UNINTENDED CONSEQUENCES OF LOLR FACILITIES: THE CASE OF ILLIQUID LEVERAGE

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Lender of last resort

- When financial sector's assets are hit by a common shock, leveraged firms lose access to private funding
  - Market for affected assets becomes illiquid

- Central banks resort to lender of last resort (LOLR) in such times to fund the firms against illiquid assets
  - In the recent crises, the Federal Reserve and the European Central Bank employed LOLR generously

Lender of last resort: The tradeoff

- (Presumably) The goal of the LOLR is to stave off defaults of financial firms whose failures may impose significant costs on the system

- Is this goal achieved?
  - Often, the success of the LOLR is assessed (indirectly) by the market prices of assets being supported
  - But what about the default risk of borrowing firms?
  - Do financial firms slow down their de-leveraging and asset sales to a point where their default risk increases?

Illiquid Leverage: Illiquid inventory / Equity

- Our main – theoretical and empirical – result is that

When LOLR is not conditioned on the solvency risk of the borrowers,

The mere existence (as opposed to usage) of the LOLR can increase the illiquid leverage of financial sector,

Raising the default risk of distressed financial firms,

(Making the financial sector LOLR-dependent as shocks worsen, and making Central Bank exits from LOLR difficult)

Relation to Stanley Fischer's work

- International Monetary Fund (IMF) as the lender of last resort for sovereign faces similar tradeoffs
  - Countries receiving LOLR may slow structural reforms
  - Fischer (*On the Need for an International Lender of Last Resort ,* 1999) recommends those receiving support be pushed by the IMF toward growth-friendly reforms
    - fiscal prudence, monetary and financial transparency, securities markets standards, bankruptcy regulations, and entry of foreign banks.

Moral hazard be contained if not eliminated!

Motivating example: Broker-dealers in 2007-08

- Took the existence of the Fed's unconstrained LOLR as given to maximize shareholder value by holding onto illiquid assets too long and optimizing risk-return tradeoff (Appendix B):
  - Reluctance to reduce risk by selling assets at a loss
  - Declarations of the absence of regulatory pressure to reduce risk
  - Use of the word “optionality”
  - Reference to market dislocations as risk-taking opportunities in crisis
  - Parlaying access to Fed into high spreads to fund prime brokerage clients

Heads I win, Tails You (Fed) Lose(s)…

We have not simply liquidated stuff at any price we could get. At some point some of the return profiles that people want... you would not want us to sell the assets. We will continue to sell assets but in a way that makes sense from generating returns to our shareholders.

- John Thain, CEO ML, Q2 Earnings Call, July 17, 2008

"As a result of the broader market dislocation, the competitive landscape has changed. Across many of our businesses, trading margins are robust and the premium on risk capital is higher than we've seen in years. In this type of environment return on assets is improving."

- David Viniar, CFO GS, Q4 Earnings Call, Dec 16, 2008

Broker-dealer leverage from 8/07 to 11/08

Panel B: Lehman Brothers					
	8/31/2007	2/29/2008	% Change	5/30/2008	% Change
Assets	659,216	786,035	19.2	639,432	-18.7
Net Assets	357,102	396,673	11.1	327,774	-17.4
Inventory	302,297	326,658	8.1	269,409	-17.5
Level I Assets	79,154	61,757	-22.0	45,565	-26.2
Illiquid Inventory	223,143	264,901	18.7	223,844	-15.5
Total Equity	21,733	24,832	14.3	26,276	5.8
Tangible Equity	22,164	25,696	15.9	27,179	5.8
Market Cap	29,029	28,115	-3.1	20,345	-27.6

Panel C: Merrill Lynch							
	6/29/2007	12/28/2007	% Change	6/27/2008	% Change	9/26/2008	% Change
Assets	1,076,324	1,020,050	-5.2	966,210	-5.3	875,780	-9.4
Net Assets	610,131	642,525	5.3	569,103	-11.4	567,406	-0.3
Inventory	224,789	234,669	4.4	217,639	-7.3	189,358	-13.0
Level I Assets	88,623	71,684	-19.1	43,814	-38.9	43,157	-1.5
Illiquid Inventory	136,166	162,985	19.7	173,825	6.7	146,201	-15.9
Total Equity	42,191	31,932	-24.3	34,778	8.9	38,355	10.3
Tangible Equity	42,523	31,566	-25.8	34,484	9.2	38,139	10.6
Market Cap	72,047	50,384	-30.1	32,221	-36.0	43,778	35.9

Broker-dealer leverage from 8/07 to 11/08

Panel D: Morgan Stanley									
	8/31/2007	2/29/2008	% Change	5/30/2008	% Change	8/29/2008	% Change	11/28/2008	% Change
Assets	1,185,131	1,090,896	-8.0	1,031,228	-5.5	987,403	-4.2	658,812	-33.3
Net Assets	688,966	636,892	-7.6	579,124	-9.1	544,087	-6.0	483,448	-11.1
Inventory	416,085	445,837	7.2	390,393	-12.4	371,555	-4.8	278,325	-25.1
Level I Assets	146,766	126,958	-13.5	118,622	-6.6	117,805	-0.7	49,461	-58.0
Illiquid Inventory	269,319	318,879	18.4	271,771	-14.8	253,750	-6.6	228,864	-9.8
Total Equity	35,250	33,280	-5.6	34,493	3.6	35,765	3.7	50,831	42.1
Tangible Equity	36,674	39,840	8.6	41,070	3.1	42,133	2.6	57,959	37.6
Market Cap	66,265	46,555	-29.7	49,045	5.3	45,287	-7.7	15,452	-65.9

Panel E: Goldman Sachs									
	8/31/2007	2/29/2008	% Change	5/30/2008	% Change	8/29/2008	% Change	11/28/2008	% Change
Assets	1,045,778	1,189,006	13.7	1,088,145	-8.5	1,081,773	-0.6	884,547	-18.2
Net Assets	706,903	788,746	11.6	653,514	-17.1	621,574	-4.9	528,161	-15.0
Inventory	428,156	498,855	16.5	411,194	-17.6	400,120	-2.7	338,325	-15.4
Level I Assets	121,665	113,754	-6.5	99,371	-12.6	93,206	-6.2	65,368	-29.9
Illiquid Inventory	306,491	385,101	25.6	311,823	-19.0	306,914	-1.6	272,957	-11.1
Total Equity	39,118	42,629	9.0	44,818	5.1	45,599	1.7	64,369	41.2
Tangible Equity	39,203	42,428	8.2	44,541	5.0	45,384	1.9	64,186	41.4
Market Cap	74,892	72,534	-3.1	75,486	4.1	70,180	-7.0	38,342	-45.4

