Central bank liquidity provision, risk-taking and economic efficiency

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- Classical problem: to what extent should central banks extend credit to funding-stressed banks in a financial crisis, given that it can increase their risk-taking and promote moral hazard?

- Our contribution: a simple model representing the key trade-offs and allowing to derive optimal CB policies from a risk management and social welfare perspective;

- Credit riskiness of counterparties and issuers is endogenous to CB's financial crisis measures and the related risk control framework;

- Policy conclusion: extending collateral availability in a crisis may not only support economic efficiency, but can even be perfectly consistent with protecting the CB balance sheet in the sense of Bagehot's "only the brave plan is the safe plan".

Motivation

- The issues of LOLR policies and CB risk management resurfaced after the crisis
  - pop-cultural narrative of captured policymakers bailing out wealthy bankers with taxpayers money;
  - policy-oriented critique of asset purchase programs (e.g. expropriation of the saver);
  - in euro area debates over risks (financial and moral hazard) stemming from Target 2 balances and insufficiently tight collateral policies of Eurosystem;

- Yet:
  - no clear picture of the trade-offs involved;
  - little understanding of how CB risk management differs from that of an atomistic market player that may regard risk parameters as exogeneous

Literature review

Fundamental ideas on central bank lender of last resort role due to Bagehot (1873):

•(1) Bank of England's Jeremiah Harman explained in 1832 regarding the crisis of 1825: “We lent it (money) by every possible means and in modes we had never adopted before consistent with the safety of the bank. Seeing the dreadful state in which the public were, we rendered every assistance in our power“

•(2) Bagehot (1873): “in time of panic it (the Bank of England) must advance freely and vigorously to the public“

•(3) Bagehot (1873): “(M)aking no loans as we have seen will ruin it (Bank of England); making large loans and stopping, as we have also seen, will ruin it. The only safe plan for the Bank (of England) is the brave plan, to lend in a panic on every kind of current security, or every sort on which money is ordinarily and usually lent. This policy may not save the Bank; but if it do not, nothing will save it."

Literature review

- 20th century contributions to understand liquidity crises: Akerlof (1970) on market breakdown due to adverse selection; Diamond & Dybvig (1983) on bank runs; Kyle (1985) on market liquidity with insiders,
- Work e.g. by Charles Goodhart on the lender of last resort
- Freixas, Rochet & Parigi (2004)
- Main differences vs. FRP:
  - correlation of solvency and liquidity shocks;
  - breakdown of money and capital markets;
  - pricing vs. availibility of credit;
  - modeling of CB risk-taking.

Why do central banks risk-taking increases anyway in a crisis?

- Rising PDs of counterparties and collateral issuers;
- Concentration of lending on weaker banks ("relative" central bank intermediation);
- Rising exposure due to BS lengthening:
  - "absolute" central bank intermediation
  - Flight into banknotes (Government flight into Government deposits, etc)

Increasing risks – financial accounts

Households / Investors			
Real Assets	E-D-B	Household Equity	E
Deposits Bank 1	D/2-d/2 + k		
Deposits Bank 2	D/2–d /2 –k		
Banknotes	B + d		

Corporates			
Real assets	D+B	Credits from banks	D+B

Bank 1			
Lending to corp. 1	D/2 + B/2 - Y	Household deposits	D/2+k–d/2
Deposits with CB	max (0, -(B/2–k +d/2-y))	Credit from central bank	max(0,B/2–k +d/2-y)
Interbank credit	Y - y		

Bank 2			
Lending to corp. 2	D/2 + B/2 +Y	Household deposits / debt	D/2-k -d/2
		Interbank credit	Y-y
		Credit from central bank	B/2+k+d/2 +y

Central Bank			
Credit operations	B+d+max(0,-(B/2–k +d/2+y))	Banknotes	B+d
Of which to bank 1:	*max(0,B/2–k +d/2)*	Deposits of bank 1 with CB	max (0, -(B/2–k +d/2-y))
Of which to bank 2:	*B/2+k +d/2*		

Why should the central bank accept an increase in the size and concentration of its exposure?

