Loan Guarantees in a Crisis: An Antidote to a Credit Crunch

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Motivation

▶ Credit contractions amplify recessions
  ■ Limited tools to counteract them
  ■ Credit guarantees one of them

▶ Credit guarantees previously used as solutions to:
  ■ Credit rationing in normal times
  ■ Banking crises

▶ Do government guarantees preserve lending in an exogenous economic crisis?
  ■ COVID-19 shock as a case in point
  ■ Strong bank balance sheets, but defensive responses
  ■ Policy intervention: Paycheck Protection Program
    ■ Large loan guarantee program
    ■ Channel funds to small businesses toward preserving employment
Banks tightened lending standards most steeply since GFC

*Net Percentage of Banks Tightening Standards for Commercial and Industrial Loans to Small Firms*

![Graph showing net percentage of banks tightening standards for commercial and industrial loans to small firms over time.](chart.png)

Source: FRED, Senior Loan Officer Opinion Survey.
The Paycheck Protection Program

- Introduced under the CARES Act in March 2020
- Unprecedented guarantee program, total funding $\sim$ $1$ trillion
- Forgivable, fully-guaranteed loans to non-financial small firms
- Forgiveness criterion: funds predominantly used for payroll
- Banks are main conduits for channeling funds
  - Process applications
  - Disburse loans using own capital
- Outsized participation by small banks
Research Questions and Empirical Approach

Research Questions:

▶ Did the PPP forestall a credit crunch or crowd out private credit?
  ▪ Effects on bank profits and risk-taking
  ▪ Determinants of bank participation and intensity

Problems:

▶ Simultaneity: Banks participate if more likely to profit from PPP
▶ Counterfactuals required to evaluate lending if not for PPP

Empirical Approach:

▶ Joint Bayesian model of participation, intensity, and outcomes
  ▪ Generate covariances and counterfactuals
The PPP averted a credit crunch, provided backstop outside program

- Loan category supported by PPP:
  - Business lending grew by 90%,
  - Would have contracted otherwise

- Loan categories not supported by PPP:
  - No measurable effects on loan growth,
  - But, forestalled lending decline

Funding capacity and risk aversion determined participation, not program profitability

- Participating banks were:
  - Larger, more profitable
  - Less capitalized, more exposed to business loans

- Margins declined for participants relative to 2019
**PPP Program: Bank decisions**

- **Key Bank Decisions:** Whether and how much to participate

- **Revenue:** interest and fees
  - Interest rate of 1%, fees accrued over loan term or on forgiveness
    - Banks required cheap funding sources

- **Costs:** opportunity cost of capital
  - Weighed on leverage ratios, but exempt from risk-based ratios
    - Required capital buffer space vs expand risk-free lending

- **Operational constraints:** Technology to process online applications
Bayesian Joint Model

Model of PPP participation, intensity, and bank outcomes

Outcomes: \( \Delta \text{NIM}, \text{C\&I Growth}, \text{Non-PPP C\&I Growth}, \text{CRE Growth} \)
Instrument 1: Technological Access

Relevance:
► Banks with access to technology are more likely to participate
► Statistically important effects on participation

<table>
<thead>
<tr>
<th>Dependent variable: PPP participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech exp. to assets</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Exclusion:
► Loan size, and thereby, intensity invariant to technological access
► “...banks with greater technology investment made a larger share of loans of all sizes.” (FDIC Quarterly, Sep 2021)
Instrument 2: COVID-affected employment share

Relevance:

▶ Demand for PPP loans rises with COVID-affected employment share. (Balyuk et al., 2021; Bartik et al., 2020)

<table>
<thead>
<tr>
<th>Dependent variable: PPP intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVID-affected employment share</td>
</tr>
<tr>
<td>[0.06, 0.1]</td>
</tr>
</tbody>
</table>

Exclusion:

▶ The share of COVID-affected industries does not reflect strategic supply decisions

▶ Approval rates not biased against COVID-affected sectors (Bartik et al., 2020)
PPP Expanded Lending, but Compressed Margins