Illiquid leverage and LOLR usage

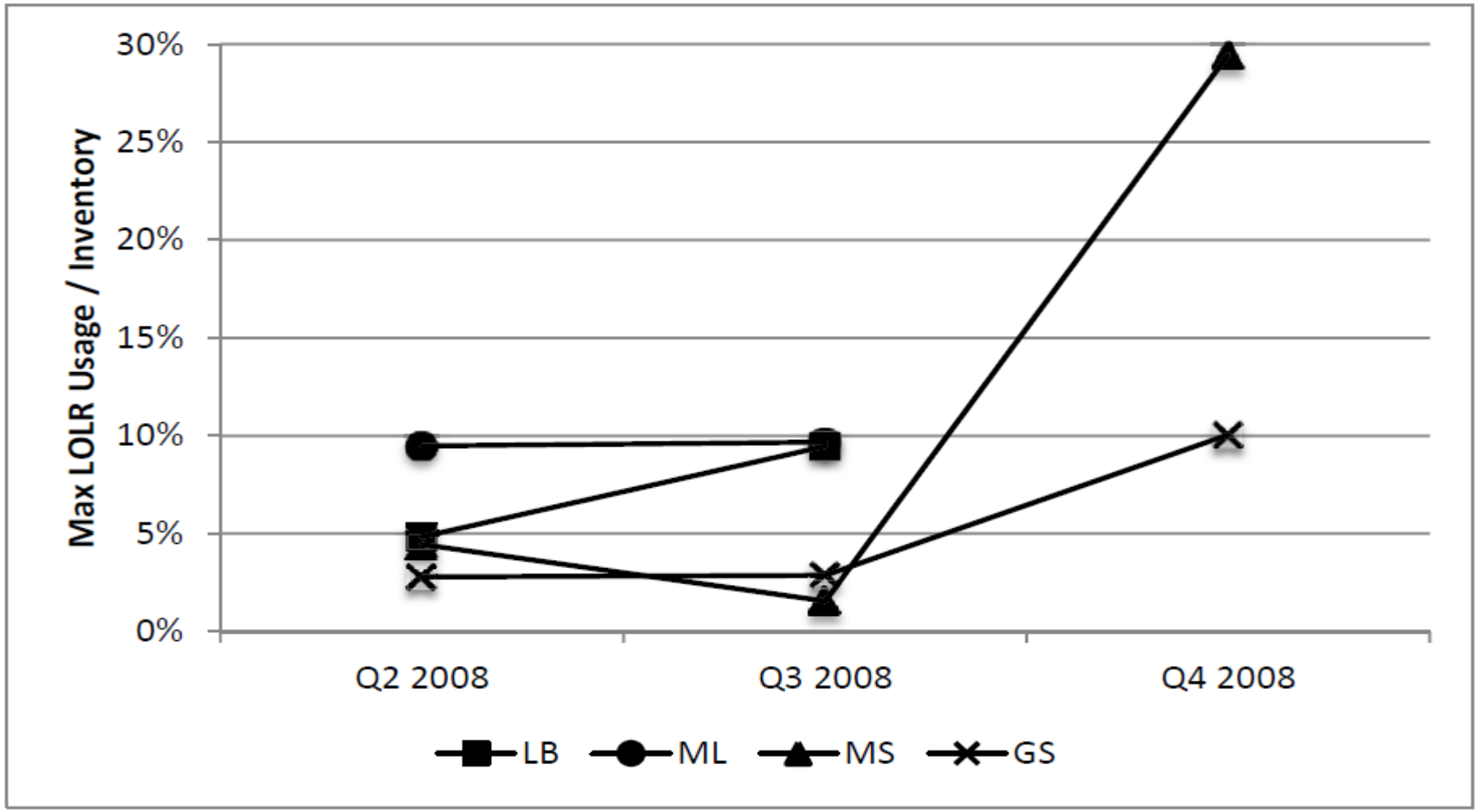
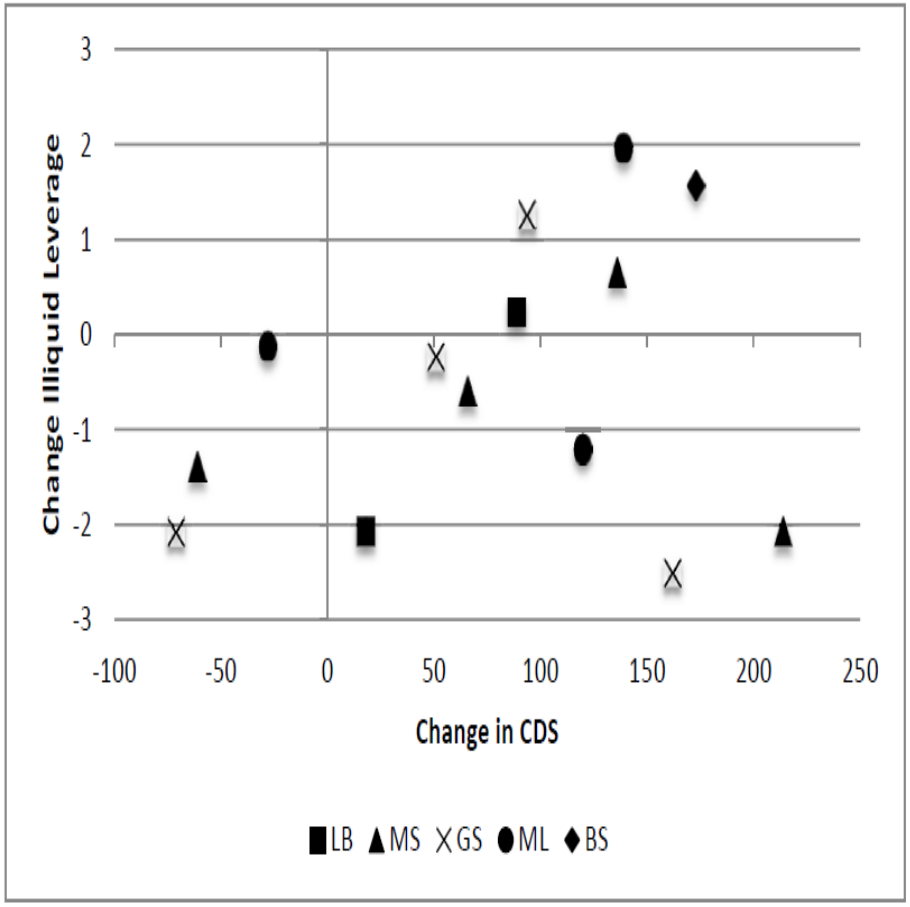
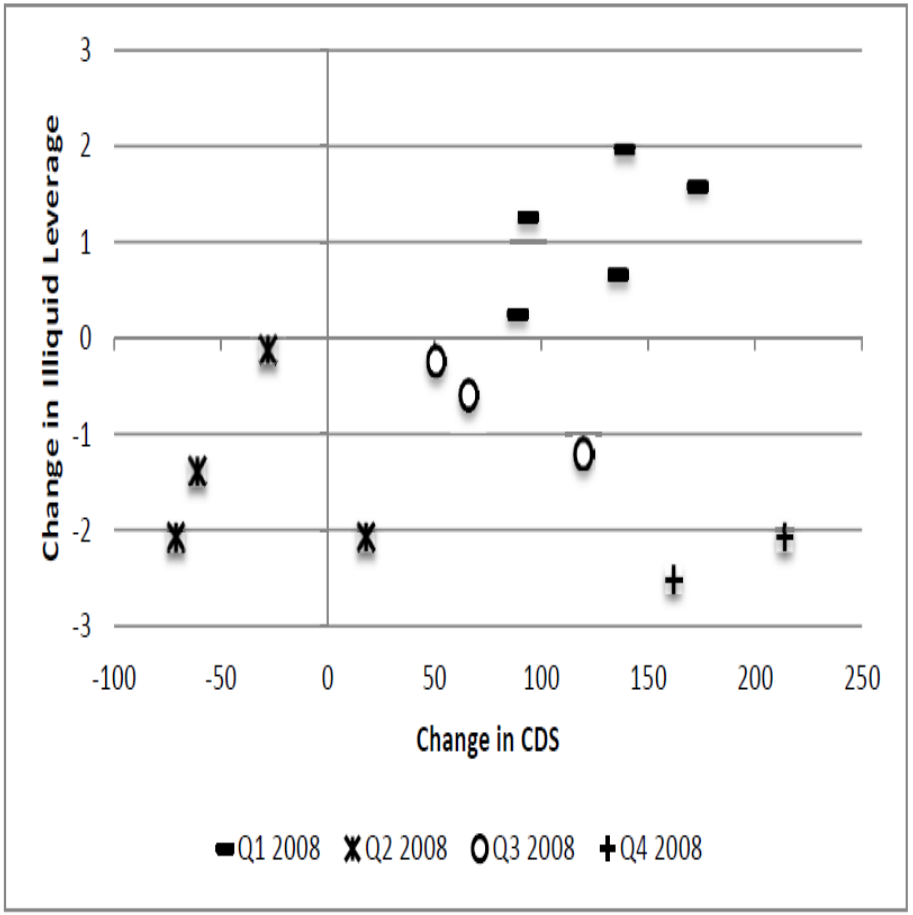


