From Subprime Loans to Subprime Growth? Evidence for the Euro Area

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From Subprime Loans to Subprime Growth? Evidence for the Euro Area

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IMF Ninth Jacques Polak Annual Research Conference on Macro Financial Linkages

Washington, DC, November 13, 2008
Motivation

Broad reassessment of risk in money and credit markets
Motivation

Increased cost of financing from banks
Motivation

Increased cost of financing
Motivation

Equity market decline
Motivation

Changes in credit standards applied to the approval of loans to or credit lines to enterprises (net percentages of banks reporting tightening credit standards)

- Realized
- Expected

Costs related to bank’s capital

Expectations regarding general economic activity

Industry or firm-specific outlook

Competition from other banks
Motivation

Changes in credit standards applied to the approval of loans to households for house purchase (net percentages of banks reporting tightening credit standards)

- Realized
- Expected

Housing market prospects

Expectations regarding general economic activity

Cost of funds and balance sheet constraints

Competition from other banks

Motivation
Motivation

Too early to observe full impact of deterioration in financing conditions on euro area economy ...

... but still useful to examine linkages between the financial and real sectors in the Euro Area, using a combination of past and recent data.

Likely channels:

- Higher lending rates
- Stricter lending standards
- Higher costs of corporate bond and equity financing
- “Financial accelerator effects”
Outline

- Empirical evidence
  - Bank characteristics $\rightarrow$ lending
  - Bank loan supply $\rightarrow$ output
  - Corporate financing conditions and economic activity
  - Risk transfers between banks and other sectors: contingent claims analysis

- Quantitative implications of results
Bank Characteristics and Lending Behavior

- Q: Is bank supply affected by deteriorating financing conditions?

- Analysis of the “bank lending channel”:
  - banks unable to fully shield loan portfolios from changes in financing costs
  - substantial group of borrowers unable to insulate spending from bank credit reduction.

- The financial turbulence/crisis of 2007-08 provides a natural experiment
  - but we need to look at bank-by-bank variation to isolate supply response from demand shock
Bank Characteristics and Lending Behavior

- Literature: mostly on U.S. data
  - banks (esp. small) decrease loan supply in tighter financing conditions
  - but little evidence of impact on real activity
- Literature for Europe: inconclusive
  - bank lending channel effective in countries with many small banks, weak capitalization and liquidity, limited non-bank funding
  - studies focus on impact of financing conditions on bank loans (less on impact on output)
Bank Characteristics and Lending Behavior

- Correlation between the q/q growth of real GDP and the net percentages from the lending surveys:

<table>
<thead>
<tr>
<th></th>
<th>Households</th>
<th>Enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan demand</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>Credit std’s</td>
<td>-0.40</td>
<td>-0.41</td>
</tr>
</tbody>
</table>

- Both loan demand and credit std’s are procyclical.
- Time series of lending surveys are too short for a more elaborate analysis.
Bank Characteristics and Lending Behavior

Euro Area: What Is Causing Banks to Tighten?

- Housing market prospects (lending to households)
- General economic conditions (lending to corporates)
- Overall-current assessment
- Overall-expected
Bank Characteristics and Lending Behavior

- Econometric estimate:
  - supply-demand disequilibrium model
  - credit determined by the minimum of supply and demand (Pazarbasioglu, 1997; Barajas, Steiner, 2002)
  - this avoids the identification problem of equilibrium models, and allows for credit crunch.
  - Estimated on individual bank data for 50 largest euro area banks in 1997-2007

- Specification:
  - Demand side: see Bundesbank (2002).
  - Supply side: see Pazarbasioglu (1997), but we add the distance to default among the supply-side variables.
(Dependent variable: year-on-year real growth rate of a bank’s total credit)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Demand</th>
<th></th>
<th></th>
<th>Supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter</td>
<td>Std. Error</td>
<td></td>
<td>Parameter</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Constant</td>
<td>-10.24</td>
<td>0.48</td>
<td></td>
<td>-8.32</td>
<td>2.31</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>1.18</td>
<td>0.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lending rate</td>
<td>-0.03</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net interest margin</td>
<td>-0.09</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to default</td>
<td></td>
<td></td>
<td>0.03</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Log (total loans)</td>
<td></td>
<td></td>
<td>-0.02</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations based on data from BankScope and DataStream.
1/ Maximum likelihood estimation. Log likelihood = 125.31.
Bank Characteristics and Lending Behavior