<table>
<thead>
<tr>
<th></th>
<th>Δ NIM (bps.)</th>
<th>C&amp;I Growth (%)</th>
<th>Non-PPP C&amp;I Growth (%)</th>
<th>CRE Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average bank effect</td>
<td>-36.3</td>
<td>89.5</td>
<td>-0.5</td>
<td>1.9</td>
</tr>
<tr>
<td>95% prob. interval</td>
<td>[-51.3, -23.0]</td>
<td>[78.7, 101.0]</td>
<td>[-12.4, 4.9]</td>
<td>[-4.6, 8.6]</td>
</tr>
</tbody>
</table>

The average small bank held 8.5% of loans as PPP.

- Incremental participation compressed interest margins
- The PPP supported loan growth within the program
- But did not boost lending outside the program
Participation Driven by Funding Capacity, Capital Preservation
Intensity Driven by Funding Capacity, Capital Preservation, and Liquidity

![Intensity Driven by Funding Capacity, Capital Preservation, and Liquidity](chart.png)
The PPP Offset A Potential Decline in Bank Lending

Counterfactual and Observed C&I Growth

Counterfactual Mean = -78.03
Participant Mean = 91.45
Non-participant Mean = 10.35

GFC-era growth rates in small bank loans
Key Takeaways and Conclusion

► The PPP averted a credit crunch
  ■ Effective fiscal policy measure for future crises
  ■ Net benefits depend on state of banking industry, economic shock

► Participation driven by risk aversion, rather than profit motive
  ■ Likely protected existing loans
  ■ Revenue source during economic uncertainty
  ■ Full guarantee an important parameter of the program

► Loan guarantee programs avert a credit crunch during an exogenous economic crisis
APPENDIX
The Paycheck Protection Program

**PPP Implementation Timeline**

- March 23, 2020: PPP launched with $349 bln under the CARES Act
- April 15, 2020: First round funds exhausted
- April 24, 2020: Second round funds of $321 bln appropriated under PPP and Health Care Enhancement Act
- July 4, 2020: Deadline extended from 6/30 to 8/8
- December 21, 2020: Third round funding of $284 bln appropriated under Consolidated Appropriations Act
- March 11, 2021: Fourth round funding of $7.25 bln under the American Rescue Plan Act

**PPP Features**
Outsized Participation by Community Banks

**PPP Loans to Total Loans**

Source: Call Reports.
Components of the Bayesian Joint Model

Selection into PPP - all banks: \( y_{i1}^* = x_{i1}^\prime \beta_1 + z_{i1}^\prime \gamma_1 + \epsilon_{i1}, \) (1)

PPP intensity - participants: \( y_{i2} = x_{i2}^\prime \beta_2 + z_{i2}^\prime \gamma_2 + \epsilon_{i2}, \) (2)

Bank outcomes - participants: \( y_{i3} = x_{i3}^\prime \beta_3 + y_{i2} \delta + \epsilon_{i3}, \) (3)

Bank outcomes - non-participants: \( y_{i4} = x_{i4}^\prime \beta_4 + \epsilon_{i4}. \) (4)

\( \epsilon_{i,p} \sim N(0, \Omega_p), \epsilon_{i,np} \sim N(0, \Omega_{np}). \)

\[
\Omega_p = \begin{pmatrix}
1 & \Omega_{12} & \Omega_{13} \\
\Omega_{21} & \Omega_{22} & \Omega_{23} \\
\Omega_{31} & \Omega_{32} & \Omega_{33}
\end{pmatrix}, \quad \Omega_{np} = \begin{pmatrix}
1 & \Omega_{14} \\
\Omega_{41} & \Omega_{44}
\end{pmatrix}.
\]
Augmented Posterior

\[ f(\theta, \Omega_p, \Omega_{np}, y^*_1 | y) \propto f(y, y^*_1 | x_i, \theta, \Omega_p, \Omega_{np}) f(\theta) f(\Omega_p) f(\Omega_{np}) \]

where,

\[ f(\theta) = f_N(\theta | \Theta_0, T_0), \theta = [\gamma_1, \gamma_2, \delta, \beta], \text{and } \beta = \{\beta_1, \beta_2, \beta_3, \beta_4\}, \]

and

\[ f(\Omega_p) = f_{\mathcal{IW}}(\Omega_p | \nu_p, Q_p), f(\Omega_{np}) = f_{\mathcal{IW}}(\Omega_{np} | \nu_{np}, Q_{np}), \]

which are independent of priors assigned to the coefficients.