Figure 9: Maximum Combined Usage of TSLF and PDCF as a % of Inventory, by Quarter

Illiquid leverage and default risk (CDS)



(a) Change in Illiquid Inventory Leverage vs. Change in CDS Spread for U.S. Broker Dealers, by Broker-Dealer



(b) Change in Illiquid Inventory Leverage vs. Change in CDS Spread for U.S. Broker Dealers, By Quarter

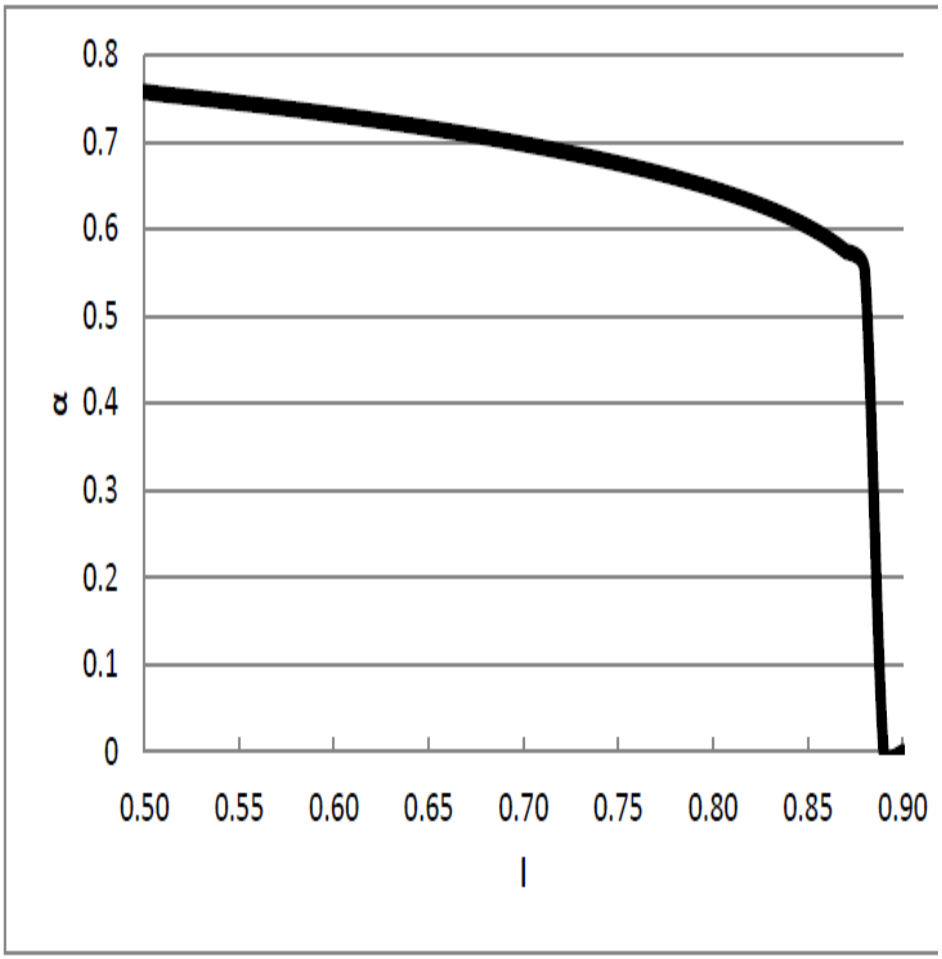
Model (PE) - Timeline

Table 1: Bank Cash Flows for a Given Choice of α and No Date-1 Default

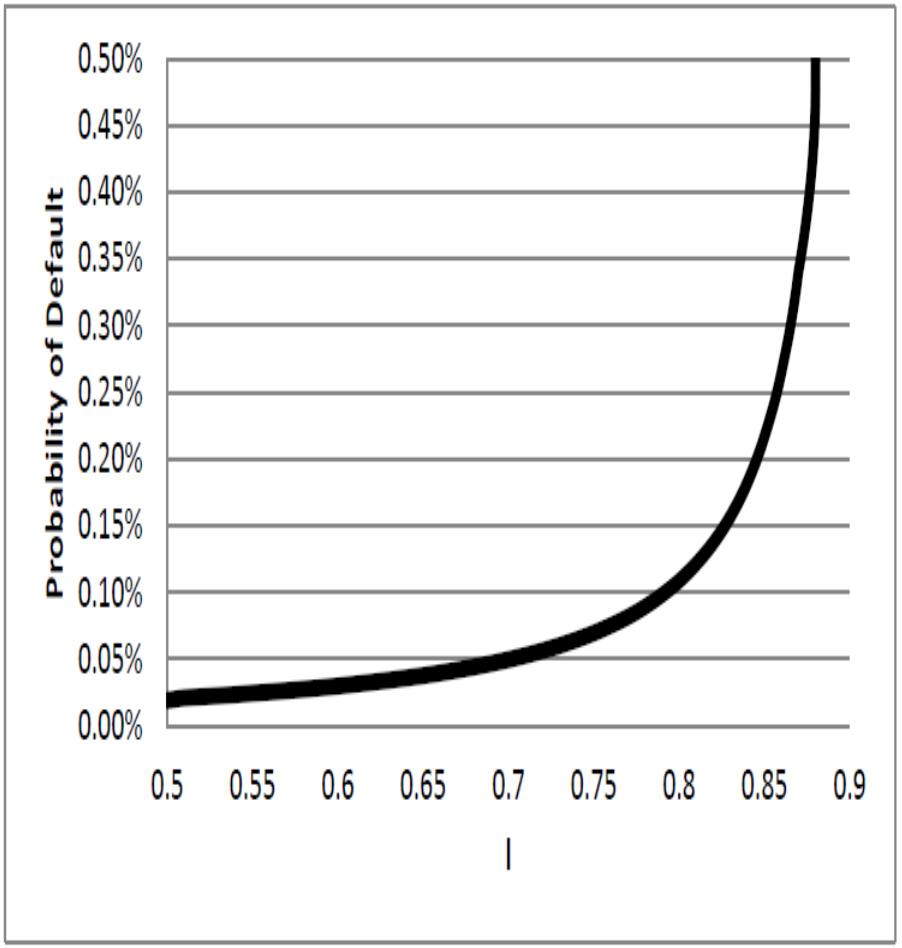
No date-1 default: $e^L + p\alpha + (e^I - \alpha)x_1 + (e^I - \alpha)lx_2 \geq B$

Date	Liquid Asset	Illiquid Asset	Illiquid Asset Cash Flows	LOLR Cash Flows	Debt Payment
Start 0	e^L	e^I			
End 0	$e^L + p\alpha$	$e^I - \alpha$			
1	$e^L + p\alpha - B + (e^I - \alpha)x_1 + (e^I - \alpha)lx_2$	$e^I - \alpha$	$(e^I - \alpha)x_1$	$(e^I - \alpha)lx_2$	B
2	$e^L + p\alpha - B + (e^I - \alpha)x_1 + (e^I - \alpha)x_2$	$e^I - \alpha$	$(e^I - \alpha)x_2$	$-(e^I - \alpha)lx_2$	

