastructures were better prepared to face the pandemic
  - ▶ Digitalization could serve as a medium to leverage market power for better prepared banks

# How can we evaluate market competition?

## **Structural measures**

(concentration indices: HHI and market share)

### *Advantages*

- ▶ Simplicity
- ▶ Not data-intensive

### *Considerations*

- ▶ Conceptual limitations
- ▶ Endogenous causal relationship between concentration and market power
- ▶ Hypothesis that only the internal characteristics of the market affect competition

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## **Performance measures**

(markups – Lerner index)

### *Advantages*

- ▶ Direct measure of market power
- ▶ Standard measure of market power among economists (less disputed)
- ▶ Enable us to decompose the *markup* (price - cost)

### *Considerations*

- ▶ Data-intensive
- ▶ Assumptions on the production function forms
- ▶ Sensitive inputs and outputs

# This paper...

- ▶ Analyze how COVID-19 affected market power in local credit markets in Brazil
- ▶ **Empirical strategy:** exploit the different timing and severity of COVID-19 across Brazilian localities
  - ▶ Brazil has continental dimensions with a rich variety of economic profiles across its 5,570 munis
  - ▶ Similarity on the economic measures to combat the pandemic (mostly from the federal government)
- ▶ **Challenge 1:** how can we evaluate market power locally using performance measures?
  - ▶ Typically at the national level due to the lack of data: cannot identify COVID-19 shocks across local markets
  - ▶ Enables us to identify the channels through which market power can change (price and marginal costs)
- ▶ **Challenge 2:** many simultaneous confounders, such as government programs to combat the economic effects of COVID-19
- ▶ **Contributions:**
  - ▶ Design of a local version of the Lerner index to evaluate local market power
  - ▶ Understand how local COVID-19 prevalence affects local market power
  - ▶ Understand the role of IT in shaping bank market power in pandemic times

# Data

## ▶ **Banks and identified credit operations**

- ▶ SCR – Credit Information System (proprietary, BCB)
- ▶ Cosif – Accounting Plan of the Institutions of the National Financial System (proprietary, BCB)
- ▶ RFB – Brazilian Federal Revenue Service (proprietary, Brazilian IRS)
- ▶ Unicad – Information on Entities of Interest to the Central Bank (proprietary, BCB)
- ▶ Estban – Monthly Banking Statistics by Municipality (public, BCB)

## ▶ **Geographical location**

- ▶ IBGE – Brazilian Institute of Geography and Statistics (public, IBGE)

## ▶ **Identified labor information**

- ▶ RAIS/Caged – Employee-employer formal relationships (proprietary, Ministry of Economy)

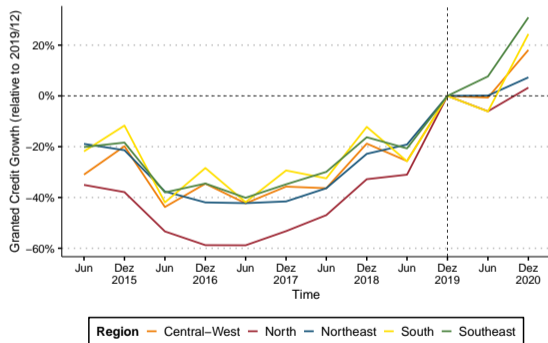
## ▶ **COVID-19**

- ▶ COVID-19 epidemiological bulletins (public, Ministry of Health)
- ▶ Emergency Aid Beneficiaries (public)

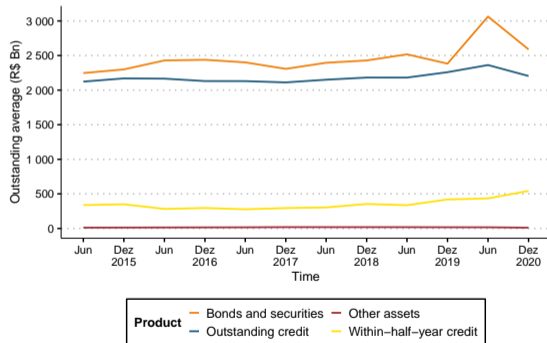
# Credit concessions increased significantly in Brazil in 2020

## Facts:

- ▶ All regions experienced a substantial increase in credit concessions
- ▶ Credit is an important product: outstanding credit takes almost half of the banks' assets



(a) Credit concessions within half-year



(b) Bank products



# Evaluation of local market power

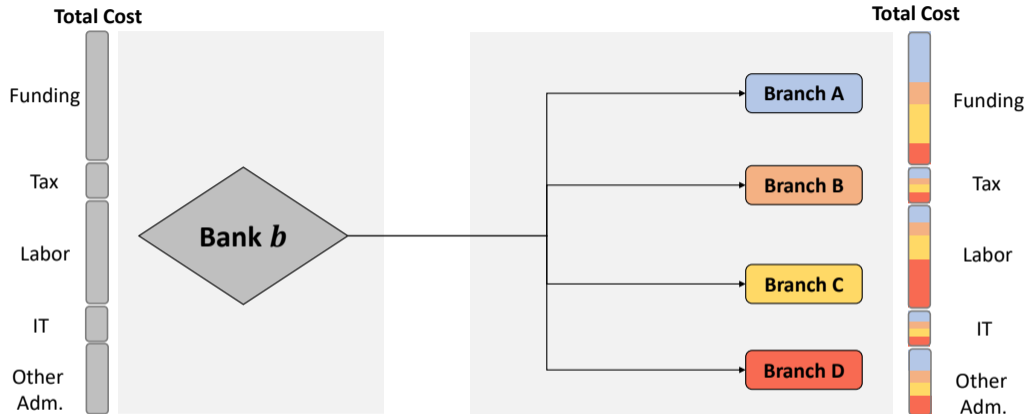
- ▶ **Local credit market:** set of “local” banks in a delimited locality granting credit of a specific modality
  - ▶ **Locality:** immediate geographic regions (IBGE), which are strongly connected neighboring munis
    - ▶ Locality is settled in terms of the bank granting credit: borrowers can be anywhere  $\Rightarrow$  coherent with production/cost functions
  - ▶ **Banks:** representative branch of each bank operating in the locality
  - ▶ **Credit modality:** credit modalities to individuals and non-financial firms
- ▶ Design of a local (and data-intensive) version of the Lerner index:

$$L_{blt}^{(m)} = \frac{p_{blt}^{(m)} - MC_{blt}^{(m)}}{p_{blt}^{(m)}}, \quad p_{blt}^{(m)} = \frac{\text{Credit Income}_{blt}^{(m)}}{\text{Credit Concessions}_{blt}^{(m)}}$$

