Financial integration and growth in a risky world

Nicolas Coeurdacier    Hélène Rey    Pablo Winant

SciencesPo and CEPR

London Business School, CEPR and NBER

Paris School of Economics
Introduction

- Where do gains from international financial integration come from?
- Conventional view:
  - efficient allocation of capital: capital flows to the developing country
  - risk sharing (reduces volatility of aggregate consumption)
- Other explanations
  - Financial markets development
  - Institutional development
  - Macroeconomic discipline
A simple thought experiment

- In a stochastic neoclassical setup
- A very risky country (5% std dev productivity shocks)
- A relatively safer country (2.5% std dev productivity shocks)
- Risky country starts with initial capital scarcity (30%)
A simple thought experiment

- How big are the gains from financial integration?
- Who benefits most from them?
- What is the direction of capital flows / debt accumulation?
A simple thought experiment

- How big are the gains from financial integration?
  - Small

- Who benefits most from them?
  - No big winner

- What is the direction of capital flows / debt accumulation?
  - Initial inflows, then outflows. Long run precautionary savings by risky country.
Explanations

- Allocative efficiency of financial integration
  - Gourinchas and Jeanne (2006). Small gains (1%)
- Business cycle and risk sharing
- Need an integrated framework.
Our contribution

- Reassess these gains in a
  - stochastic
  - general equilibrium
  - neoclassical growth model
  - with incomplete markets

- Use a global approximation methods to study the transition path towards the long run equilibrium

- Emphasize relation between risk and capital accumulation
Findings

- No big winner
- Welfare gains are small
  - unevenly distributed across time
- Buildup of precautionary assets by risky country
- Some calibrations generate capital flow reversal or growth impeding integration
Literature review

- Theoretical literature
  - Allocative efficiency:
    - Gourinchas and Jeanne (2006)
  - Stochastic models with aggregate uncertainty
    - Van Wincoop (1999), Lewis (1999)
  - Growth models with idiosyncratic uncertainty
    - Angeletos and Panousi (2012)
    - Corneli (2010)

- Empirical literature
The model

- 2 symmetric countries with a stochastic neoclassical structure
- Production:
  - Productivity shocks:
    \[ \log (a_t) = \rho \log (a_{t-1}) + \epsilon_t \]
  - Production:
    \[ y_t = a_t k_t^\theta \]
  - Investment with convex adjustment costs
    \[ k_t = (1 - \delta) k_{t-1} + k_{t-1} \varphi \left( \frac{i_{t-1}}{k_{t-1}} \right) \]
- Optimization problem:
  \[ \max W_0 = E_t \left[ \sum_{t \geq 0} \beta^t \left( \frac{c_t}{1 - \gamma} \right)^{1-\gamma} \right] \]
The model

- **Budget equation:**

  \[ c_t = y_t - i_t + b_t p_t - b_{t-1} \]

  - \( b_t \): promise to repay 1 next period
  - \( p_t = \frac{1}{r_t} \): price of the bond

- **Optimal bond holdings**

  \[ p_t = E_t \left[ \left( \frac{c_{t+1}}{c_t} \right)^{-\gamma} \right] \]

- **Special cases:**

  - \( b_t = 0 \): autarky
  - \( \frac{1}{p_t} = \bar{r}^w \): small open economy
  - \( \phi(.) = \delta \): endowment economies
Solution methods

- global solution: policy function iteration
- why not standard perturbations (as usual in international macro)?
  - big shocks take us away from deterministic steady-state
  - perturbation solutions of order $< 3$ miss the stabilizing effect of precautionary savings
  - portfolio choice needs special treatment
- problems with projections:
Solution methods

- **global solution**: policy function iteration
- why not standard perturbations (as usual in international macro)?
  - big shocks take us away from deterministic steady-state
  - perturbation solutions of order $< 3$ miss the stabilizing effect of precautionary savings
  - portfolio choice needs special treatment
- problems with projections:
  - no natural bounds for debt $\rightarrow$ use solution from second order perturbation to get 2 standard deviations after 50 periods
Solution methods