Gibbs Sampler Details

The likelihood and priors we have specified generate conditional conjugacy. We use a Gibbs sampler to estimate the model.

- Sample $\Omega$ from $\Omega|\theta, y, y_1^*$ in one block by partitioning into sub-matrices, where $\theta = [\beta, \gamma_1, \gamma_2, \delta]'$
- Sample $\theta$ from the distribution $\theta|\Omega, y, y_1^*$
- Sample $y_{i1}^*$ from $y_{i1}^*|\theta, y, \Omega$ for $i = 1, 2, \ldots, n$
SBA Application Portal

Implications for Lenders

Navigation Tree

Save/Next

www.sba.gov/for-lenders
Excluded Variables: Technical Access

\[ z_{i1} = \frac{\text{Data processing and telecom expenses}}{\text{Total assets}} \]

- Included in equation for participation in the PPP
- Excluded from remaining equations
Excluded Variables: COVID-affected employment share

\[ z_{i2} = \frac{\sum_{j=1}^{J} Emp_j d_{i,j}}{\sum_{j=1}^{J} d_{i,j}}, \]

\( Emp_j = \) COVID-affected employment share in county \( j \),

\( d_{i,j} = \) 2019 deposits of bank \( i \) in county \( j \).

- Included in equation for PPP intensity

- Excluded from remaining equations
Net Interest Margins By PPP Participation Intensity

NIM Counterfactual

- High Exposure
- Low Exposure

PPP Introduced

Percent Quarterly
Approval Rates by Sector

Source: Bartik et al., 2020. COVID-affected employment share: Exclusion and Relevance
## Summary Statistics

### Table: Summary Stats By PPP Lending Intensity

<table>
<thead>
<tr>
<th></th>
<th>High PPP</th>
<th>Low PPP</th>
<th>Non-Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>Pre-pandemic Averages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tech Exp. to Assets</td>
<td>0.20</td>
<td>(0.13)</td>
<td>0.18</td>
</tr>
<tr>
<td>COVID-affected emp. share</td>
<td>19.69</td>
<td>(6.99)</td>
<td>17.05</td>
</tr>
<tr>
<td>C&amp;I to Assets</td>
<td>10.85</td>
<td>(6.93)</td>
<td>7.57</td>
</tr>
<tr>
<td>C&amp;I Commitments to Assets</td>
<td>15.42</td>
<td>(9.78)</td>
<td>9.84</td>
</tr>
<tr>
<td>Unused C&amp;I Commitments to Assets</td>
<td>4.57</td>
<td>(3.87)</td>
<td>2.26</td>
</tr>
<tr>
<td>Small C&amp;I to Assets</td>
<td>6.22</td>
<td>(4.00)</td>
<td>5.31</td>
</tr>
<tr>
<td>Core Deposits to Assets</td>
<td>71.62</td>
<td>(10.29)</td>
<td>68.09</td>
</tr>
<tr>
<td>Liquid Assets to Total Assets</td>
<td>20.63</td>
<td>(11.90)</td>
<td>19.09</td>
</tr>
<tr>
<td>ALLL to Total Loans</td>
<td>1.32</td>
<td>(0.64)</td>
<td>1.34</td>
</tr>
<tr>
<td>Total Assets ($ Millions)</td>
<td>0.68</td>
<td>(1.02)</td>
<td>0.42</td>
</tr>
<tr>
<td>ln(Total Assets)</td>
<td>12.78</td>
<td>(1.10)</td>
<td>12.20</td>
</tr>
<tr>
<td>Leverage Ratio</td>
<td>10.90</td>
<td>(2.20)</td>
<td>11.85</td>
</tr>
<tr>
<td>Tier 1 Ratio</td>
<td>15.60</td>
<td>(5.80)</td>
<td>17.57</td>
</tr>
<tr>
<td>ROA&lt;sup&gt;2019 Avg&lt;/sup&gt;</td>
<td>1.19</td>
<td>(0.61)</td>
<td>1.19</td>
</tr>
<tr>
<td><strong>Post-Pandemic Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPP Share</td>
<td>13.15</td>
<td>(6.98)</td>
<td>3.91</td>
</tr>
<tr>
<td>NIM</td>
<td>3.46</td>
<td>(0.59)</td>
<td>3.49</td>
</tr>
<tr>
<td>ΔNIM</td>
<td>-50.06</td>
<td>(49.65)</td>
<td>-39.57</td>
</tr>
<tr>
<td>CI Gwth</td>
<td>129.97</td>
<td>(118.09)</td>
<td>51.47</td>
</tr>
<tr>
<td>CI Gwth Less PPP</td>
<td>-3.70</td>
<td>(22.15)</td>
<td>-2.64</td>
</tr>
<tr>
<td>Total Banks</td>
<td>1,824</td>
<td></td>
<td>1,689</td>
</tr>
</tbody>
</table>
Quarterly Results

