Discussion on
“Spillovers, capital flows and prudential regulation in small open economies” by
Paul Castillo, Cesar Carrera, Marco Ortiz, Hugo Vega

Ilhyock Shim
Senior Economist, Bank for International Settlements

RBNZ Workshop on “The interaction of monetary and macroprudential policy”, Wellington, New Zealand, 22 October 2014

The views expressed are those of the presenter and not necessarily those of the Bank for International Settlements.
Outline

1. Key features of the model economy
2. Correlations between tradable and non-tradable sectors
3. Main findings of the paper
4. Comparison with related papers
5. Housing and capital in the model
6. Housing in the utility function and LTV policy
7. LTV ratio vs aggregate borrowing constraint
8. LTV policies in Latin America
9. Symmetry between two sectors in calibration
Key features of the model economy

- Domestic banking system
  - Workers (households) lend their savings $b^{NT}$ to non-tradable sector entrepreneurs. Workers accept $h^{NT}$ (a durable good, asset and production factor) owned by NT entrepreneurs as collateral and lend $\theta^{NT} q^{h} h^{NT}$.

- International capital markets
  - Foreign economy lends $b^{T*}$ to tradable sector entrepreneurs. It accepts $k^{NT}$ (a durable good, asset and production factor) owned by T-entrepreneurs as collateral and lend $\theta^{T*} q^{k} k^{T}$.

- Consider spillover effects between the tradable and non-tradable sectors relevant to Latin American economies.
Correlation between the tradable and non-tradable sectors in 5 Latin American economies

<table>
<thead>
<tr>
<th>Growth rate of domestic bank credit to the private sector</th>
<th>GDP growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation for all years and countries</td>
<td>0.780194</td>
</tr>
<tr>
<td>Correlation for all years for Bolivia</td>
<td>0.839092</td>
</tr>
<tr>
<td>Correlation for all years for Colombia</td>
<td>0.701947</td>
</tr>
<tr>
<td>Correlation for all years for Chile</td>
<td>0.883147</td>
</tr>
<tr>
<td>Correlation for all years Mexico</td>
<td>0.913452</td>
</tr>
<tr>
<td>Correlation for all years for Peru</td>
<td>0.931611</td>
</tr>
<tr>
<td>Correlation for all countries in 2006</td>
<td>0.962629</td>
</tr>
<tr>
<td>Correlation for all countries in 2007</td>
<td>0.843875</td>
</tr>
<tr>
<td>Correlation for all countries in 2008</td>
<td>0.664299</td>
</tr>
<tr>
<td>Correlation for all countries in 2009</td>
<td>0.77318</td>
</tr>
<tr>
<td>Correlation for all countries in 2010</td>
<td>0.887546</td>
</tr>
<tr>
<td>Correlation for all countries in 2011</td>
<td>-0.34432</td>
</tr>
<tr>
<td>Correlation for all countries in 2012</td>
<td>0.3314</td>
</tr>
</tbody>
</table>

For the economies, we can check the co-movement of foreign credit to tradable sector and domestic credit provided to non-tradable sector, instead of aggregate IIP growth.
Main findings: spillover and co-movement between two sectors

- A positive productivity shock in the tradable sector increases asset prices, relaxes the borrowing constraint of both tradable and non-tradable sectors, and generates an increase in output in both sectors.
- A positive productivity shock in the non-tradable sector increases non-tradable output, lowers the price of non-tradable goods, generates depreciation of the real exchange rate, and mildly increases tradable output.
- An increase in foreign interest rate tightens the borrowing constraint of tradable sector firms, forces a fall in tradable output, triggers real depreciation and reduces output in the non-tradable sector too.
Main findings: borrowing constraints

- When borrowing constraints are tighter ($\theta$ is lower), the borrowing constraints are more restrictive (the tradable sector needs to hold much more capital as collateral).
  - Positive productivity shock in tradable sector relaxes borrowing constraints much, so correlation between the tradable and non-tradable outputs increases.
- Increase/decrease in asset prices and borrowing (and appreciation/depreciation of the real exchange rate) work as amplification mechanisms.
  - Countercyclical borrowing constraints based on aggregate borrowing gap mitigate procyclicality, and thus reduce the volatility of output and asset prices and improve welfare.
Comparison with related papers

- Caballero and Krishnamurthy (2001, JME)
  - Domestic firms have limited international collateral (e.g., export sector revenue, seizable in case of default) that determines foreign borrowing.
  - Firms also have domestic collateral (e.g., real estate) that determines how much financing they can obtain from each other.
  - These two collateral constraints interact via a credit crunch, in particular through (1) disintermediation due to fire sale and (2) inadequate precaution (insurance) against adverse shocks.
Comparison with related papers (continued)