$p_{blt}^{(m)}$  and  $MC_{blt}^{(m)}$  are bank  $b$ 's effective price and marginal cost at location  $l$  during time  $t$  for product  $m$

**Bottomline:** estimate effective prices, marginal costs, and Lerner indices for each bank operating at each locality in a specific credit product semiannually

# Evaluation of local market power: bank-to-branch allocation



## Aggregate data

- **COSIF**: High-quality, detailed (national) bank financial statements

## Cost allocation across branches

- **SCR** (loan-level): credit from bank branches to borrowers with geographical info on both sides
- **ESTBAN** (bank-locality) balance-sheet accounts but not *detailed* income accounts
- **RAIS** (bank-branch) number of employees and payroll

# Evaluation of local market power: production function

## Inputs

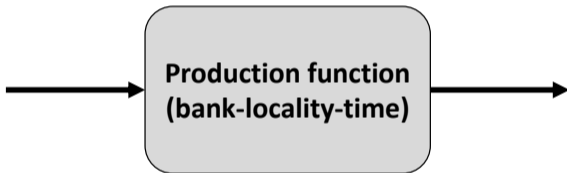
Funding prices

Tax prices

Labor prices

IT prices

Other adm. prices



## Outputs

*Credit modalities  
(concessions within half-year)*

Individuals – payroll deducted

⋮

Firms – working capital

⋮

*Credit modalities  
(concessions before half-year)*

Individuals – payroll deducted

⋮

Firms – working capital

⋮


**Bonds and securities**

**Other assets**

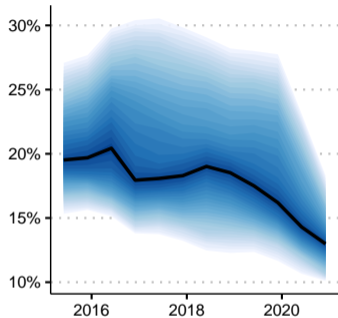
### Data source

 Cosif + Estban

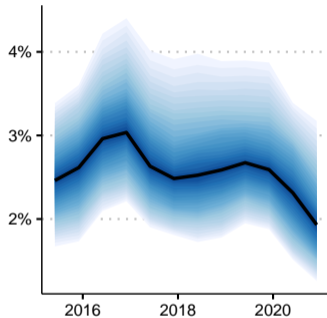
 SCR

 Estban

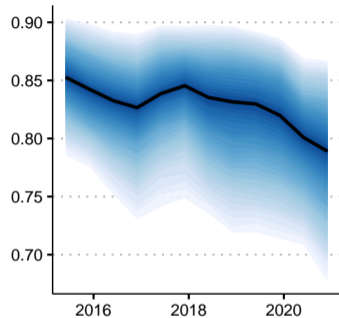
# What we typically have as market competition results



(a) Effective price



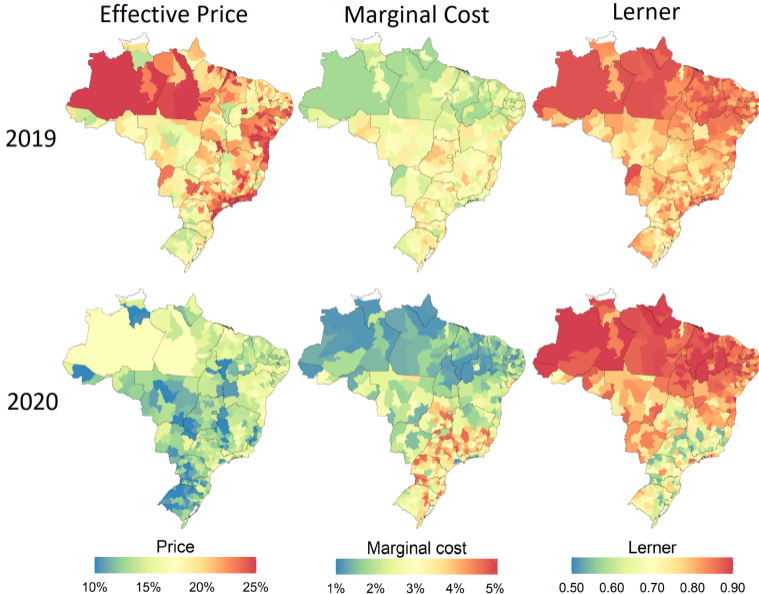
(b) Marginal cost



(c) Lerner

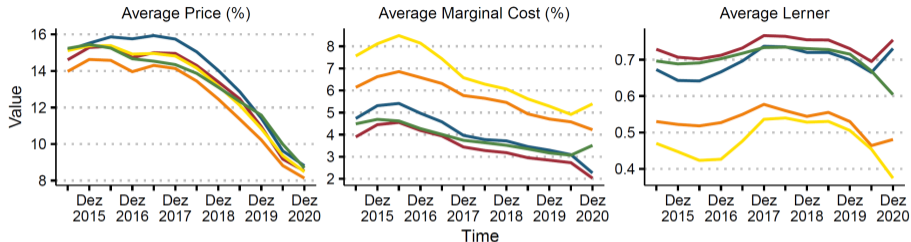
**Bottomline:** bank-specific “national averages” may overlook important aspects of local markets

# Geographical distribution pre- and during the pandemic

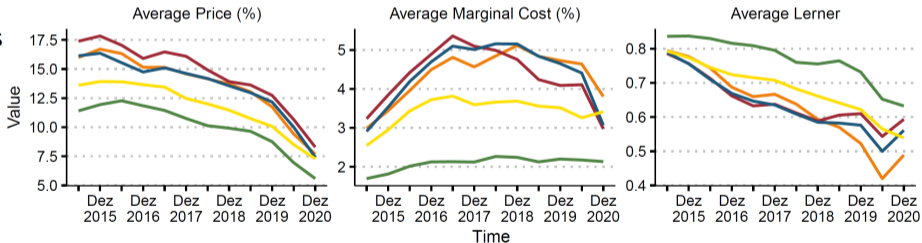


# Region-specific competition at the modality level

Individuals  
(payroll-deducted)