- Negative social externalities of funding liquidity stress and default (asset fire spiral etc). CB as public agent should aim at internalizing externalities
- CB is not threatened by illiquidity as it was given the privilege to be sole issuer of legal tender => even for commercial reasons, should take liquidity risk in a liquidity crisis on its balance sheet
- Haircuts are a powerful risk mitigation tool in situations in which credit risk is asymmetric
- CB may also be a natural Lender of Last Resort because it has privileged rights in terms of information access and securing of claims

Modeling background: solvency vs liquidity

- Illiquidity kills directly – insolvency is opaque and may go unnoticed (for a while)
- Opacity is particularly relevant from perspective of CB
- Insolvency is revealed for sure after illiquidity-induced default
- From a social point of view, “insolvency” and “expected economic performance” are both relevant but not identical
- Economic performance exhibits persistence
- Funding market access (funding liquidity) is a noisy reflection of solvency

Modeling background: solvency vs liquidity

- Default is costly as it means to fundamentally re-organize the use of resources (even without negative externalities)
- Default may be good for society as it re-assigns resource control away from those who may have underperformed
- Default is only one form of costs of funding liquidity problems. Others: fire sales spiral, credit crunch, etc.
- Central banks can never become illiquid (in their own currency), and therefore they also cannot default.
- For eventual losses of creditors (including the CB), collateral protection and seniority rules matter

Basic model setup

- Households
  - hold equity stakes in corporates P and banks Q
  - hold banknotes B and bank deposits D
  - receive noisy signals on solvency and withdraw funding
- Two Banks (ex ante identical)
  - intermediate between HH and corporates (real assets) and the CB (banknotes)
  - fund illiquid investment projects (each: B+D+Q/2)
- Two corporates, which each have a bilateral relation with one bank – default if and only if their bank defaults
- Central bank
  - has no info on solvency of banks/corp.
  - uses haircut h to provide liquidity and to minimize the costs of:
    - letting a solvent bank default
    - keeping unsound projects afloat

Financial accounts (without shocks)

Table 2: Financial accounts in the model

Households/Investors			
Assets		Liabilities	
Real assets	$E - D - B - Q - P$	Equity	E
Deposits Bank 1	$D/2$		
Deposits Bank 2	$D/2$		
Bank equity	Q		
Corporate equity	P		
Banknotes	B		

Corporate 1			
Assets		Liabilities	
Real assets	$(D + B + P + Q)/2$	Loans from Bank 1	$(D + B + Q)/2$
		Equity	$P/2$

Corporate 2			
Assets		Liabilities	
Real assets	$(D + B + P + Q)/2$	Loans from Bank 2	$(D + B + Q)/2$
		Equity	$P/2$

Financial accounts (without shocks)

Bank 1			
Assets		Liabilities	
Loans to Corporate 1	$(D+B+Q)/2$	Households' deposits	$D/2$
		CB borrowing	$B/2$
		Equity	$Q/2$

Bank 2			
Assets		Liabilities	
Loans to Corporate 2	$(D+B+Q)/2$	Households' deposits	$D/2$
		CB borrowing	$B/2$
		Equity	$Q/2$

Central bank			
Assets		Liabilities	
Credit operations	B	Banknotes	B

Sequence of events

- Period 1:
  - Zero-mean solvency shocks materialize: μ (system wide), $\eta_{1,2}$ (idiosyncratic, for each corporate individually)
  - Zero-mean liquidity shocks materialize: $d=\varepsilon-\alpha\mu$, $k=\theta+\beta(\eta_1-\eta_2)$
  - Banks adjust borrowing from the CB, limited to $1/2(1-h)(B+D+Q)$
  - If collateral constraint is hit, banks default, forcing also corporate default and destruction of x% of corp. assets
- Period 2:
  - Not defaulted corporates ("old" corporates) are subject to repetition of period 1 $\eta_{1,2}$
  - "New" corporates get new draw of idiosyncratic shock $\eta'_{1,2}$
  - CB losses and social welfare are evaluated.

Social welfare and CB losses

- Definitions.
  - Social welfare W (=efficiency) is simply the value of assets in the economy at the end of period 2
  - Central bank losses calculated from the cascading of asset value shocks and defaults through the respective balance sheets (also reflecting collateralisation).
  - If solvency and liquidity shocks are normally distributed, then E(W) can be expressed analytically as a function of:
    - the haircut level h;
    - volatilities of solvency and liquidity shocks;
    - correlation between solvency and liquidity shocks.