- Aoki, Benigno and Kiyotaki (2009, NBER)
  - Entrepreneurs use fixed asset (land), material goods (working capital) and labour to produce output.
  - Borrower’s credit limit is affected by the price of fixed asset, while the asset price is affected by credit limits.
  - Some fraction of future output becomes collateral for domestic loans (e.g., project finance or equity).
  - Foreign creditors generally have more difficulties in enforcing debts in a different country, so impose more restricted collateral constraint: foreign creditors lend up to future value of land \((b^* \leq qk)\); a domestic lead creditor chooses lending \(b\) such that \(b + b^* \leq qk + \theta y\).
Comparison with related papers (continued)

● Agenor, Alper and Pereira da Silva (2014, JIMF)
  ▪ Consider housing in the utility function.
  ▪ Firms borrow only from domestic banks and banks borrow on world capital markets.
  ▪ Countercyclical risk-weighted capital regulation calibrated on credit gaps (deviation of real credit for investment from its steady state value) reduce the volatility of inflation and output.
Housing and capital in the model

- Two types of durable goods (assets) are used as collateral AND production factors.
- Housing
  - Housing is not consumed by economic agents.
  - It is more natural to view it as land which is fixed asset and a production factor.
- Capital
  - What is real-world counterpart of “capital” as international collateral and a domestic production factor?
- In reality, tradable sector firms can also borrow from domestic banks/investors using housing as collateral.
Housing in the utility function and LTV policy

- Kuttner and Shim (2013) illustrate that the maximum LTV ratio influences the demand for housing credit by limiting households’ ability to borrow funds for house purchases.

\[
\max_{c_1, c_2, h} u(c_1) + \frac{1}{1 + \rho} u(c_2) + v(h)
\]

\[
c_1 + p_1 h + \frac{1}{1 + r} c_2 \leq p_2 h + y_1 + \frac{1}{1 + r} y_2
\]

\[
u'(c_1) = \frac{1 + r}{1 + \rho} u'(c_2) \quad \text{and} \quad u'(c_1) = \left[ p_1 \frac{r - \pi}{1 + r} \right]^{-1} v'(h)
\]

\[B \leq \theta p_1 h.
\]

\[(1 - \theta)u'(y_1 - (1 - \theta)p_1 h) = \frac{1}{p_1} v'(h) + \frac{1 + \pi}{1 + \rho} u'(p_2 h + y_2)
\]
LTV ratio vs aggregate borrowing constraint

- LTV ratio on housing-purchase loans (mortgages) vs borrowing constraints applied to collateralised loans
  - Risk mgt tools calibrated on house price dynamics vs structural parameter determined by the severity of institutional frictions or level of financial development.
- $\theta^{NT}$ and $\theta^{T*}$ are chosen by domestic and foreign lenders considering frictions, respectively.
  - So, it is not natural to interpret the adjustment of $\theta^{T*}$ as capital controls imposed by domestic authorities.
- Regulator cannot impose a higher ratio $\theta^{int}$ than the level privately deemed adequate $\theta^{priv}$ (Figure 3).
  - This has a bearing on the effectiveness of raising the maximum LTV ratio during housing market downturn.
## LTV policies in Latin America

<table>
<thead>
<tr>
<th>Country</th>
<th>Changes in the LTV policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>In December 1999, after experiencing a mortgage crisis in the late 1990s, to limit household debt and reduce excessive leverage of mortgage borrowers, the authorities introduced the LTV ratio caps of 70% for regular mortgages (and 80% for low-income people's mortgages), and the DSTI ratio cap of 30%.</td>
</tr>
<tr>
<td>Chile</td>
<td>In Aug 2009, in order to restore the flow of credit, the authorities raised the maximum LTV ratio for covered bond-type mortgages from 75% to 100% for debtors with higher credit ratings.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>AR</th>
<th>BR</th>
<th>CO</th>
<th>CL</th>
<th>MX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated average LTV ratio (%)</td>
<td>80-90</td>
<td>80-100</td>
<td></td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td>Maximum LTV ratio (%)</td>
<td></td>
<td>75-100</td>
<td>70</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>
Symmetry between two sectors in calibration

- Production technologies
  - Tradable sector capital share = tradable sector housing share = 0.3
  - Non-tradable sector capital share = non-tradable sector housing share = 0.3
  - AR1 coefficients on TFP process are the same (0.7).

- Collateral constraint: $\theta^{NT} = \theta^{T\ast}$
  - $\theta^{NT}$ is for using housing as collateral in domestic borrowing, while $\theta^{T\ast}$ is for using capital as collateral for international borrowing.

- How important is the assumption of symmetry between tradable sector and non-tradable sector in generating high correlations between the two sectors?