Non-financial firms  
(working capital)



**Region** — Central-West — North — Northeast — South — Southeast

# COVID-19 and local market power

Focus on credit concessions within the semester to capture current market conditions more accurately

**Local market power:** local version of the Lerner index:

$$L_{blt}^{(m)} = \frac{p_{blt}^{(m)} - MC_{blt}^{(m)}}{p_{blt}^{(m)}},$$

$p_{blt}^{(j)}$  and  $MC_{blt}^{(j)}$  are the average effective price and marginal cost of bank  $b$  at location  $l$  at time  $t$  relative to banking product  $m$

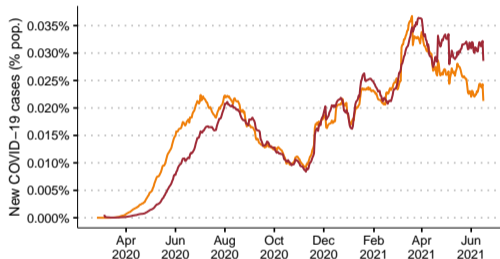
**Mechanism:**  $\uparrow$  local COVID-19 prevalence  $\Rightarrow$  potential changes in market power through the:

- ▶ *Effective price channel:* increases lead to higher market power
- ▶ *Marginal cost channel:* increases lead to lower market power

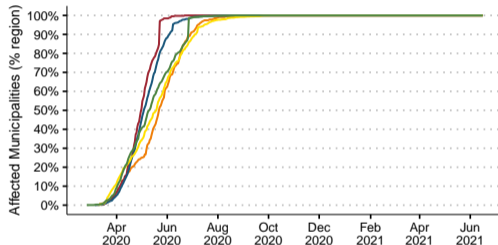
...  $\Rightarrow$  observed changes in local market power depend on the most dominant channel

# Local measure for COVID-19 intensity

- ▶ Exploit the different timing and severity that Brazilian municipalities experienced local COVID-19 cases



**Municipality Type** — Capital — Inland



**Region** — Central-West — North — Northeast — South — Southeast

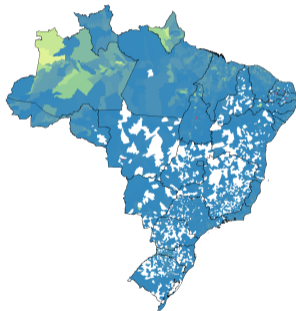
- (a) Incidence of COVID-19 cases (% local population) (b) Share of munis. with at least one COVID-19 case



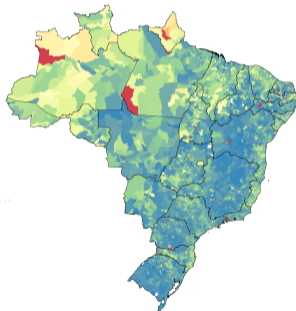
# Our exogenous variation: COVID-19 affected localities differently

**COVID-19 prevalence:** avg. accumulated number of COVID-19 cases in 2020 as a share of the local population

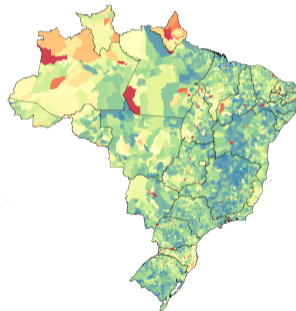
May 31, 2020



August 31, 2020



December 31, 2020



Share of population affected



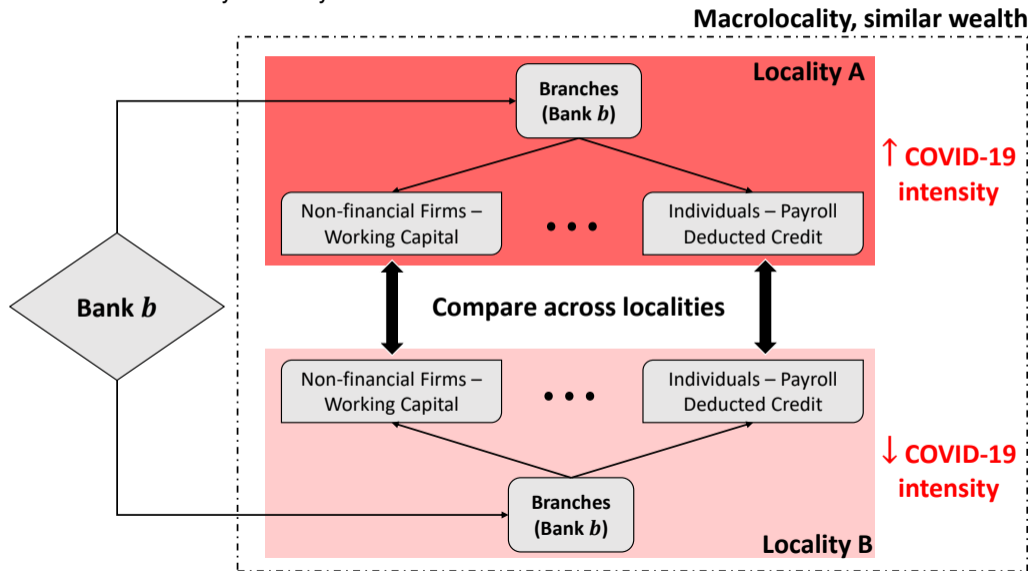
# Local correlates of COVID-19 prevalence