Effect of LOLR on De-leveraging and Default Risk

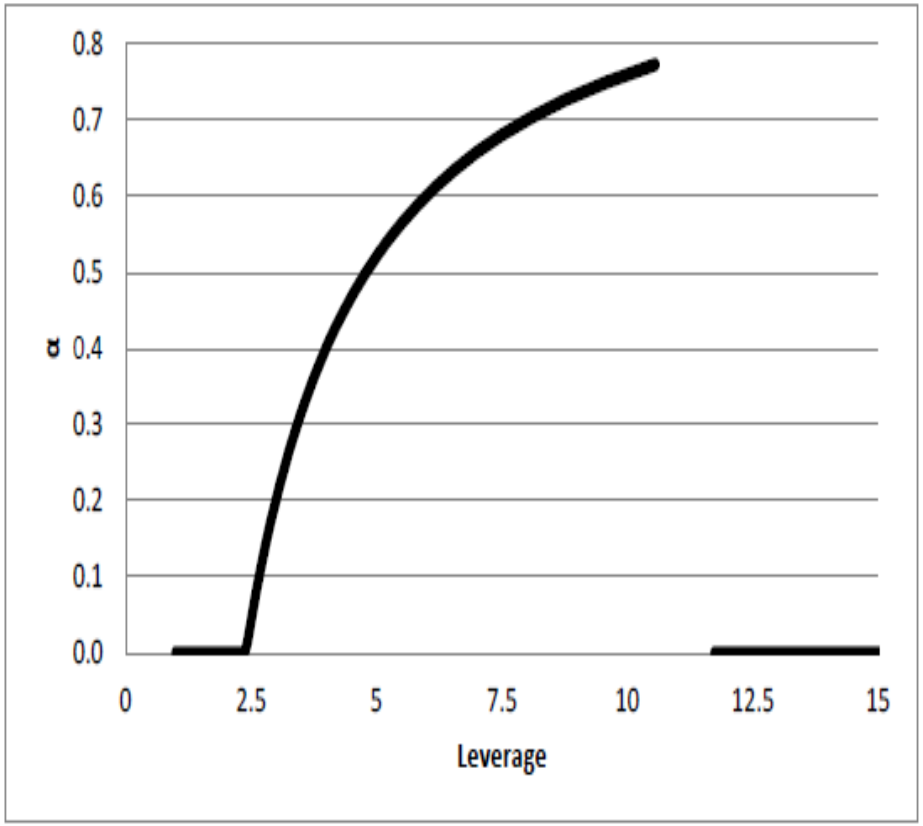


(a) Banks Sales of the Illiquid Asset, α, as a Function of l

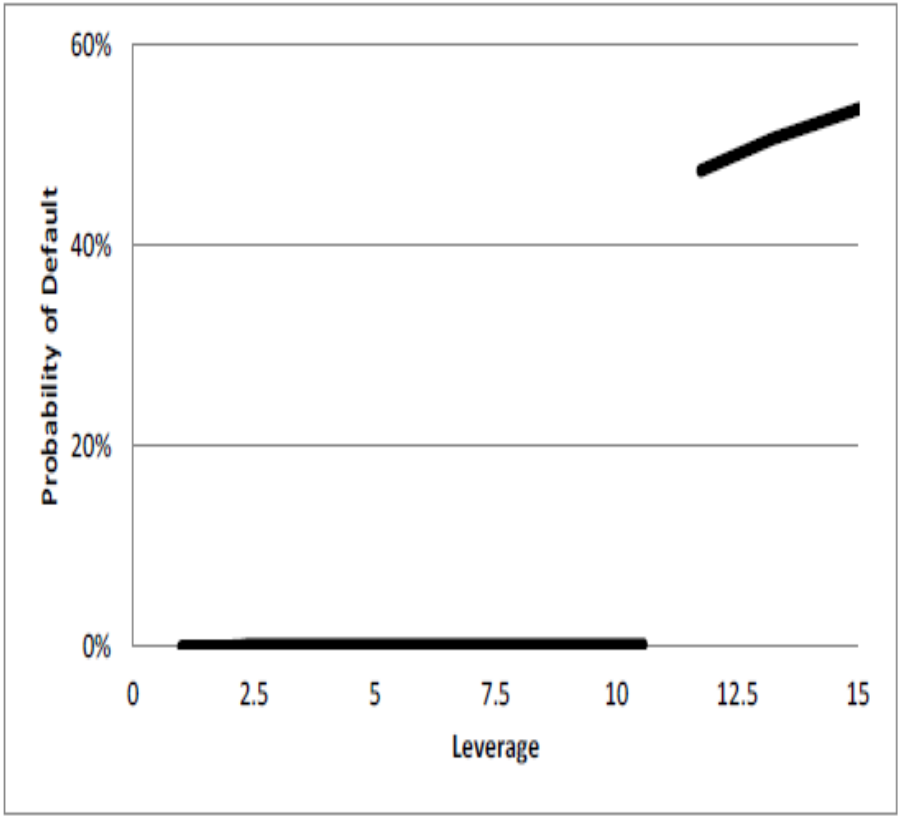


(b) Bank Probability of Default as a Function of l

Solvency risk aggravates the moral hazard



(a) Banks Sales of the Illiquid Asset, α, as a Function of Leverage



(c) Bank Probability of Default as a Function of Leverage (Full Vertical Axis)

Model (GE) - Timeline

Table 2: Buyer Cash Flows for a Given Choice of α^{Buyer} and No Date-1 Default

No date-1 default: $e^{L,Buyer} - p\alpha^{Buyer} + (e^{I,Buyer} - \alpha^{Buyer})x_1 + (e^{I,Buyer} - \alpha^{Buyer})l^{Buyer}x_2 \geq B^{Buyer}$

Date	Liquid Asset	Illiquid Asset	Illiquid Asset Cash Flows	LOLR Cash Flows	Debt Payment
Start 0	$e^{L,Buyer}$	$e^{I,Buyer}$			
End 0	$e^{L,Buyer} - p\alpha^{Buyer}$	$e^{I,Buyer}$ $+\alpha^{Buyer}$			
1	$e^{L,Buyer} - p\alpha^{Buyer} - B^{Buyer}$ $+(e^{I,Buyer} + \alpha^{Buyer})x_1$ $+(e^{I,Buyer} + \alpha^{Buyer})l^{Buyer}x_2$	$e^{I,Buyer}$ $+\alpha^{Buyer}$	$(e^{I,Buyer}$ $+\alpha^{Buyer})x_1$	$(e^{I,Buyer}$ $+\alpha^{Buyer})l^{Buyer}x_2$	B^{Buyer}
2	$e^{L,Buyer} - p\alpha^{Buyer} - B^{Buyer}$ $+(e^{I,Buyer} + \alpha^{Buyer})x_1$ $+(e^{I,Buyer} + \alpha^{Buyer})x_2$	$e^{I,Buyer}$ $+\alpha^{Buyer}$	$(e^{I,Buyer}$ $+\alpha^{Buyer})x_2$	$-(e^{I,Buyer}$ $+\alpha^{Buyer})l^{Buyer}x_2$	