Table: Quarterly Treatment Effects by Outcome

<table>
<thead>
<tr>
<th></th>
<th>ΔNIM(bps)</th>
<th>C&amp;I Gwth(%)</th>
<th>Non-PPP C&amp;I Gwth(%)</th>
<th>CRE Gwth(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>-4.27</td>
<td>10.52</td>
<td>-0.46</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>[-6.03, -2.7]</td>
<td>[9.26, 11.87]</td>
<td>[-1.46, 0.57]</td>
<td>[-0.54, 1.01]</td>
</tr>
<tr>
<td>Q2 2020</td>
<td>-6.91</td>
<td>10.72</td>
<td>0.36</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>[-9.15, -4.92]</td>
<td>[8.65, 12.92]</td>
<td>[-0.89, 1.71]</td>
<td>[-0.71, 1.09]</td>
</tr>
<tr>
<td>Q3 2020</td>
<td>-0.19</td>
<td>9.53</td>
<td>-0.33</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>[-2.54, 2.39]</td>
<td>[7.18, 12.04]</td>
<td>[-2.33, 1.54]</td>
<td>[-0.76, 1.61]</td>
</tr>
</tbody>
</table>

Note: The reported values are posterior means of the parameters, and 95% credibility intervals in brackets. The results are based on 55,000 MCMC draws with a burn-in of 5000.
Robustness: Alternative Instruments

<table>
<thead>
<tr>
<th></th>
<th>COVID-affected Employment</th>
<th>Small firm Employment</th>
<th>Core Deposit Ratio</th>
<th>Unused C&amp;I Cmmt Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>0.093</td>
<td>-0.135</td>
<td>0.106</td>
<td>0.263</td>
</tr>
<tr>
<td>[0.07, 0.11]</td>
<td>[-0.16, -0.11]</td>
<td>[0.09, 0.13]</td>
<td>[0.24, 0.29]</td>
<td></td>
</tr>
</tbody>
</table>

Note: Table shows standardized coefficients for each exogenous variable on PPP intensity. Coefficients are estimated using the Bayesian joint model shown in equations 2 - 4. 95% credibility intervals are shown in brackets.
Robustness of Treatment Effects: Alternative Instruments