| Dependent Variable:<br>Model:                                    | % Pop. Affected by COVID-19 <sub><i>t</i></sub> |                        |                        |                       |  |
|--|---|------------------------|------------------------|-----------------------|--|
|  | (I)   | (II)                   | (III)                  | (IV)                  | (V)  |
| Distance to capital <sub><i>t</i></sub>                          | 0.0399<br>(0.0429)                              | -0.0315<br>(0.0469)    | -0.0722<br>(0.0680)    | 0.1608<br>(0.1559)    | 0.2112<br>(0.2215)                         |
| <i>Per capita</i> GDP <sub><i>t</i></sub>                        | 0.2296***<br>(0.0540)                           | 0.2599***<br>(0.0587)  | 0.2498***<br>(0.0771)  | 0.2377***<br>(0.0812) | 0.1338<br>(0.0870)                         |
| Population <sub><i>t</i></sub>                                   | -0.1587***<br>(0.0583)                          | -0.1239**<br>(0.0492)  | -0.0745**<br>(0.0306)  | -0.0365<br>(0.0445)   | -0.0476<br>(0.0374)                        |
| Has capital <sub><i>t</i></sub> (dummy)                          | 0.8025***<br>(0.2274)                           | 0.5607***<br>(0.2077)  | 0.3779*<br>(0.2055)    | 0.0720<br>(0.3800)    | 0.2681<br>(0.2994)                         |
| Agriculture as Preponderant Activity <sub><i>t</i></sub> (dummy) | -0.3963***<br>(0.1050)                          | -0.5405***<br>(0.1191) | -0.5461***<br>(0.1669) | -0.4735<br>(0.2942)   | -0.7117<br>(0.4938)                        |
| Industry as Preponderant Activity <sub><i>t</i></sub> (dummy)    | -0.0357<br>(0.1698)                             | -0.1071<br>(0.1696)    | -0.1648<br>(0.1916)    | -0.2432<br>(0.2335)   | -0.3220<br>(0.3011)                        |
| (Intercept)  | -0.0289<br>(0.0517)                             |                        |                        |                       |  |
| <i>Fixed-effects</i>   | —   | Region                 | State                  | Macrolocality         | Macrolocality,<br><i>Per capita</i> GDP(2) |
| Observations   | 508   | 508                    | 508                    | 506                   | 425  |
| R <sup>2</sup>   | 0.0643  | 0.0983                 | 0.2506                 | 0.3789                | 0.4613                                     |

**Bottomline:** local COVID-19 prevalence is unrelated to many municipality-level observables once we compare localities with similar *per capita* GDP within the same macrolocality

# Empirical setup: viewing COVID-19 as a local demand shock

Data is at the bank-locality-modality-time level



# Challenge: many simultaneous confounders

1. **Households:** financial support via direct cash transfers and incentives for credit renegotiation/restructuring

*Treatment:* control for emergency aid volume over GDP in each location

2. **Firms:** financial support in the form of incentives for banks to renegotiate and extend credit to the corporate sector and special credit line programs for SMEs

*Treatment:* control for the number of SMEs in each location

3. **Banks:** changes in the regulatory framework to foster credit concessions, such as reductions in reserve requirements

*Treatment:* compare branches of the same bank (within-bank)

4. **Macroeconomics:** monetary and exchange policies

*Treatment:* no problem in a differences-in-differences analysis

# COVID-19 reduces effective prices, but not economically significant

*b*: bank; *m*: credit modality; *l*: locality; *t* time

| Dependent Variables:   | Credit<br>Income <sub><i>bmlt</i></sub> | Granted<br>Credit <sub><i>bmlt</i></sub> | Effective<br>Price <sub><i>bmlt</i></sub> |
|--|---|--|---|
| COVID-19 <sub><i>t</i></sub> · % Pop. Affected by COVID-19 <sub><i>l</i></sub> | -0.0120***<br>(0.0045)                  | -0.0156***<br>(0.0030)                   | -0.0173***<br>(0.0042)                    |
| COVID-19 <sub><i>t</i></sub> · Emergency Aid Volume / GDP <sub><i>l</i></sub>  | -0.0029<br>(0.0124)                     | -0.0113<br>(0.0113)                      | -0.0324**<br>(0.0152)                     |
| COVID-19 <sub><i>t</i></sub> · Number of SMEs <sub><i>l</i></sub>              | -0.0232***<br>(0.0074)                  | -0.0203***<br>(0.0054)                   | -0.0099*<br>(0.0059)                      |
| <i>Fixed-effects &amp; Controls</i>  |   |  |   |
| Locality   | Yes                                     | Yes                                      | Yes                                       |
| Time · Bank · Modality · Macrolocality · <i>Per capita</i> GDP(2)              | Yes                                     | Yes                                      | Yes                                       |
| Other Controls?  | Yes                                     | Yes                                      | Yes                                       |
| Observations   | 75,402                                  | 75,514                                   | 75,514                                    |
| R <sup>2</sup>   | 0.6830                                  | 0.8050                                   | 0.7903                                    |

## ► Findings:

- Credit income and granted credit reduce: economically significant for a 1-std.dev. increase in COVID-19 prevalence (-19% and -18.6% of the sample mean)
- Effective prices reduce: statistically significant but not economically significant (1.6% of the sample mean)

► **Bottomline:** The decrease in credit income is offset by a similar decrease in credit concessions

# COVID-19 increases marginal costs

*b*: bank; *m*: credit modality; *l*: locality; *t* time

| Dependent Variable:  | Marginal Cost <sub><i>bmlt</i></sub> |
|--|--------------------------------------|
| COVID-19 <sub><i>t</i></sub> · % Pop. Affected by COVID-19 <sub><i>l</i></sub> | 0.0173***<br>(0.0036)                |
| COVID-19 <sub><i>t</i></sub> · Emergency Aid Volume / GDP <sub><i>l</i></sub>  | -0.0236*<br>(0.0143)                 |
| COVID-19 <sub><i>t</i></sub> · Number of SMEs <sub><i>l</i></sub>              | 0.0318***<br>(0.0059)                |
| <i>Fixed-effects &amp; Controls</i>  |                                      |
| Locality   | Yes                                  |
| Time · Bank · Modality · Macrolocality · <i>Per capita</i> GDP(2)              | Yes                                  |
| Other Controls?  | Yes                                  |
| Observations   | 75,514                               |
| R <sup>2</sup>   | 0.7738                               |