- Results: all key coefficients have expected signs and are significant.
- Explains year-on-year real growth rates of customer loans as a function of a bank’s distance to default (+), real GDP growth rate as a proxy for overall economic activity (+), lending rate and net interest margin (-), and bank size approximated by total value of loans (-).
- The effect of bank soundness on loan supply is significant, but small. It implies that a 1 st.d. drop in DD is associated with a y/y real growth of credit that is 1.5 percentage points lower than otherwise.
Bank Characteristics and Lending Behavior
Bank Characteristics and Lending Behavior

% of credit supply

excess demand for credit

demand minus supply

+2 st.dev.

-2 st.dev.

excess supply of credit

Loan Supply and Output

Bank lending to private sector

Gross domestic product

Real year-on-year change (%)
Loan Supply and Output

- Examine relationship btw bank loan supply and economic activity

- Econometric problem

- Identification solution
  - Use shocks to country-specific money demand as an instrument for shocks to bank supply
  - First proposed by Driscoll (2004) for the U.S. (using state-level data)
Loan Supply and Output

Identification scheme:

- Regress output growth on growth rate of bank loans (and its lagged value), and its own lagged values.

- Recover shocks to money demand for each euro area country in the sample and regress growth rate of bank loans on its lagged values and the estimated money demand shocks.

- Re-estimate effect of bank credit on output using the country-specific shocks to money demand as instruments.
Loan Supply and Output

- Estimated on country-level data for 1999Q1 to 2008Q2 (robustness check: 2003Q1-2008Q2).
- Sample includes 11 euro area countries.
- Key variables: real GDP, M3, deposit rates, and bank loans to non-financial corporations.
- All variables are constructed as deviations from their cross-sectional mean values.
## Loan Supply and Output

### Table 2. OLS Regression of Output on Loans

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>St. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \tilde{y}_{it-1}$</td>
<td>-0.2135</td>
<td>(0.1805)</td>
</tr>
<tr>
<td>$\Delta \tilde{y}_{it-2}$</td>
<td>-0.0899</td>
<td>(0.1756)</td>
</tr>
<tr>
<td>$\Delta \tilde{I}_{it}$</td>
<td>0.1486</td>
<td>(0.0324)**</td>
</tr>
<tr>
<td>$\Delta \tilde{I}_{it-1}$</td>
<td>0.0115</td>
<td>(0.0342)</td>
</tr>
<tr>
<td><strong>Obs.</strong></td>
<td><strong>232</strong></td>
<td></td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td><strong>0.09</strong></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. All variables are demeaned by their cross-sectional averages
2. Critical values for 1 percent, 5 percent and 10 percent are denoted by (***)**, (**) and (**), respectively.
# Loan Supply and Output

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>St. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \tilde{y}_{it-1}$</td>
<td>-0.2478</td>
<td>(0.3474)</td>
</tr>
<tr>
<td>$\Delta \tilde{y}_{it-2}$</td>
<td>-0.0119</td>
<td>(0.3287)</td>
</tr>
<tr>
<td>$\Delta \tilde{\varepsilon}_{it}$</td>
<td>0.0679</td>
<td>(0.0466)</td>
</tr>
<tr>
<td>$\Delta \tilde{\varepsilon}_{it-1}$</td>
<td>0.2205</td>
<td>(0.0492)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>232</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**Notes:**
1. All variables are demeaned by their cross-sectional averages.
2. Critical values for 1 percent, 5 percent, and 10 percent are denoted by (***) (**), and (*), respectively.
3. Money demand shocks are denoted by $\varepsilon_{it}$. 
## Loan Supply and Output

### Table 4. Second Stage IV Regression of Output on Loans

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>St. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \tilde{y}_{it-1}$</td>
<td>-0.1514</td>
<td>(0.0582)**</td>
</tr>
<tr>
<td>$\Delta \tilde{y}_{it-2}$</td>
<td>-0.0178</td>
<td>(0.0447)</td>
</tr>
<tr>
<td>$\Delta \tilde{l}_{it}$</td>
<td>0.0955</td>
<td>(0.0496)**</td>
</tr>
<tr>
<td>$\Delta \tilde{l}_{it-1}$</td>
<td>0.0178</td>
<td>(0.0447)</td>
</tr>
</tbody>
</table>

**Notes:**
1. All variables are demeaned by their cross-sectional averages.
2. Critical values for 1 percent, 5 percent and 10 percent are denoted by (**), (**) and (*), respectively. 3. Country-level money demand shocks are used as instruments.
Loan Supply and Output

- The loan supply effect on output is positive (and statistically significant) but relatively small.