Simulation exercise

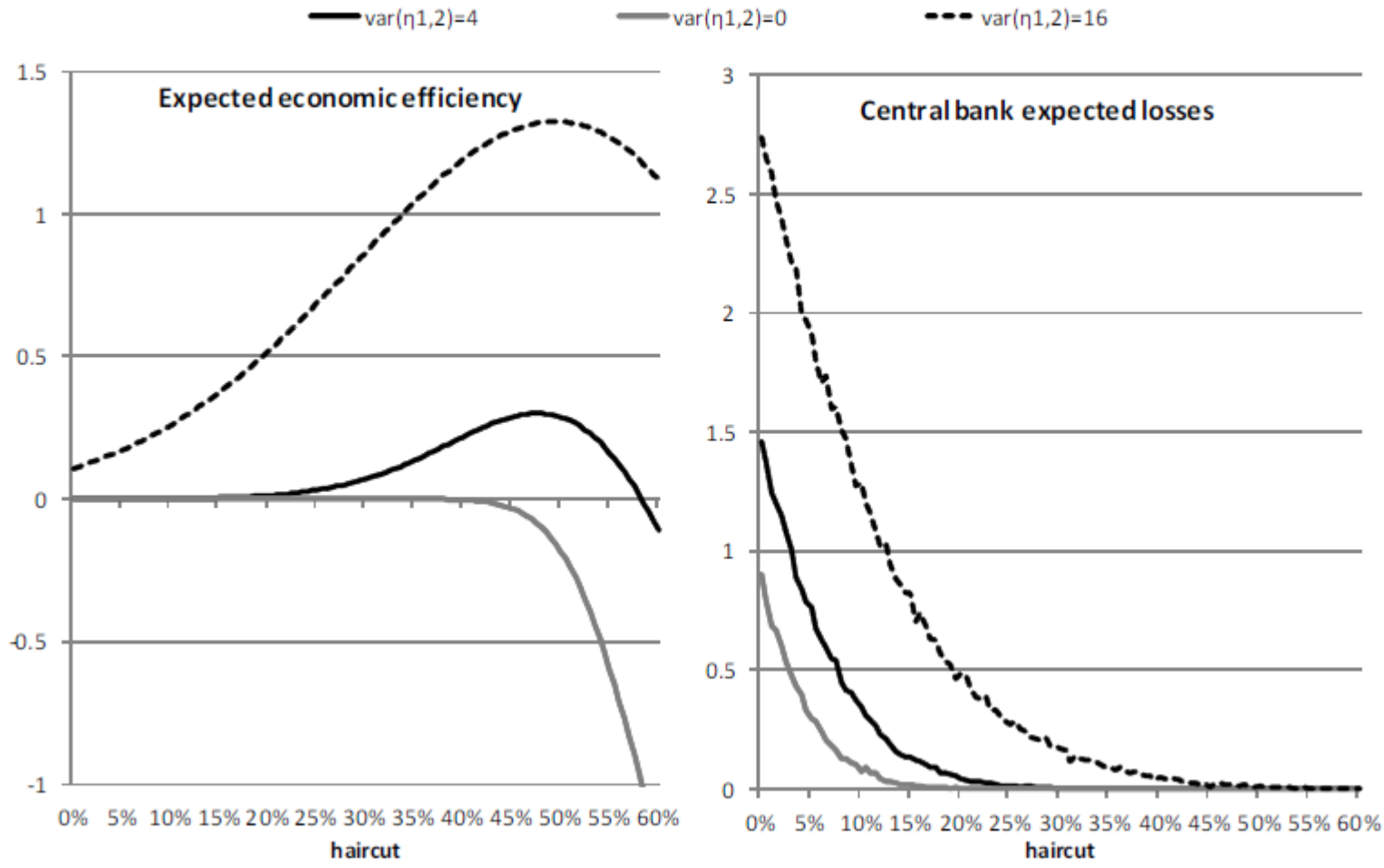
- HH equity fixed (at 100) and divided between:
  - real assets (50), banknotes (20), deposits (27)
  - equity stakes in corporates (2) and banks (1)
  - Analytical solution for economic efficiency
  - Simulation for central bank expected loss

Table 3: Model specifications considered

	Specifications					
	I	II	III	IV	V	VI
$\sigma_{\eta_{1,2}}$	2	0/2/4	2	2	2	2
σ_{μ}	2	2	0/2/4	2	2	2
β	1	1	1	0.1/0.2/1	1	1
σ_{θ}	1	1	1	1	0/1/4	1
σ_{ϵ}	1	1	1	1	1	1
α	1	1	1	1	1	1
x	1	1	1	1	1	0/1/15/25