- ▶ **Findings:** marginal costs increase 1 cent for a 1-std.dev. increase in COVID-19 prevalence (11% of the sample mean: 5.9 cents) ⇒ economically relevant
- ▶ **Bottomline:** the increase in marginal costs suggests bank branches are unable to adjust local cost factors quickly as a response to the reduction in credit concessions

# Stickiness of most local cost factors in the short term: IT provides cost flexibility

**Rationale:**  $\uparrow$  COVID-19 prevalence  $\Rightarrow$   $\downarrow$  credit concessions  $\Rightarrow$  can bank branches adjust costs accordingly?

| Dependent Variables:<br>Model:  | Local Total Cost <sub>blt</sub> |                     |                     |                    |                     |                        |
|---|---------------------------------|---------------------|---------------------|--------------------|---------------------|------------------------|
|   | (I)                             | (II)                | (III)               | (IV)               | (V)                 | (VI)                   |
| COVID-19 <sub>t</sub> × % Pop. Affected by COVID-19 <sub>t</sub>                                      | 0.0008<br>(0.0144)              | 0.0014<br>(0.0139)  | 0.0001<br>(0.0137)  | 0.0025<br>(0.0136) | -0.0012<br>(0.0144) | 0.0014<br>(0.0149)     |
| COVID-19 <sub>t</sub> × % Pop. Affected by COVID-19 <sub>t</sub> × % Local Cost Factor <sub>blt</sub> |                                 | -0.0011<br>(0.0039) | -0.0106<br>(0.0065) | 0.0130<br>(0.0130) | -0.0136<br>(0.0137) | -0.0106***<br>(0.0017) |
| COVID-19 <sub>t</sub> · Emergency Aid Volume / GDP <sub>t</sub>                                       | 0.0158<br>(0.0278)              | 0.0143<br>(0.0264)  | 0.0188<br>(0.0275)  | 0.0183<br>(0.0250) | 0.0176<br>(0.0284)  | 0.0080<br>(0.0256)     |
| COVID-19 <sub>t</sub> · Number of SMEs <sub>t</sub>   | 0.0505<br>(0.0405)              | 0.0502<br>(0.0404)  | 0.0508<br>(0.0402)  | 0.0492<br>(0.0410) | 0.0518<br>(0.0408)  | 0.0495<br>(0.0405)     |
| <i>Local Cost Factor</i>  | —                               | <b>Funding</b>      | <b>Tax</b>          | <b>Labor</b>       | <b>Other Adm.</b>   | <b>IT</b>              |
| <i>Fixed-effects &amp; Controls</i>   |                                 |                     |                     |                    |                     |                        |
| Locality + Time · Bank · Macrolocality · Per capita GDP(2)  | Yes                             | Yes                 | Yes                 | Yes                | Yes                 | Yes                    |
| Other controls?   | Yes                             | Yes                 | Yes                 | Yes                | Yes                 | Yes                    |
| Observations  | 9,342                           | 9,342               | 9,342               | 9,342              | 9,342               | 9,342                  |
| R <sup>2</sup>  | 0.9422                          | 0.9426              | 0.9424              | 0.9423             | 0.9426              | 0.9425                 |

## Bottomline:

- ▶ Branches cannot quickly adjust local costs as a response to the *relative reduction* in credit concessions
- ▶ Branches more reliant on IT spending have a more flexible cost structure

# More benefits of IT: flexibility in credit concessions

**Rationale:** Digitalization enables remote transactions  $\Rightarrow$  more digitalized banks are less constrained by local borrowers' conditions  $\Rightarrow$  bank branches may lend credit away if local COVID-19 conditions are severe

| Dependent Variable:<br>Model:  | % Clients Outside Locality <sub>blt</sub> |                        | Granted Credit <sub>bmlt</sub> |
|--|---|------------------------|--------------------------------|
|  | (I)                                       | (II)                   | (III)                          |
| COVID-19 <sub>t</sub> · % Pop. Affected by COVID-19 <sub>t</sub>                           | -0.0429***<br>(0.0157)                    | -0.0415***<br>(0.0162) | -0.0150***<br>(0.0039)         |
| COVID-19 <sub>t</sub> · % Pop. Affected by COVID-19 <sub>t</sub> · % IT Cost <sub>bl</sub> |   | 0.0240***<br>(0.0033)  | 0.0135**<br>(0.0067)           |
| COVID-19 <sub>t</sub> · Emergency Aid Volume / GDP <sub>t</sub>                            | 0.0045<br>(0.0212)                        | 0.0031<br>(0.0223)     | -0.0055<br>(0.0107)            |
| COVID-19 <sub>t</sub> · Number of SMEs <sub>t</sub>  | -0.0266<br>(0.0156)                       | -0.0249<br>(0.0155)    | -0.0227***<br>(0.0053)         |
| <i>Fixed-effects &amp; Controls</i>  |   |                        |                                |
| Locality + Time · Bank · Macrolocality · Per capita GDP(2)                                 | Yes                                       | Yes                    | —                              |
| Locality + Time · Bank · Modality · Macrolocality · Per capita GDP(2)                      | —   | —                      | Yes                            |
| Other controls?  | Yes                                       | Yes                    | Yes                            |
| Observations   | 9,342                                     | 9,342                  | 75,514                         |
| R <sup>2</sup>   | 0.8003                                    | 0.8006                 | 0.8077                         |

## Bottomline:

- ▶ Overall, bank branches concentrate lending locally for more affected localities
- ▶ However, IT enables bank branches to increase lending away in more affected localities