- An increase in the supply of bank loans by 1 percentage points is likely to lead to an increase in real GDP by about 0.1 percentage point.

- A cutback in bank loan supply is likely to have a negative impact on economic activity.
Corporate Financing and Economic Activity

- Analyze relationship between corporate bond spread and output in the Euro Area.

- Corporate bond risk premium is a good predictor of real activity.

- Can be treated as a proxy for financing conditions.
Corporate Financing and Economic Activity

- Define corporate bond spread = 7-year BBB-rated corporate bond yield – 7-year government bond yield (robustness check: different bonds)

- Monthly industrial production ... proxy for real activity.


- Vars: spread, (log) IP, 3M EURIBOR rate, (log) REER.

- Number of lags = 2 (robustness check: different lags)
Response of annual growth in industrial production to 1 st.d. innovation in corporate spread
Corporate Financing and Economic Activity

- A positive shock to the corporate bond spread leads to a negative response of real activity.

- One standard deviation shock (about 60 basis points) has an adverse effect on industrial production, which peaks at about $\frac{1}{4}$ percent in 8-20 months.

- The effect is statistically significant.

- Results are fairly robust across alternative specifications.
Risk Transfers: Contingent Claims Analysis

- CCA: an enhanced version of the balance sheet approach that takes into account market-based data.
  - Basic idea: changes in observed variables used to infer changes in unobserved vars (econ. value of firm, sector).
  - Basic tool: risk-adjusted balance sheet
  - Sectors are viewed as interconnected portfolios of assets, liabilities, and guarantees.
  - Can capture “non-linearities”

- First time CCA is used to identify vulnerabilities in the corporate, banking, and public sectors in the Euro Area.
Risk Transfers: Contingent Claims Analysis

Source: Gray and Jones (2006).
Risk Transfers: Contingent Claims Analysis

... shows estimated PDs (next 4 quarters) in banks and corporates
Risk Transfers: Contingent Claims Analysis

... shows estimated PDs for sovereigns
Quantitative Implications

First approach:

- Estimated losses in euro-area commercial banks: US$45 bn (sub-prime related losses in euro-area banks as of March 2008; reported in IMF’s April 2008 GFSR)
- Latest estimates of the total exceptional losses in euro-area global banks (=sub-prime related losses plus exceptional part of losses on European assets) may be as large as 10 times that amount.
- These latest estimates would translate, other things being equal, into a decline in C/A from 5.6 to 4.8%.
- To keep C/A unchanged (i.e. no change in leverage), assets would have to shrink by 14 percent.
- But banks are aiming to deleverage...
Quantitative Implications
Quantitative Implications

- First approach (continued):
  - If the banks aim to increase C/A to 5.9% (sample maximum), loans would go down by 19%.
  - If C/A goes up to 7 percent, loans go down 31%.
  - From the econometric estimate, a decline in the supply of bank loans by 10 percentage points is likely to lead to a decline in real GDP by about 1 percentage point.
  - This means that the above declines in assets would translate to 1.9-3.1 percentage points negative impact on real GDP.
  - The impact can be mitigated by capital injections; exacerbated if massive deleveraging or strong confidence effects (breaking down the relationships).
Quantitative Implications

- Second approach:
  - Average DD:
    - 8.0 in July 2007
    - 0.0 in October 2008
  - Using our estimates, this → negative 19 % pt impact on real credit, which → negative 1.9 % pt real GDP decline.

- All in all, the two approaches suggest an impact on output in the range of 2–3 percentage points.
Conclusions

- Deterioration in banks’ health translates into lower bank loan supply.
- Cutback in bank loan supply likely to have a negative impact on economic activity.
- Higher costs of corporate bond financing lead to significant decline in industrial production.
- Risk indicators for the banking, corporate, and public sectors show an improvement in balance sheets since 2002–03, followed by a deterioration in 2007-2008, reflecting a combination of the increased market volatility and lower capitalization.
- Current estimates of bank losses would mean a negative 2-3 % pt impact on GDP.