 Treatment effects by instrument

Source: Call Reports.
Robustness: Effects of Drawdowns in 2020 Q1

Table: *C&I Loan Draw Effects*

<table>
<thead>
<tr>
<th></th>
<th>ΔNIM(bps)</th>
<th>C&amp;I Gwth(%)</th>
<th>Non-PPP C&amp;I Gwth(%)</th>
<th>CRE Gwth(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>-4.27</td>
<td>10.52</td>
<td>-0.46</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>[-6.03, -2.7]</td>
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<td>[-1.46, 0.57]</td>
<td>[-0.54, 1.01]</td>
</tr>
<tr>
<td>Baseline + CI gwh top qrtile</td>
<td>-3.92</td>
<td>12.13</td>
<td>0.20</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>[-5.45, -2.37]</td>
<td>[10.67, 13.61]</td>
<td>[-0.78, 1.17]</td>
<td>[-0.46, 0.99]</td>
</tr>
</tbody>
</table>

Note: The reported values are posterior means of the parameters, and 95% credibility intervals in brackets. The results are based on 55,000 MCMC draws with a burn-in of 5000.
Robustness: Comparison with Classical Methods

Table: *OLS and Two-stage Least Squares Estimation*

<table>
<thead>
<tr>
<th></th>
<th>(\Delta \text{NIM(bps)})</th>
<th>C&amp;I Gwth(%)</th>
<th>Non-PPP C&amp;I Gwth(%)</th>
<th>CRE Gwth(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
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<td>-0.46</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>([-6.03, -2.7])</td>
<td>([9.26, 11.87])</td>
<td>([-1.46, 0.57])</td>
<td>([-0.54, 1.01])</td>
</tr>
<tr>
<td><strong>OLS</strong></td>
<td>-1.22**</td>
<td>11.26**</td>
<td>-0.10*</td>
<td>0.18***</td>
</tr>
<tr>
<td></td>
<td>((-5.00))</td>
<td>((47.74))</td>
<td>((-2.10))</td>
<td>((4.41))</td>
</tr>
<tr>
<td><strong>IV</strong></td>
<td>-3.25**</td>
<td>15.07**</td>
<td>0.77*</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>((-4.61))</td>
<td>((15.15))</td>
<td>((2.15))</td>
<td>((0.87))</td>
</tr>
</tbody>
</table>

Notes: Table shows estimates of PPP intensity on bank profitability and balance sheet outcomes from the Bayesian joint model ("Baseline") as well as a standard OLS and a two-stage least squares model. The two-stage least squares model uses the share of COVID-affected employment in a bank’s local market as the instrument. For the baseline model, 95% credibility intervals are shown in brackets. T-statistics are shown in parenthesis for the OLS and two-stage least squares estimates.

\* \(p < 0.05\), \** \(p < 0.01\), \*** \(p < 0.001\)
Participation, intensity, and outcomes positively correlated

Table: Covariance estimates from the Bayesian joint model

<table>
<thead>
<tr>
<th></th>
<th>ΔNIM</th>
<th>C&amp;I Gwth</th>
<th>Non-PPP C&amp;I Gwth</th>
<th>CRE Gwth</th>
</tr>
</thead>
<tbody>
<tr>
<td>COV(participation, intensity)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>COV(participation, bank outcome)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>COV(intensity, bank outcome)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>COV(non-participation, bank outcome)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: Blue and red symbols denote statistically important positive and negative covariances respectively. Grey symbols represent covariance estimates that were not statistically important.
Is the Counterfactual Estimate Reasonable?

GFC-era Community Bank Growth Rates

Counterfactual C&I growth
Outcomes for non-participants

The image shows a graph with various financial metrics such as Size, ROA, Lev, C&I, ALLL, HQLA, Cases, Capital Share, Share, Share, ΔNIM, C&I Growth, Non-PPP C&I Growth, CRE Growth, and the corresponding data points for each metric.
PPP intensity compressed bank margins

Dependent variable = ΔNIM

Source: Call Reports.
C&I loans grew with PPP intensity

Dependent variable = C&I growth

Source: Call Reports.
The PPP did not induce lending outside the program

*Dependent variable = Non-PPP C&I growth*
Risk-taking via CRE loans did not rise with PPP intensity

Dependent variable = CRE growth

---

Source: Call Reports.