Prices determined by market-clearing

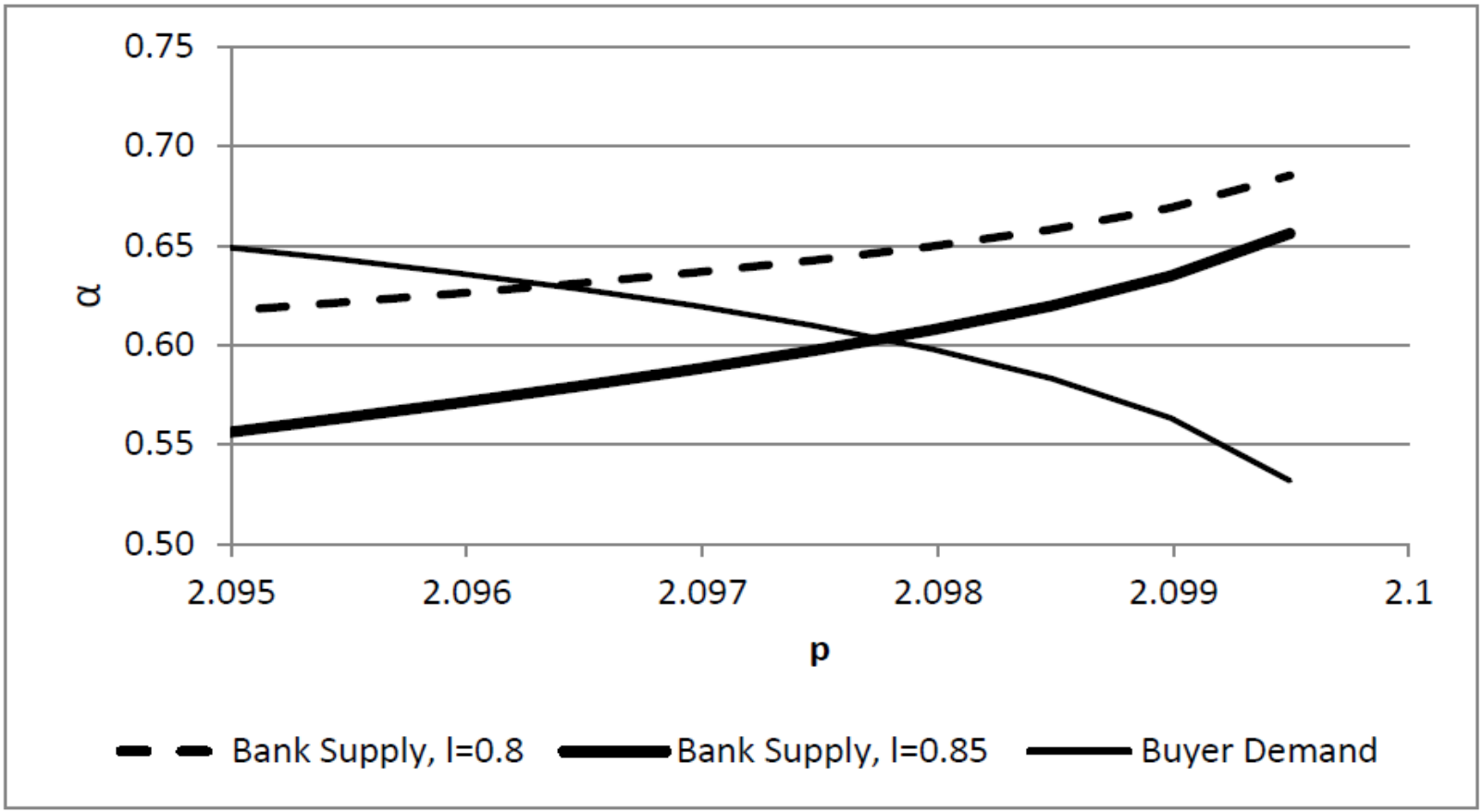
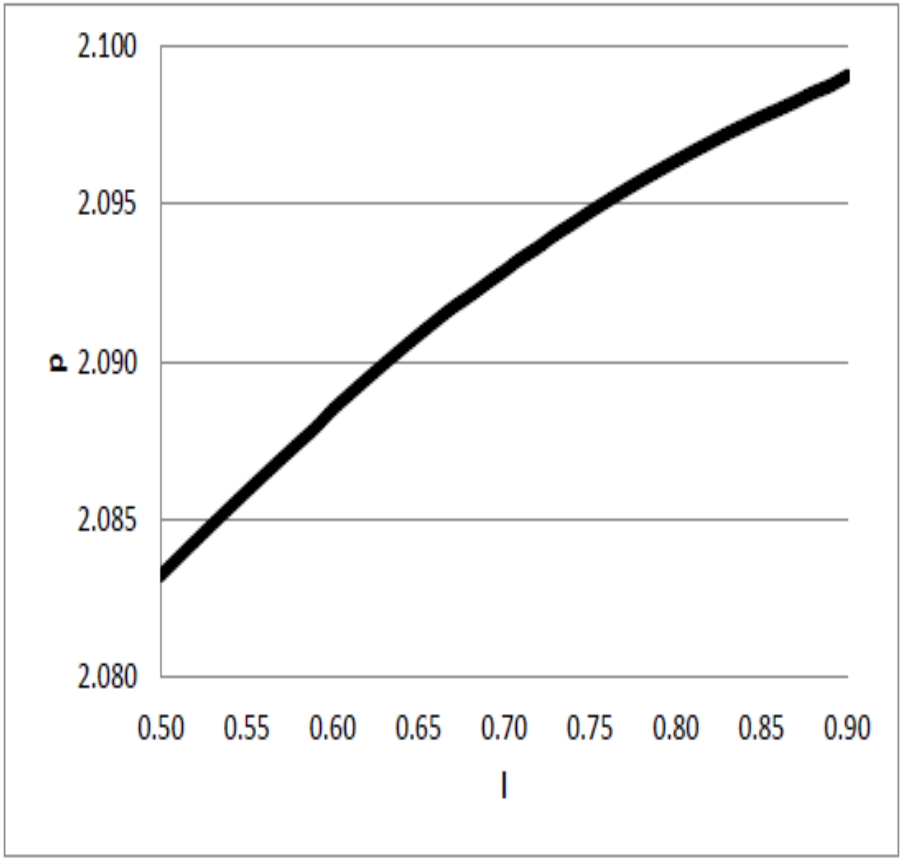
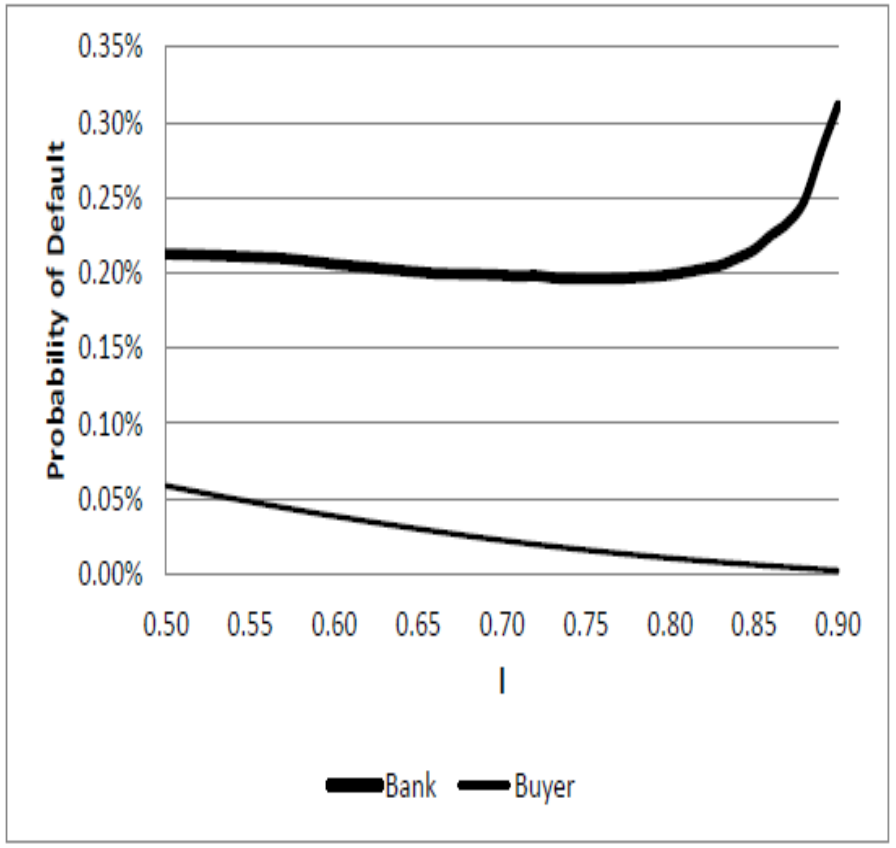