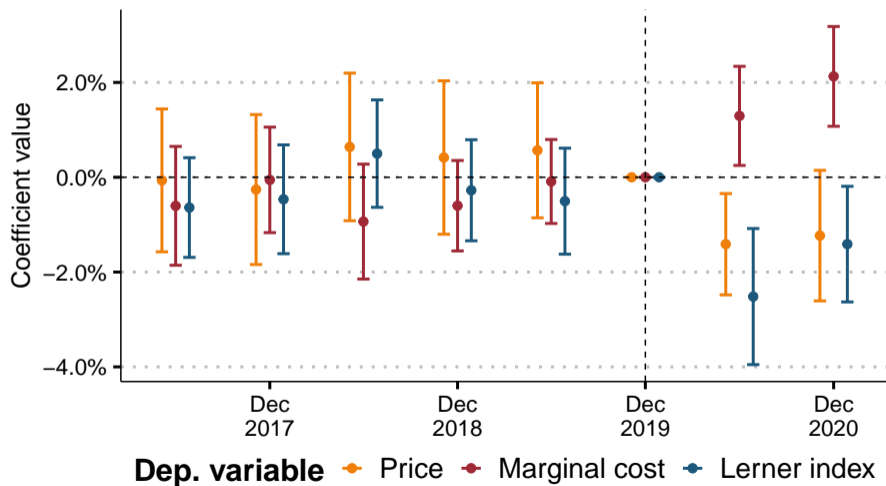
# The net effect: COVID-19 reduces local market power, but not for more digitalized banks who further improve their positioning

| Dependent Variables:   | Effective Price <sub>bmlt</sub> | Marginal Cost <sub>bmlt</sub> | Lerner <sub>bmlt</sub> | Effective Price <sub>bmlt</sub> | Marginal Cost <sub>bmlt</sub> | Lerner <sub>bmlt</sub> |
|--|---------------------------------|-------------------------------|------------------------|---------------------------------|-------------------------------|------------------------|
| COVID-19 <sub>t</sub> · % Pop. Affected by COVID-19 <sub>t</sub>                         | -0.0173***<br>(0.0042)          | 0.0173***<br>(0.0036)         | -0.0164***<br>(0.0038) | -0.0179***<br>(0.0049)          | 0.0165***<br>(0.0048)         | -0.0158***<br>(0.0050) |
| COVID-19 <sub>t</sub> · % Pop. Affected by COVID-19 <sub>t</sub> · IT Cost <sub>bl</sub> |                                 |                               |                        | -0.0133*<br>(0.0078)            | -0.0179**<br>(0.0080)         | 0.0174**<br>(0.0068)   |
| COVID-19 <sub>t</sub> · Emergency Aid Volume / GDP <sub>t</sub>                          | -0.0324**<br>(0.0152)           | -0.0236*<br>(0.0143)          | 0.0194<br>(0.0153)     | -0.0348*<br>(0.0184)            | -0.0267<br>(0.0175)           | 0.0217<br>(0.0199)     |
| COVID-19 <sub>t</sub> · Number of SMEs <sub>t</sub>                                      | -0.0099*<br>(0.0059)            | 0.0318***<br>(0.0059)         | -0.0346***<br>(0.0065) | -0.0102<br>(0.0069)             | 0.0306***<br>(0.0077)         | -0.0334***<br>(0.0086) |
| <i>Fixed-effects &amp; Controls</i>  |                                 |                               |                        |                                 |                               |                        |
| Locality   | Yes                             | Yes                           | Yes                    | Yes                             | Yes                           | Yes                    |
| Time · Bank · Modality · Macrolocality · Per capita GDP(2)                               | Yes                             | Yes                           | Yes                    | Yes                             | Yes                           | Yes                    |
| Other controls and 2nd-order interactions?   | Yes                             | Yes                           | Yes                    | Yes                             | Yes                           | Yes                    |
| Observations   | 75,514                          | 75,514                        | 75,514                 | 75,514                          | 75,514                        | 75,514                 |
| R <sup>2</sup>   | 0.7903                          | 0.7738                        | 0.7450                 | 0.7910                          | 0.7749                        | 0.7456                 |

## Bottomline:

- ▶ COVID-19 reduce the local market power of bank branches mainly through the marginal cost channel
- ▶ However, bank branches more reliant on IT improve their positioning in terms of local market power

# Event study: local market power conditions are similar regardless of the observed COVID-19 prevalence before the pandemic



# Conclusions

- ▶ Branches in localities more affected by COVID-19 reduce lending and receive less credit income *relative to* branches in less affected areas
  - ▶ Effective price reduction is statistically significant, but not economically significant
  - ▶ Both financial support for households and SMEs contribute to reducing effective prices
- ▶ Branches cannot quickly adjust local costs in response to the *relative* drop in credit concessions
  - ▶ As a result, marginal costs increase
  - ▶ Financial support for SMEs contributes for increasing marginal costs
- ▶ Digitalization before the pandemic was a crucial factor
  - ▶ Digitalized banks are more flexible to reduce local costs and lend away to other localities (potentially less affected by COVID-19)
- ▶ In summary, COVID-19 reduced the local market power of bank branches
  - ▶ However, more digitalized banks were better prepared to face pandemic conditions and instead further improved their positioning in terms of local market power

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# APPENDIX

## A. COVID-19 and local economic activity

- ▶ Localities with higher COVID-19 prevalence are more likely to implement public health measures to contain the virus spread  $\Rightarrow$  may affect local economic activity
  
- ▶ How to estimate local economic activity?
  - ▶ Official municipality-level GDP (IBGE) has a lag of three to four years
  - ▶ High-frequency payment transactions received by firms in several streams:
    - ▶ Debit and credit cards: 3.5 million firms, 1.68 billion operations, 22% of Brazil's 2020 GDP
    - ▶ Invoices: 1.8 billion firms, 2.81 billion operations, 50% of Brazil's 2020 GDP
    - ▶ Wire transfers (STR/Sitraf, BCB): 6.7 million firms, 258.7 million operations, 59% of Brazil's 2020 GDP
    - ▶ Exports (*Câmbio*, BCB): 25 thousand firms, 20.4 thousand operations, 3% of Brazil's 2020 GDP
  
- ▶ **Proxy for local economic activity:** aggregate all non-financial firm inflows to the locality-time level