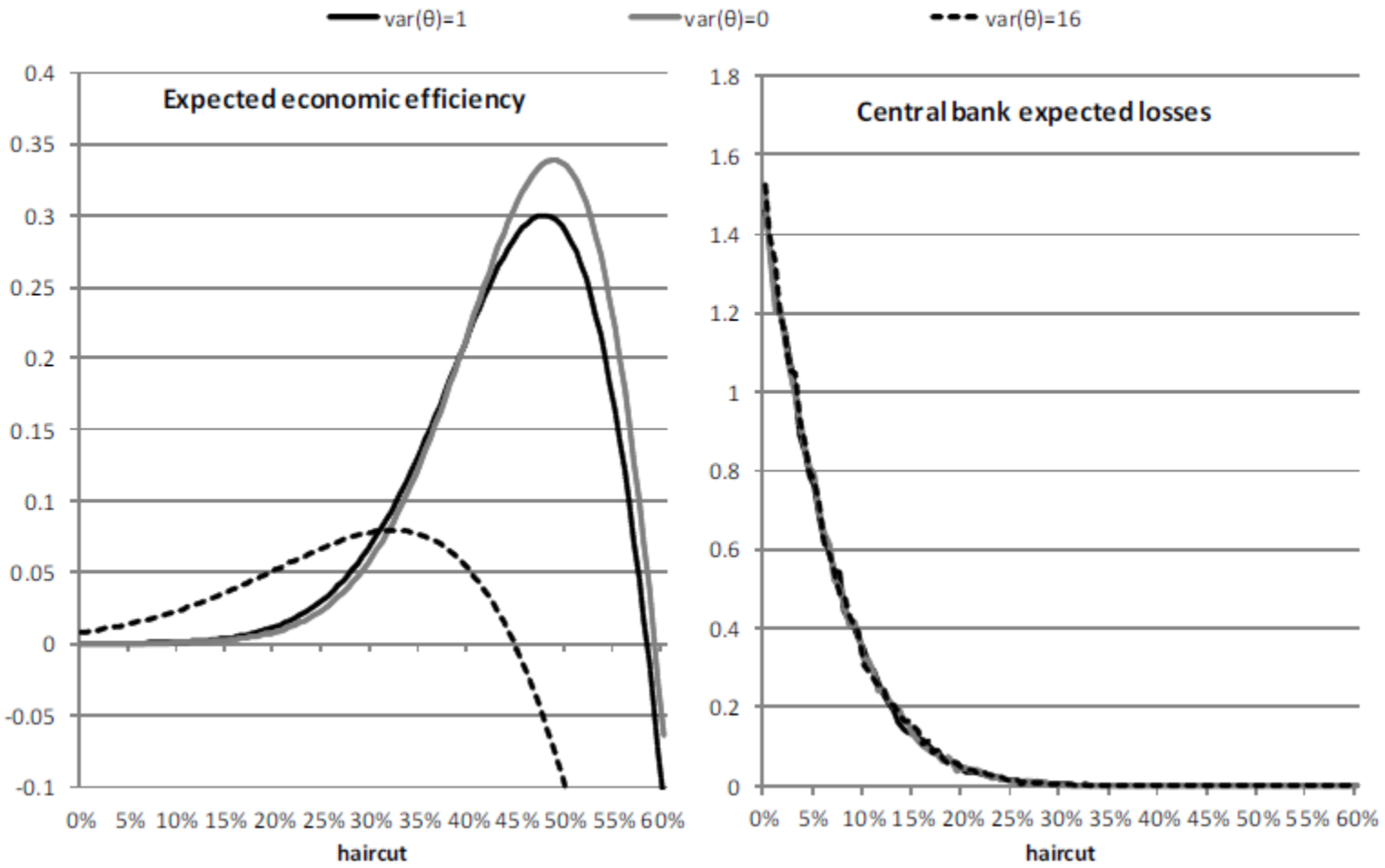
The role of the volatility of firm-specific asset shocks for optimal haircuts

Figure 4: Expected economic efficiency and central bank losses in Specification II