Figure 3: The Endogenous Determination of the Illiquid Asset Price and Quantity Traded. Bank Supply and Buyer Demand of the Illiquid Asset, α, as a Function of the Price of the Illiquid Asset, p, for Two Advance Rates of the LOLR Facility Available to Banks, l

LOLR raises prices, but moral hazard can prevail



(a) The Equilibrium Illiquid Asset Price, p, as a Function of the LOLR Facility Advance Rate Available to Banks, l



(c) The Probability of Bank and Buyer Default as a Function of the LOLR Facility Advance Rate Available to Banks, l

Should LOLR provide liquidity to healthy buyers?

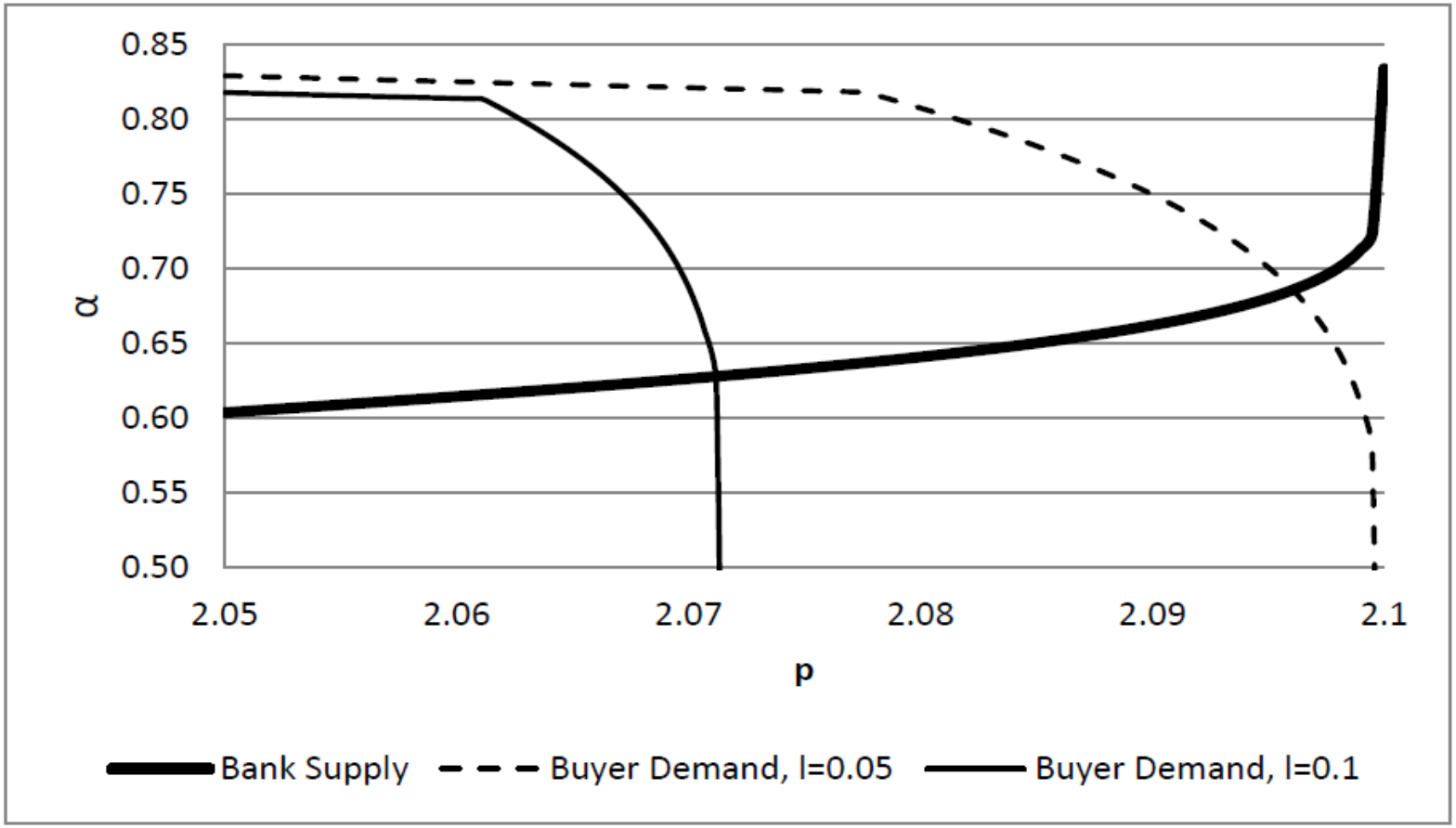
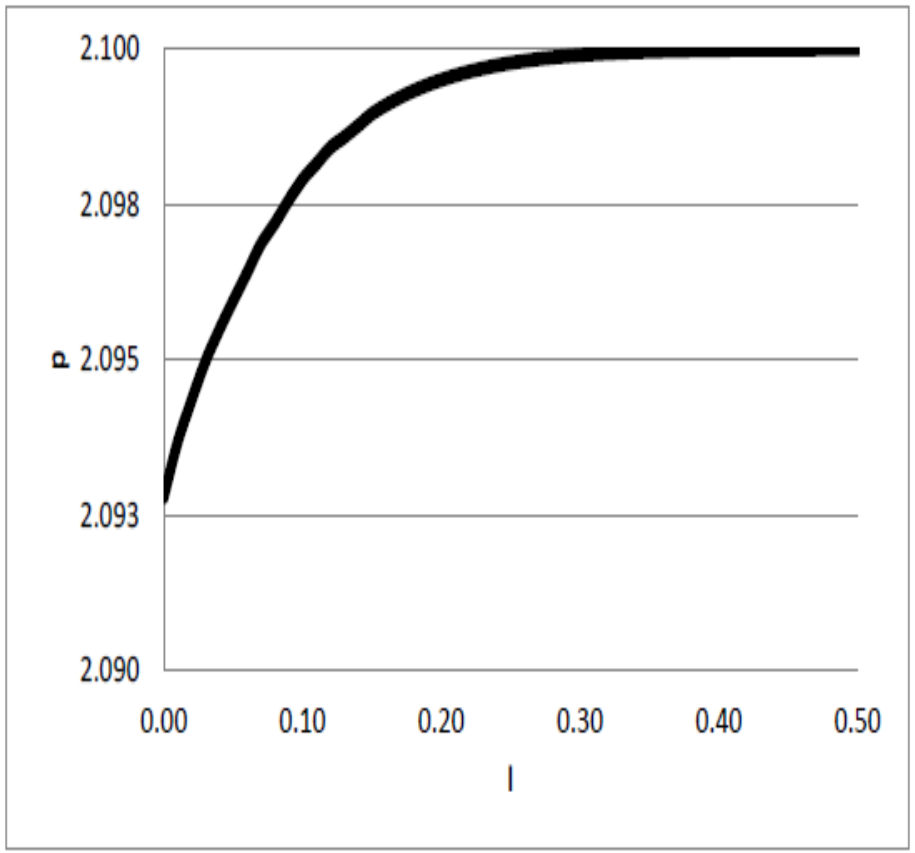
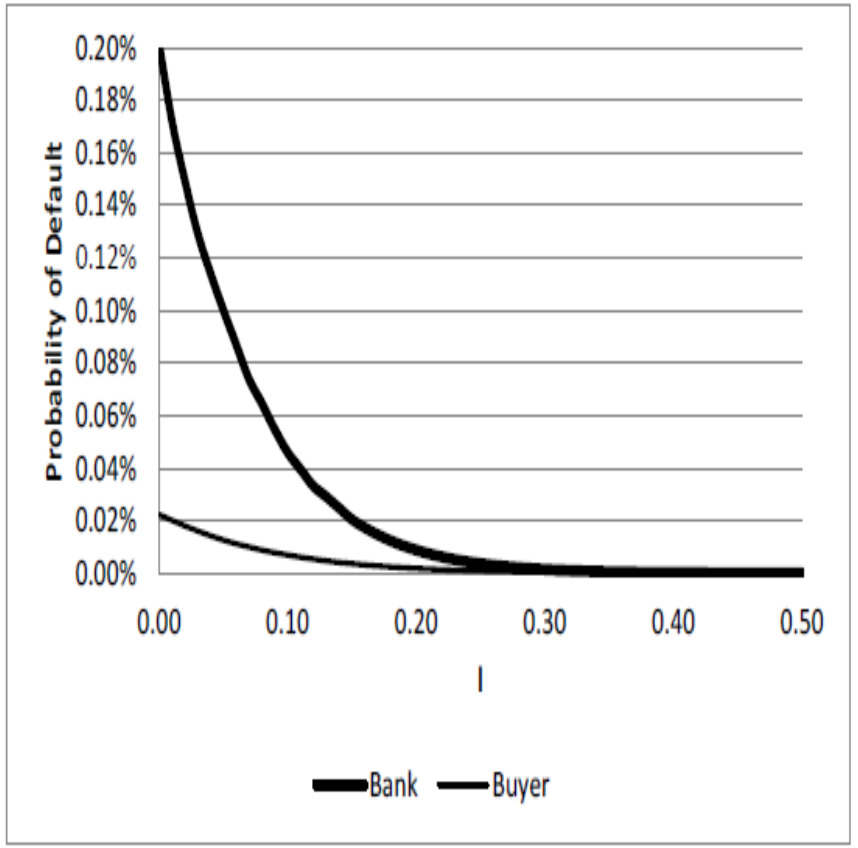