## A. COVID-19 and local economic activity: results

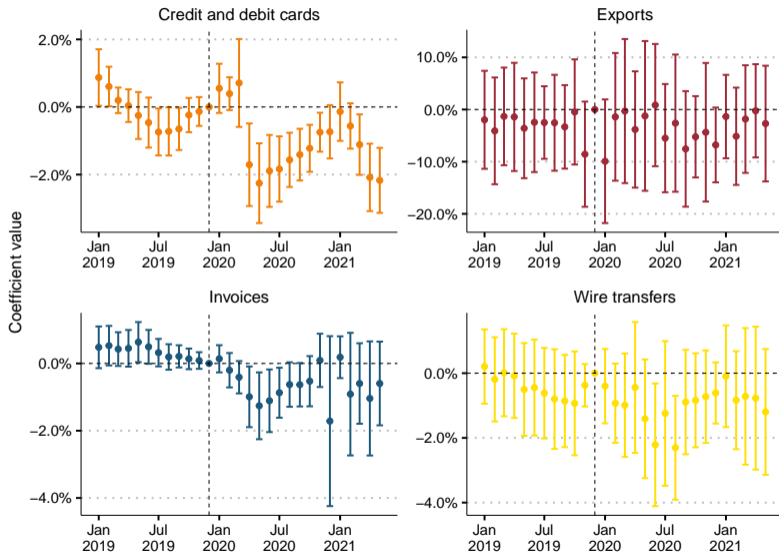
$$\text{Income}_{l,t} = \alpha_l + \alpha_{g(l),t} + \beta \text{ Share Affected by COVID-19}_l \cdot \text{COVID-19}_t + \epsilon_{l,t},$$

$l$  is the locality,  $t$  is time (monthly)

| Dependent Variables (Inflow):   | All                    | Cred/Deb<br>Cards      | Invoices               | Exports             | Wire<br>Transfers   |
|---|------------------------|------------------------|------------------------|---------------------|---------------------|
| Model:  | (I)                    | (II)                   | (III)                  | (IV)                | (V)                 |
| <i>Variables</i>  |                        |                        |                        |                     |                     |
| % Pop. Affected by COVID-19 <sub><math>l</math></sub><br>× COVID-19 <sub><math>t</math></sub> | -0.0248***<br>(0.0058) | -0.0092***<br>(0.0034) | -0.0098***<br>(0.0032) | -0.0083<br>(0.0172) | -0.0059<br>(0.0038) |
| <i>Fixed-effects &amp; Controls</i>   |                        |                        |                        |                     |                     |
| Locality  | Yes                    | Yes                    | Yes                    | Yes                 | Yes                 |
| Time · Macrolocality<br>· Per capita GDP(2)   | Yes                    | Yes                    | Yes                    | Yes                 | Yes                 |
| <i>Fit statistics</i>   |                        |                        |                        |                     |                     |
| Observations  | 13,514                 | 13,514                 | 13,514                 | 9,359               | 13,514              |
| R <sup>2</sup>  | 0.9920                 | 0.9971                 | 0.9982                 | 0.9147              | 0.9929              |

**Bottomline:** firm income reduces  $\Rightarrow$  local economic activity reduces

# A. COVID-19 and local economic activity: parallel trends





## B. Within-locality, across-bank: COVID-19 and banks

- ▶ Previous within-bank and across-locality analysis does not allow us to understand how COVID-19 prevalence affected *different* banks in the *same* locality
- ▶ Need of a bank-specific measure of COVID-19 exposure
- ▶ **Rationale:** a bank is expected to be more exposed to COVID-19 if it has more outstanding credit in more affected localities

$$\text{Bank Exposure to COVID-19}_b = \frac{\sum_{l \in \mathcal{L}} \text{Credit}_{bl} \cdot \text{Share of Population Affected by COVID-19}_l}{\sum_{l \in \mathcal{L}} \text{Credit}_{bl}}$$

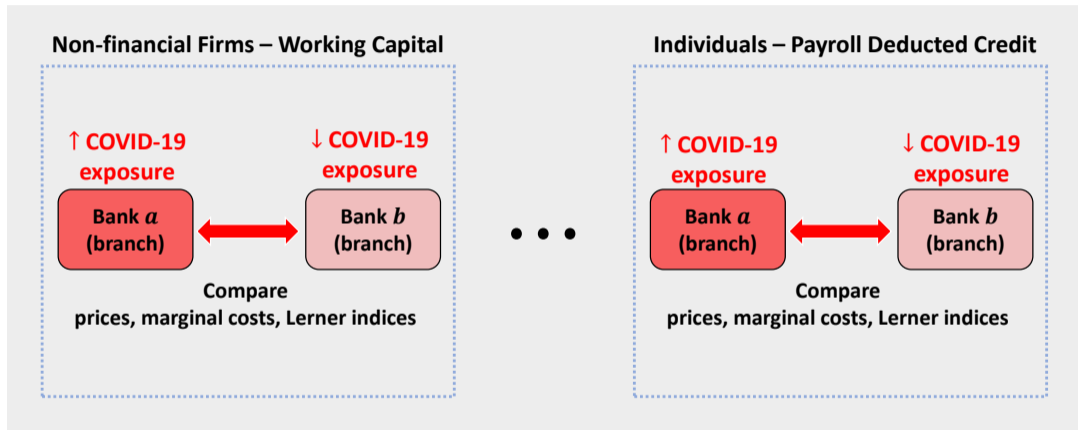
in which  $\text{Credit}_{bl}$  is the pre-determined bank  $b$ 's outstanding credit to locality  $l$  (December 2019)

- ▶ Similar strategy to estimate the bank exposure to the emergency aid program

## B. Within-locality, across-bank: empirical setup

- ▶ Data is at the bank-locality-modality-time level

LOCALITY A



- ▶ Compare banks of similar size: mitigate concerns about credit growth differences arising from credit programs to combat the COVID-19 that were mainly operationalized by large banks