- global solution: policy function iteration
- why not standard perturbations (as usual in international macro) ?
  - big shocks take us away from deterministic steady-state
  - perturbation solutions of order $< 3$ miss the stabilizing effect of precautionary savings
  - portfolio choice needs special treatment
- problems with projections:
  - no natural bounds for debt $\rightarrow$ use solution from second order perturbation to get 2 standard deviations after 50 periods
  - high number of states ($\geq 5$) $\rightarrow$ smolyak colocation to reduce number of points
Integration experiment

- Integration experiment
  - choose initial level of capital
  - simulate consumption in autarky \( b_t = 0 \)
  - simulate consumption in the bond economy

- Normalize welfare in terms of deterministic consumption

\[
W_0 = E_t \left[ \sum_{t \geq 0} \beta^t \frac{(c_t)^{1-\gamma}}{1-\gamma} \right]
= \text{def} \sum_{t \geq 0} \beta^t \frac{(\bar{c})^{1-\gamma}}{1-\gamma}
\]

- Welfare gains:

\[
\bar{c}_{\text{integration}} - \bar{c}_{\text{autarky}}
\]
Calibration

- Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount rate</td>
<td>$\beta$ 0.96</td>
</tr>
<tr>
<td>Relative risk aversion</td>
<td>$\gamma$ 4</td>
</tr>
<tr>
<td>Capital share</td>
<td>$\theta$ 0.3</td>
</tr>
<tr>
<td>Depreciation rate</td>
<td>$\delta$ 0.1</td>
</tr>
<tr>
<td>Capital adjustment costs</td>
<td>s.t. $\sigma^i = 3\sigma^y$</td>
</tr>
</tbody>
</table>

- Productivity shocks
  - volatility matches the groups of the 50% riskiest country vs. 50% safest

<table>
<thead>
<tr>
<th>Autocorrelation of shocks</th>
<th>Autocorrelation</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky economy</td>
<td>0.9</td>
<td>5%</td>
</tr>
<tr>
<td>Safe economy</td>
<td>0.9</td>
<td>2.5%</td>
</tr>
</tbody>
</table>
The riskless case: partial equilibrium

- no shocks
- interest rate $\frac{1}{p_t} = r^w = \frac{1}{\beta}$
- capital starts 30% below steady-state
The riskless case: partial equilibrium
The riskless case: partial equilibrium

- No precautionary savings in autarky:
  - only initial level of capital matters
- Standard argument:
  - capital goes where returns are higher
- But
  - gains from financial integration are transitory only
  - integration speeds up transition towards steady-state level of capital
  - debt must be repaid in the long run
The riskless case: general equilibrium

- no shocks
- capital starts 30% below steady-state
- rest of the world has the same size than the country
The riskless case: general equilibrium
Riskless case: welfare gains

- welfare gains:

<table>
<thead>
<tr>
<th>Country</th>
<th>Rest of the world</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial</td>
<td>1.08%</td>
</tr>
<tr>
<td>General</td>
<td>0.21%</td>
</tr>
</tbody>
</table>

- in partial equilibrium:
  - welfare costs are small because they are transitory

- in general equilibrium
  - welfare gains must be shared between the two countries
  - rest of the world was making welfare losses to maintain fixed interest rate
  - gains were overestimated in the partial equilibrium settings!
Business cycles

Endowments

- Remove capital and add shocks:

<table>
<thead>
<tr>
<th></th>
<th>Autocorrelation</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky country</td>
<td>0.9</td>
<td>0.05</td>
</tr>
<tr>
<td>Safe country</td>
<td>0.9</td>
<td>0.025</td>
</tr>
</tbody>
</table>

- Volatilities roughly match volatility of the 50% more/less volatile countries

- Another motive for financial integration: consumption smoothing
  - intratemporal reduction in volatility
  - intertemporal reallocation of consumption
Endowments
Endowments

- interest rate close to safer country:
  - aggregate risk is reduced
- risky country accumulates bonds as precautionary savings
- debt converge to the "risky steady-state" in the long run
  - no unit root
  - cf. household finance and buffer stock of savings
  - precautionary savings due to market incompleteness
  - local approximation around risky steady-state (Coeurdacier et al. 2012)
## Endowments

<table>
<thead>
<tr>
<th>Welfare gains</th>
<th>Country</th>
<th>Rest of the world</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial integration</td>
<td>0.62%</td>
<td>0.52%</td>
</tr>
<tr>
<td>Complete markets</td>
<td>0.6%</td>
<td>0.65%</td>
</tr>
<tr>
<td>Complete markets $\gamma = 16$</td>
<td>2.5%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

