Mitigating the Procyclicality of Basel II

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The views expressed in this paper are those of the authors and should not be attributed to the Banco de España or the Eurosystem
“The IMF, the expanded FSF, and other regulators and bodies should develop recommendations to mitigate procyclicality, including the review of how valuation and leverage, bank capital, executive compensation, and provisioning practices may exacerbate cyclical trends.”

_G20 Summit on Financial Markets and the World Economy,_

November 2008
Introduction

• Concern: bank capital regulation may amplify business cycles

• In particular, contraction in loan supply in downturns due to
  → Lower bank capital due to higher default rates
  → Possibly higher capital requirements (Basel II)

• Will capital buffers neutralize this effect?
  → Repullo and Suarez (2008): No
  → Basel II will make things worse
  → Rationale for cyclical adjustment of cap. requirements
Introduction

• How should cyclical adjustment of Basel II be made?
  → The devil is in the details

• Gordy and Howells (2006): Two basic alternatives
  - Smooth the inputs of the Basel II formula
    → Through-the-cycle ratings
  - Smooth the output (with point-in-time ratings)
    → Using aggregate or individual bank information
Strategy of paper

- Estimate model of probabilities of default (PDs)
  → Data on Spanish firms’ loans for the period 1984-2007
  → Credit Register of Bank of Spain
- Compute corresponding Basel II capital requirements
- Smooth cyclical behavior using Hodrick-Prescott (HP) filter
- Compare different smoothing procedures
  → Using root mean square deviations from HP benchmark
Preview of results

• Best procedure

→ Smooth output with multiplier of Basel II requirements

→ Multiplier depends on GDP growth

\[
\mu(g_t) = 2\Phi\left(\frac{0.086(g_t - \bar{g})}{\sigma_g}\right)
\]

where \( \Phi(\cdot) \) is the cdf of a normal random variable

→ If \( g_t = \bar{g} \) then \( \mu(g_t) = 2\Phi(0) = 1 \)

→ If \( g_t = \bar{g} + \sigma_g \) then \( \mu(g_t) = 2\Phi(0.086) \approx 1.07 \)
Outline

• Data
• Empirical model of PDs
• Basel II capital requirements
• Smooth Basel II capital requirements
• Results
• Discussion
• Concluding remarks
Data

• Credit Register (CIR) of Bank of Spain
• Data on all commercial and industrial loans (above threshold)
• Sample period: 1984-2007 (end-of-year data)
• For estimation purposes use 10% of sample (912,456 observ.)
Logit model of PDs

• Dependent variable

\[ y_{j,t+1} = \begin{cases} 
1, & \text{if firm } j \text{ defaults in year } t + 1 \\
0, & \text{otherwise}
\end{cases} \]

• Explanatory variables (dated in year \( t \))
  - Previous delinquencies and defaults
  - Utilization of lines of credit
  - Total borrowing (proxy for size) and fraction collateralized
  - Number of bank relationships and changes of main lender
  - Macroeconomic controls + industry and regional dummies
Empirical results

• Point-in-time (PIT) PDs are increasing in
  - Previous delinquencies and defaults
  - Utilization of lines of credit
  - Collateralized borrowing
  - Number of banking relationships
  - Changes in main lender

• Point-in-time (PIT) PDs are decreasing in
  - Total borrowing
  - GDP growth, credit growth, stock market returns
Basel II capital requirements

• Compute Basel II capital requirements using
  - Basel II formula for corporate exposures
  - Estimated PIT PDs for each firm
  - LGD = 45% (as in foundation IRB)
  - Maturity = 1 year

• Compute PIT capital requirements per unit of loans
Basel II capital requirements

![Graph showing Basel II capital requirements over time from 1986 to 2006. The graph indicates fluctuations in capital requirements with peaks in 1990 and 2002.](image-url)
Capital requirements & GDP growth

Capital (left) & GDP growth (right)
Capital requirements & credit growth

The chart illustrates the trend of capital requirements and credit growth over the years from 1986 to 2006. The red line represents capital (left), while the blue line shows credit growth (right). The y-axis indicates the percentage growth ranging from -5% to 40%, and the x-axis represents the years.
Capital requirements & stock market returns
Smooth Basel II capital requirements

• Apply HP filter to the PIT capital requirements series
  → Smoothing parameter $\lambda = 100$ (annual data)
  → Similar results for other values of $\lambda$
Smooth Basel II capital requirements

![Graph showing capital requirements from 1986 to 2006. The graph includes a line for Capital and another line labeled HP filter.]
Smoothing the inputs: TTC ratings

• Use logit model to estimate through-the-cycle (TTC) PDs
  → Replace current macroeconomic controls by their average value over the sample period