## B. Within-locality, across-bank: baseline results

*b*: bank; *m*: credit modality; *l*: locality; *t* time

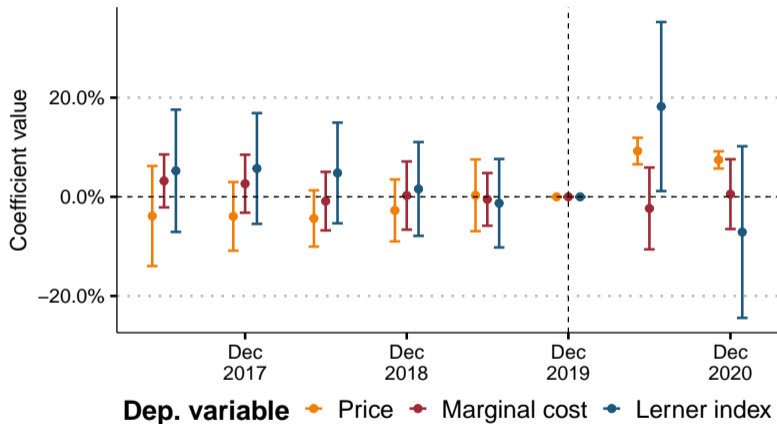
| Dependent Variables:  | Effective<br>Price <sub><i>bmlt</i></sub> | Marginal<br>Cost <sub><i>bmlt</i></sub> | Lerner <sub><i>bmlt</i></sub> | Credit<br>Income <sub><i>bmlt</i></sub> | Granted<br>Credit <sub><i>bmlt</i></sub> | Contractual<br>Price <sub><i>bmlt</i></sub> |
|---|---|---|-------------------------------|---|--|---|
| Model:  | (I)                                       | (II)                                    | (III)                         | (IV)                                    | (V)                                      | (VI)  |
| <i>Variables</i>  |   |   |                               |   |  |   |
| Bank's Exposure to COVID-19 <sub><i>b</i></sub><br>× COVID-19 <sub><i>t</i></sub> | 0.0933***<br>(0.0306)                     | -0.0193<br>(0.0229)                     | 0.0413**<br>(0.0182)          | 0.0242<br>(0.0209)                      | -0.0172***<br>(0.0065)                   | 0.0252*<br>(0.0146)                         |
| <i>Fixed-effects &amp; Controls</i>   |   |   |                               |   |  |   |
| Bank  | Yes                                       | Yes                                     | Yes                           | Yes                                     | Yes                                      | Yes   |
| Time · Modality · Locality · Bank Size(4)   | Yes                                       | Yes                                     | Yes                           | Yes                                     | Yes                                      | Yes   |
| Other Controls?   | Yes                                       | Yes                                     | Yes                           | Yes                                     | Yes                                      | Yes   |
| <i>Fit statistics</i>   |   |   |                               |   |  |   |
| Observations  | 89,390                                    | 89,390                                  | 89,390                        | 89,227                                  | 89,390                                   | 89,181                                      |
| R <sup>2</sup>  | 0.7915                                    | 0.3074                                  | 0.4725                        | 0.7469                                  | 0.7360                                   | 0.8786                                      |

### Bottomline:

- ▶ Banks more exposed to COVID-19 increase local market power through the effective price channel
- ▶ Effective price increases through a negative supply shock (↓ granted credit, ↑ contractual price) and not through increased credit income

## B. Within-locality, across-bank: event study

Coefficient: Time · Bank exposure to COVID-19



**Bottomline:** Local market power increases for banks more exposed to COVID-19, but the effects only last for the first semester of 2020

## B. Within-locality, across-bank: bank heterogeneities

*b*: bank; *m*: credit modality; *l*: locality; *t* time

| Dependent Variables:  | Price <sub><i>bmlt</i></sub> |                       |                        | Marginal Cost <sub><i>bmlt</i></sub> |                     |                      | Lerner <sub><i>bmlt</i></sub> |                       |                       |
|---|------------------------------|-----------------------|------------------------|--------------------------------------|---------------------|----------------------|-------------------------------|-----------------------|-----------------------|
| Model:  | (I)                          | (II)                  | (III)                  | (IV)                                 | (V)                 | (VI)                 | (VII)                         | (VIII)                | (IX)                  |
| <i>Variables</i>  |                              |                       |                        |                                      |                     |                      |                               |                       |                       |
| Bank's Exposure to COVID-19 <sub><i>b</i></sub><br>× COVID-19 <sub><i>t</i></sub>   | 0.0941***<br>(0.0162)        | 0.0957***<br>(0.0154) | 0.1127***<br>(0.0111)  | -0.0217<br>(0.0135)                  | -0.0199<br>(0.0146) | -0.0251*<br>(0.0139) | 0.0448***<br>(0.0092)         | 0.0385***<br>(0.0098) | 0.0432***<br>(0.0108) |
| Bank's Exposure to COVID-19 <sub><i>b</i></sub><br>× COVID-19 <sub><i>t</i></sub><br>× % Local IT Cost <sub><i>bl</i></sub> | 0.0012<br>(0.0013)           |                       |                        | -0.0161***<br>(0.0052)               |                     |                      | 0.0152***<br>(0.0050)         |                       |                       |
| × Market Share <sub><i>bml</i></sub>  |                              | 0.0467***<br>(0.0149) |                        |                                      | -0.0243<br>(0.0150) |                      |                               | 0.0093<br>(0.0198)    |                       |
| × Liquidity Index <sub><i>b</i></sub>   |                              |                       | -0.0283***<br>(0.0068) |                                      |                     | 0.0015<br>(0.0065)   |                               |                       | 0.0011<br>(0.0052)    |
| <i>Fixed-effects</i>  |                              |                       |                        |                                      |                     |                      |                               |                       |                       |
| Bank  | Yes                          | Yes                   | Yes                    | Yes                                  | Yes                 | Yes                  | Yes                           | Yes                   | Yes                   |
| Time · Modality · Locality · Bank Size(4)   | Yes                          | Yes                   | Yes                    | Yes                                  | Yes                 | Yes                  | Yes                           | Yes                   | Yes                   |
| Other controls?   | Yes                          | Yes                   | Yes                    | Yes                                  | Yes                 | Yes                  | Yes                           | Yes                   | Yes                   |
| <i>Fit statistics</i>   |                              |                       |                        |                                      |                     |                      |                               |                       |                       |
| Observations  | 89,390                       | 89,390                | 89,390                 | 89,390                               | 89,390              | 89,390               | 89,390                        | 89,390                | 89,390                |
| R <sup>2</sup>  | 0.7917                       | 0.7920                | 0.7920                 | 0.3082                               | 0.3077              | 0.3074               | 0.4741                        | 0.4772                | 0.4725                |

### Bottomline:

- ▶ More digitalized banks increase even further their local market power compared to other banks of similar size in the same locality