- Welfare gains of integration are small and approximately evenly distributed
- Upper bounds of welfare gains
  - Lucas computation
  - Complete markets
- Different types of welfare gains? How do they interact?
Growth model with aggregate uncertainty

Full model

- Capital starts at the autarky level
- At risky steady-state
  - where economy converges in the absence of shocks
Baseline
Full model

<table>
<thead>
<tr>
<th>Risky steady-states</th>
<th>$k$</th>
<th>$k^{ROW}$</th>
<th>$r$</th>
<th>$r^{ROW}$</th>
<th>$b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autarky</td>
<td>3.07</td>
<td>2.95</td>
<td>3.33%</td>
<td>3.95%</td>
<td></td>
</tr>
<tr>
<td>Partial integration</td>
<td>2.94</td>
<td>2.98</td>
<td>3.95%</td>
<td>3.95%</td>
<td>−6.41</td>
</tr>
</tbody>
</table>

- With risk and capital there is precautionary savings in autarky
- Integration partly removes this precautionary savings
  - another potential source of welfare gains
  - affects long run accumulation of capital / income

<table>
<thead>
<tr>
<th>Country</th>
<th>Welfare gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>0.24%</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>0.30%</td>
</tr>
</tbody>
</table>
4 different sources of welfare gains

- intratemporal risk-sharing
- intertemporal savings
- efficient capital allocation
- long-term capital level

- Generate interesting patterns for the dynamics
Full model + capital scarcity

- Capital starts at $-30\%$ in risky country
- Capital starts at the autarky level in ROW
Risky capital + capital scarcity
Welfare gains

To account for these patterns:
- short term vs. long term gains
- deterministic vs. stochastic gains

\[
W_0 = E_0 \left[ \sum_{t \geq 0} \beta^t \frac{(c_t)^{1-\gamma}}{1-\gamma} \right]
\]

\[
= E_0 \left[ \sum_{t \leq T^s} \beta^t \frac{(c_t)^{1-\gamma}}{1-\gamma} \right] + E_0 \left[ \sum_{t > T^s} \beta^t \frac{(c_t)^{1-\gamma}}{1-\gamma} \right]
\]

short term

\[
= \sum_{t \geq 0} \beta^t \frac{(D_0 c_t)^{1-\gamma}}{1-\gamma} + \sum_{t \geq 0} \beta^t E_0 \left[ \frac{(c_t)^{1-\gamma}}{1-\gamma} - \frac{(D_0 c_t)^{1-\gamma}}{1-\gamma} \right]
\]

deterministic stochastic

short-term: \( T^s = 20 \) periods
## Welfare gains

<table>
<thead>
<tr>
<th>Percentage gains</th>
<th>Short term</th>
<th></th>
<th>Long term</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Country</td>
<td>ROW</td>
<td>Country</td>
</tr>
<tr>
<td>Riskless (scarce)</td>
<td>stoch</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>det</td>
<td>2.04</td>
<td>-1.74</td>
<td>0.21</td>
</tr>
<tr>
<td>Baseline</td>
<td>stoch</td>
<td>-0.67</td>
<td>1.25</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>det</td>
<td>-0.74</td>
<td>1.14</td>
<td>-0.09</td>
</tr>
<tr>
<td>Capital scarce</td>
<td>stoch</td>
<td>0.06</td>
<td>0.04</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>det</td>
<td>1.19</td>
<td>-0.67</td>
<td>1.26</td>
</tr>
<tr>
<td>Big safe country</td>
<td>stoch</td>
<td>-0.56</td>
<td>0.66</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>det</td>
<td>-0.66</td>
<td>0.59</td>
<td>-0.06</td>
</tr>
<tr>
<td>Risk aversion $\gamma = 6$</td>
<td>stoch</td>
<td>-0.98</td>
<td>2.37</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>det</td>
<td>-1.11</td>
<td>2.24</td>
<td>-0.34</td>
</tr>
</tbody>
</table>
Conclusion

- When asked about benefits to financial integration policy makers mention: risk sharing and allocative efficiency. We show that none of those really matter.
- Benchmark model to relate growth effects before and after financial integration to volatility and size of countries. Capital flows reversals.
- Calls for empirical investigations!