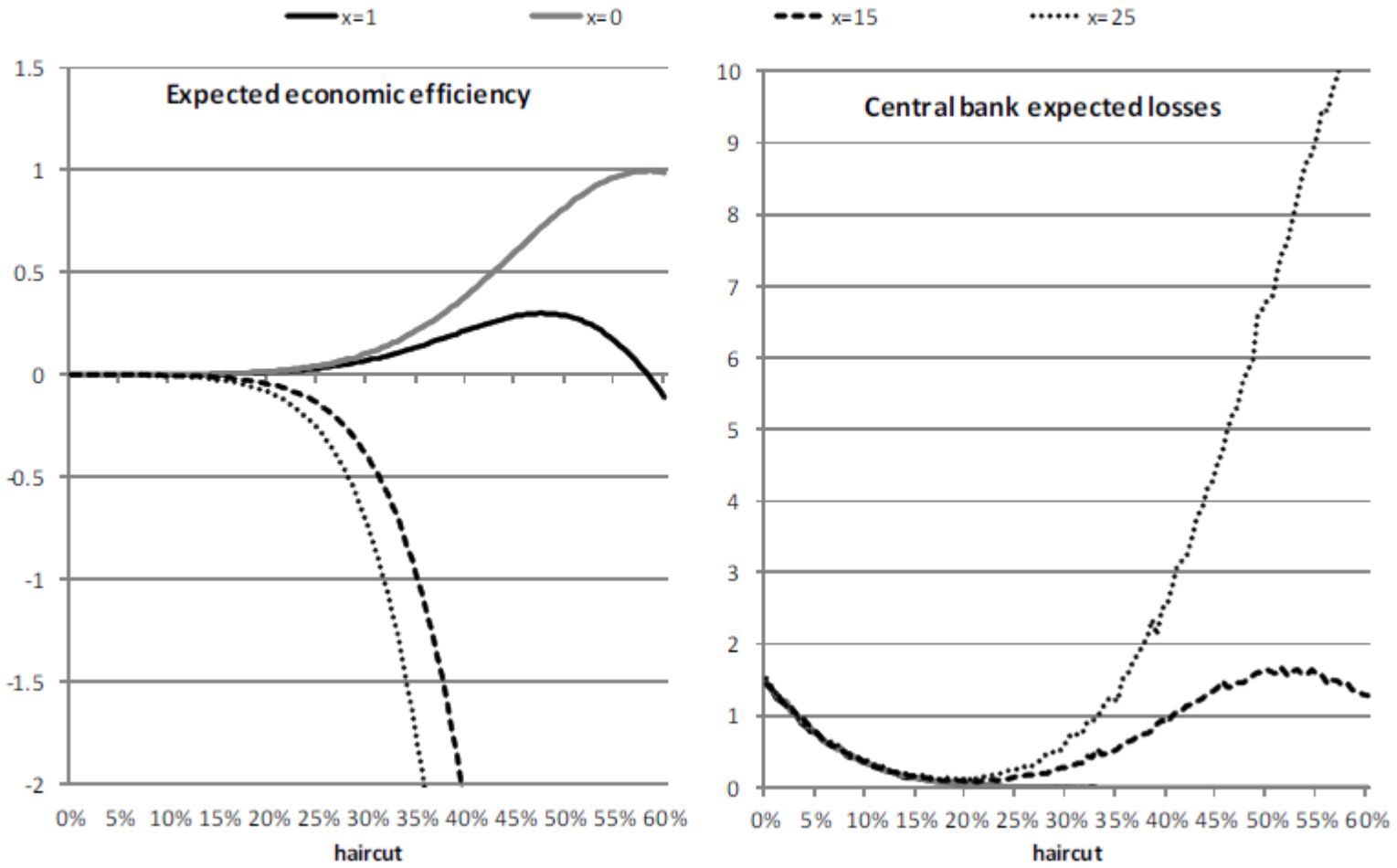
Role of noise in deposit shift shock

Figure 7: Expected economic efficiency and central bank losses in Specification V



Role of cost of default

Figure 8: Expected economic efficiency and central bank losses in Specification VI



Conclusions

- Economic efficiency is in many cases non-monotonous functions of central bank collateral haircuts; depending on circumstances, relationship between haircut and efficiency can be very different and hence the optimum central bank haircut policy.
- In financial crisis, in which liquidity shocks tend to become more volatile and erratic, and costs of default increase (due to contagion), a lower haircut is likely to be optimal than in stable times
- In assessing central bank risk taking in a financial crisis, it must not be ignored that the central bank is not an atomistic player in the market, but that risk parameters are endogenous to central bank action
- If cost of defaults (or of excessive deleveraging, etc) are sufficiently high, Bagehot's "only the brave plan is the save plan" can be replicated, i.e. higher haircuts can lead to higher central bank risk taking