• Compute Basel II capital requirements using
  - Basel II formula for corporate exposures
  - Estimated TTC PDs for each firm
  - LGD = 45%
  - Maturity = 1 year

• Compute TTC capital requirements per unit of loans
Smoothing the inputs: TTC ratings

[Graph showing the smoothing of inputs with three different lines representing Capital, HP filter, and TTC adjustment over the years 1986 to 2006.]
Smoothing the outputs: multiplier approach

• Smooth PIT capital requirements series by multiplier

\[ \hat{k}_t = \mu_t k_t \]

where \( k_t \) is the original series and \( \hat{k}_t \) is the smoothed series

• Proposed business cycle multiplier

\[ \mu_t = \mu(g_t, \alpha) = 2\Phi \left( \frac{\alpha(g_t - \bar{g})}{\sigma_g} \right) \]
Smoothing the outputs: multiplier approach

• Proposed business cycle multiplier

\[ \mu(g_t, \alpha) = 2\Phi\left(\frac{\alpha(g_t - \bar{g})}{\sigma_g}\right) \]

• Properties

  - If \( g_t = \bar{g} \) then \( \mu_t = 2\Phi(0) = 1 \)
  
  - If \( g_t \to +\infty \) then \( \mu_t \to 2 \) and if \( g_t \to -\infty \) then \( \mu_t \to 0 \)

• Two issues

  - What is the variable that proxies for business cycle?
  
  - How do we choose \( \alpha \)?
Smoothing the outputs: multiplier approach

- Criterion for choice of $\alpha$ (for each proxy for business cycle)
  \[ \rightarrow \text{Minimize RMSD of adjusted series from HP benchmark} \]

- Results

  \[ \begin{align*}
  \alpha \text{ (GDP growth)} &= 0.086 \\
  \alpha \text{ (credit growth)} &= 0.066 \\
  \alpha \text{ (stock market returns)} &= 0.017
  \end{align*} \]
Smoothing the outputs: GDP adjustment
Smoothing the outputs: credit adjustment

- Capital
- HP filter
- Credit adjustment
Smoothing the outputs: stock market adjustment
Smoothing the outputs: autoregressive adjustment

- Gordy and Howells (2006)
- Use autoregressive filter to smooth PIT capital requirements

\[ \hat{k}_t = \hat{k}_{t-1} + \delta (k_t - \hat{k}_{t-1}) \]

where \( k_t \) is the original series and \( \hat{k}_t \) is the smoothed series

- Criterion for choice of \( \delta \)
  - Minimize RMSD of adjusted series from HP benchmark
  - Result: \( \delta = 0.30 \)
Smoothing the outputs: autoregressive adjustment

- Capital
- HP filter
- Autoregressive adjustment
Summary of results

• What is the best procedure?
  - Smoothing the inputs: TTC ratings
  - Smooth the outputs: multiplier approach
  - Smooth the outputs: autoregressive approach

• Criterion
  → Choose the one minimizing RMSD from HP benchmark
Summary of results

Root mean square deviations (RMSD) from HP benchmark

<table>
<thead>
<tr>
<th>Factor</th>
<th>RMSD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTC ratings</td>
<td>0.45</td>
</tr>
<tr>
<td>GDP growth multiplier ($\alpha = 0.086$)</td>
<td>0.36</td>
</tr>
<tr>
<td>Credit growth multiplier ($\alpha = 0.066$)</td>
<td>0.60</td>
</tr>
<tr>
<td>Stock market multiplier ($\alpha = 0.017$)</td>
<td>0.75</td>
</tr>
<tr>
<td>Autoregressive adjustment ($\delta = 0.30$)</td>
<td>0.48</td>
</tr>
</tbody>
</table>
Discussion

• Other forward-looking variables (instead of stock market)
  → Gordy (2008): CDS indices, but sample is too short

• Other arguments against TTC adjustment: Gordy (2008)
  → No consensus on what TTC exactly means
  → TTC ratings not useful for pricing and risk management
  → TTC ratings may contradict spirit of other Basel II criteria

• LGDs vary over the business cycle
  → Further cyclicality of PIT capital requirements
  → The required adjustment (i.e. the value of $\alpha$) will be higher
Further research

• Extend the sample up to 2008
• Look at smoothing of individual banks’ capital requirements
  → Use individual banks’ data (credit growth) for adjustment
• Look at other loan portfolios
Concluding remarks

• Question: How should cyclical adjustment of Basel II be made?
  → Benchmark for comparing different procedures
  → Introduce some discipline in discussion

• Result: Use simple multiplier that depends on GDP growth
  → Adjustment is fairly small (but effective)
  → 7% surcharge for each standard deviation

• Procedure could also be applied to expected losses
  → Rationale for (Spanish) dynamic provisioning mechanism