More pluralism, more stability? 

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I would like to thank the organisers for the kind invitation to speak at this prestigious conference. I am delighted and honoured to be in such distinguished company.

The question I would like to address today is whether a more pluralistic international monetary system – one with more international currencies on a more equal footing – would enhance global monetary, financial and macroeconomic stability.

This is a perennial question. It was, for instance, just as prominent under the Bretton Woods system as under the arrangements that have followed – which some regard as a “non-system” (eg Padoa-Schioppa and Saccomanni (1994)). And it presupposes the answer to another, more fundamental, question: what is the Achilles heel of the international monetary and financial system (IMFS)?

Note that I am choosing my words carefully. For, the “financial” dimension is just as important as the “monetary” one, although the shorthand “international monetary system” is much more common. This tendency perhaps harks back to post-war arrangements in which, for quite some time, finance played a subordinated role owing to constraints on capital flows and foreign exchange transactions. As we all know, that world is long gone.

There are three takeaways from my presentation.

First, there is no doubt that the dominance of one currency creates challenges for the IMFS. Fundamentally, the domestic interests of the country of issue need not coincide with those of the system as a whole.

Second, it is less clear, though, whether a more pluralist system, even if it was achieved, could help address the IMFS’s main weakness. To my mind, that weakness is its inability to prevent the build-up and unwinding of hugely damaging financial imbalances, or outsize financial cycles, thereby amplifying weaknesses in national arrangements (Borio (2014a)). This is what, with a colleague, Piti Disyatat, we have termed its “excess (financial) elasticity” (Borio and Disyatat (2011)). Think of an elastic band that you can stretch out further and further but that, as a result, snaps back more violently.

Third, addressing this weakness would require stronger anchors at national and international level. Some progress has been made, especially at national level. But much more needs to be done.

In what follows, I will first recall some basic facts to illustrate the US dollar’s dominance in the IMFS. Here I will consider the dollar’s three familiar roles, as a means of payment, a store of value and a unit of account. I will then explore the possible problems that this can create and put forward three propositions. I will finally turn to possible solutions and make three observations.

1 I would like to thank Bob McCauley, in particular, for help in the preparation of these remarks.
• In the US, banks play a crucial role in corporate bond markets: 95% of trading volume is intermediated by banks

• For US NFCs, market funding has recently become twice as large as bank funding

Source: US Financial Accounts
• On the one hand, regulatory reforms make banks’ traditional activities (risk, liquidity, maturity transformation) more efficient/resilient

• On the other hand, some reforms (like the leverage ratio) may have unintended adverse consequences on banks' market–making activities, and corporate bond markets

  • By forcing banks to fund all assets, regardless of their underlying risk and purpose, with a minimum of —costly— equity, the leverage ratio may discourage banks from holding bonds for market–making purposes, reduce market liquidity, and raise firms’ cost of funding

  • Greenwood, Hanson, Stein, Sunderam (2017): “the Supplementary Leverage Ratio is (...) discouraging some banks from investing in the safest assets (...) We would urge that the SLR be dialed back (...)

  • FT (24 Sept 2018): “Regulatory changes have made it more expensive for banks to hold large inventories of bonds, which has hindered their role as liquidity providers in fixed income markets”
Question of the paper

- Does leverage ratio regulation hinder the functioning of bond markets?
  - Does it push up bid–ask spreads? Does it reduce trading volumes?

- Taking these effects into account, what is the net impact of banking regulation on the economy and welfare?

- Study these questions through the lens of a [dynamic] general equilibrium model
  - **Novelty:** the dual role of banks as both lenders and market–makers
Main Takeaways

• Regulation has a varied impact on measures of corporate bond market liquidity
  → It raises the bid–ask spread
  → But it also raises the volume of trades

• The regulator accepts a higher bid–ask spread, to improve banks’ funding liquidity and the efficiency of financial intermediation
  → The impact on market liquidity is not necessarily an unintended consequence

• Exempting bonds from the leverage ratio would only marginally reduce the bid–ask spread and have no effect on the real economy and welfare after re–calibration
Macro–model: real flows between agents

\[ a_t: \text{Savings}; \ e_t: \text{Equity}; \ d_t: \text{Deposits}; \ b_t: \text{Bonds}; \ l_t: \text{Loans} \]
Macro–model: real flows between agents

Frictions on the secondary bond market → Bond inventory constraint: $b_t^b \geq (1 + \kappa)b_t^h$

- $a_t$: Savings; $e_t$: Equity; $d_t$: Deposits; $b_t$: Bonds; $\ell_t$: Loans
Macro–model: real flows between agents

Frictions on the secondary bond market → Bond inventory constraint: $b_t^b \geq (1 + \kappa)b_t^h$

Frictions on the interbank market → Regulatory leverage constraint: $\frac{e_t}{a_t + e_t} \geq \tau$