Figure 5: The Endogenous Determination of the Illiquid Asset Price and Amount Traded. Bank Supply and Buyer Demand of the Illiquid Asset, α, as a Function of the Price of the Illiquid Asset, p, for Two Advance Rates of the LOLR Facility Available to Buyers, l

LOLR raises prices AND moral hazard is contained





(a) The Equilibrium Illiquid Asset Price, p, as a Function of the LOLR Facility Advance Rate Available to Buyers, l

Policy Implications

- Lender of last resort policies can be improved to take account of their effect on illiquid leverage
- Proposal I: Provide LOLR only to firms with sufficient levels of solvency; condition LOLR terms on solvency risk
- Proposal II: Require that firms accessing LOLR engage in de-leveraging from illiquid assets within a certain time frame
- Proposal III: Provide LOLR to relatively healthy, potential buyers of assets

Recent Bank of England announcements

- Mark Carney's recent speech (24 Oct 2013) announced sweeping overhaul of BoE's LOLR
  - Considering extension to clearing houses, broker-dealers and other financial firms when financial sector is shaky
  - More cheaply, for longer, and against wider range of collateral in case of funding problems
  - "enemy of taxpayer bailouts, fragile markets and financial instability"
  - Assumes safety and soundness regulations in good times will work well
  - Speech ignores Bagehot's "penalty rate" altogether, but recognizes the lending rate should vary with BOE's collateral risk
  - Suggests incentives be for private liquidity in normal times, but not in times of aggregate or tail risks

Unintended consequences of such LOLR

- Dismal regulatory success in curbing financial sector's (endogenous) correlated risks/leverage
  - Static risk weights, forbearance, delayed recapitalizations
- Extensive LOLR with little regard for borrower health may itself undermine the ex-ante measures
  - Distressed parts of the financial sector will sustain illiquid leverage in anticipation of such LOLR
- How can extension of LOLR be done better?
  - Why not lend based on borrower's solvency risk?
  - Why not lend to healthy, potential buyers of assets?