$a_t$: Savings; $e_t$: Equity; $d_t$: Deposits; $b_t$: Bonds; $\ell_t$: Loans
Households’ “preferred habitat”

- A continuum of households incur idiosyncratic financial transaction costs

- Household \((q^d, q^e, q^b_h)\) earns net returns \(q^d r_t^a, q^e r_t^e\) and \(q^b_h r_t^b h\) on deposits, equity, and bonds, and invests in the asset with the highest net return \(\approx \) “preferred habitat”

\[
\max_{\{a_{t+1}, c_t\}_{t=0, \ldots, \infty}} \mathbb{E}_q \left[ \mathbb{E}_t \left( \sum_{i=0}^{\infty} \beta^t \max_{\{1^j_{t+1+i}\}_{j\in\{b^h, d, e\}}} u(c_{t+i}) \right) \right]
\]

s.t.: \(c_t + a_{t+1} = r_t a_t + \pi_t\) with \(r_t \equiv Q_t^d r_t^d \frac{d_t}{a_t} + Q_t^b h r_t^b h \frac{b_t^h}{a_t} + Q_t^e r_t^e \frac{e_t}{a_t}\)

- For a household, it is costly to move away from its preferred habitat
Banks arbitrage between loans and bonds

- Banks maximize profits by choosing *ex ante* whether they invest in loans ($\ell_t$) or bonds ($b^b_t$).

- Once banks have lent to the firm, they learn their idiosyncratic “loan servicing cost”
  - Bank $q^\ell$ gets unit return $q^\ell r^\ell_t$, with $q^\ell \in [0, 1]$.
  - High-$q^\ell$ banks purchase loans from low-$q^\ell$ banks on an “interbank” market, against claims that promise return $r^i_t \rightarrow$ the minimum return of a loan is $r^i_t$.

- There is a threshold $\overline{q}^\ell_t = \frac{r^i_t}{r^\ell_t}$, above (below) which banks borrow (lend) from (to) other banks.

- Banks face a bond portfolio management cost and get unit return $Q^b b^b_t r^b_t$ on bonds.

- If $r^i_t > Q^b b^b_t r^b_t$, then banks prefer to invest in loans, rather than in bonds.
Frictions on the secondary bond market

- Banks sell bonds to households, but must hold an inventory of $\kappa$ per intermediated bond

- They charge households a fee $\omega_t$ for making the bond market ("bid–ask" spread):

$$\omega_t = \kappa \frac{\mathbb{E}_{t-1} \left( \Psi_{t-1,t} (1 + \Delta_t) \left( r^i_t - Q^b_b r^b_t \right) \right)}{\mathbb{E}_{t-1} \left( \Psi_{t-1,t} (1 + \Delta_t) r^b_t \right)}$$

Opportunity cost of holding bonds
Frictions on the interbank market

- Frictions hinder \textit{ex post} reallocation of corporate loans from low–\( q^\ell \) to high–\( q^\ell \) banks
  - The loan servicing cost \( q^\ell \) is private information
  - Banks can terminate loans early, get private benefits \( \zeta \), and abscond/default

- High–\( q^\ell \) banks have to limit their borrowing to \( \phi_t \):

\[
\phi_t = \frac{\ell_t}{\zeta} \left( r_t^i - r_t^d \frac{1 - \frac{e_t}{d_t + e_t}}{1 - \frac{b_t}{d_t + e_t}} + \ldots \right)
\]
• Pecuniary externality: More capital \( \frac{e_t}{d_t + e_t} \) raises the borrowing limit \( \phi_t \), which raises the equilibrium interbank rate \( r^i_t \), improves lending efficiency \( q^\ell_t \), raises the borrowing limit,...

• As price takers, banks do not internalise these effects and have too little capital \( \text{ex ante} \)

→ Regulation requires banks to hold a minimum level of capital: \( \frac{e_t}{d_t + e_t} \geq \tau \Leftrightarrow \frac{e_t}{\ell_t + b_t^b} \geq \tau \)
Key mechanism 1: the regulator’s trade–off

- A regulator sets $\tau^*$ to maximize welfare, i.e. to minimize aggregate transaction costs:

\[
\begin{align*}
&\text{Banks’ transaction costs} \\
&\quad (1 - Q_t^\ell)r_t^\ell\ell_t + (1 - Q_t^{b^b})r_t^b(b_t^b - b_t^h) + (1 - Q_t^d)r_t^d\ell_t + (1 - Q_t^{b^h})r_t^{b^h}\ell_t + (1 - Q_t^e)r_t^e\ell_t
\end{align*}
\]

- Lower costs for banks are balanced against higher costs for households

- Savers bear the cost of regulation (not firms or banks)
Key mechanism 2: general equilibrium effects of capital regulation

Leverage regulation induces households to demand more bonds, which lowers the equilibrium bond yield.
Key mechanism 3: banking regulation and market liquidity

![Diagram showing the relationship between bid-ask spread and volume of market-making services, illustrating partial equilibrium effect and general equilibrium effect.]

- Bid-ask spread, \( \omega_t \)
- Volume of market-making services

14/25
Regulation: bank–based versus market–based intermediation

Bank–based intermediation:

Corporate loans

Lending efficiency

Interbank loans

Market–based intermediation:

Bond issuance

Bid–ask spread

Firms’ unit cost of funding
Optimal leverage ratio

Banks’ versus households’ transaction costs

**Banks**

\[ \frac{\chi}{a} \]

**Households**

\[ \frac{\chi'}{a} \]

**Aggregate**

\[ \frac{\chi}{a} \]

**Welfare**

\[ -24.48 \]
Narrow versus comprehensive leverage regulation

- Should the regulator exempt bonds (and re-calibrate)?

- $\frac{e_t}{\ell_t} \geq \theta$ ("Narrow") versus $\frac{e_t}{\ell_t + b_t} \geq \tau$ ("Comprehensive")

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**Leverage ratio**

- Narrow leverage regulation, **-** Leverage regulation, ★/★ Optimal requirements,
- ●/● non regulated equilibrium.
Additional takeaways

- Market liquidity is part of the regulatory trade-off

- The cost of regulation is borne by savers, and regulation has distributional effects among them (e.g. depositors versus bondholders versus shareholders)

- Calibrated general equilibrium effects of regulation are material

- Dynamics [TBC]
Timeline

Figure 13: Shocks and Decisions in Period $t$

- End of period $t - 1$
- Beginning of period $t$
- End of period $t$
- Beginning of period $t + 1$

Agents’ decisions / market clearing
Idiosyncratic shocks
Aggregate shocks
Firms arbitrage between bonds and loans

- Firms finance their production with bonds and loans, and maximize their expected profit

\[
\max_{k_t, b_t, \ell_t} \mathbb{E}_{t-1}\left(\Psi_{t-1,t} \left( z_t k_t^\alpha + (1 - \delta) k_t - r^\ell_t \ell_t - r^b_t b_t \right) \right)
\]

\[
k_t = \ell_t + b_t
\]
\[
r^b_t = r^\ell_t
\]
\[
r^\ell_t = \alpha z_t k_t^{\alpha-1} + 1 - \delta
\]
• Banks choose deposits and bond holdings to maximise their expected return on equity:

\[
\max_{d_t, b_t} \mathbb{E}_{t-1} \left( \psi_{t-1,t} \left[ r_t \ell_t + (1 - \mu (\bar{q}_t^\ell)) (q_t^\ell r_t^\ell - r_t^i) (\ell_t + \phi_t) + Q_t^b r_t^b (b_t^b - b_t^h) + \omega_t r_t^b b_t^h - r_t d_t \right] \right)
\]

s.t.: \( \ell_t = d_t + e_t - b_t^b \) and \( b_t^b \geq (1 + \kappa) b_t^h \) and \( e_t \geq \tau (\ell_t + b_t^b) \)

Opportunity cost of bonds versus loans

\[
\Rightarrow \omega_t = \kappa \frac{\mathbb{E}_{t-1} \left( \psi_{t-1,t} (1 + \Delta_t) \left( r_t^i - Q_t^b r_t^b \right) \right)}{\mathbb{E}_{t-1} \left( \psi_{t-1,t} (1 + \Delta_t) r_t^b \right)}
\]
This section studies the effects of banking regulation on banks, the corporate bond market, and households at the steady state of the economy. Our focus is on the effects of a marginal increase in the privately optimal capitalisation level coincides with the regulatory minimum, \( \tau \).

Minimum requirements did not reflect supervisors’ – explicit or implicit – expectation that banks exceed those requirements, in order for them to be considered well-capitalised.

Indeed, minimum requirements differed from an average leverage ratio of 8.14% (see Table 1) for the period of observation. On average, US banks’ highest capital adequacy ratio pre-dates the run-up to the systemic banking crisis of 2007–09 and the associated build-up of bank leverage which, with the benefit of hindsight, proved unsustainable (Adrian and Shin (2010)).

We calibrate the model on annual US data for the years from 1988 to 2003. The sample thus summarizes the outcome of the calibration.

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Parameters

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<th>Values</th>
<th>Data sources</th>
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Targets

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Portfolio re-balancing:

Returns on assets:
Funding Liquidity, Market Liquidity, and Optimal Regulation

**Exogenous variation in market liquidity (variation in $\kappa$)**

- **Bid-ask spread**
- **Banks' borrowing limit**

**Exogenous variation in funding liquidity (variation in $\zeta$)**

- **Bid-ask spread**
- **Banks' borrowing limit**