Financial Integration and Liquidity Crises

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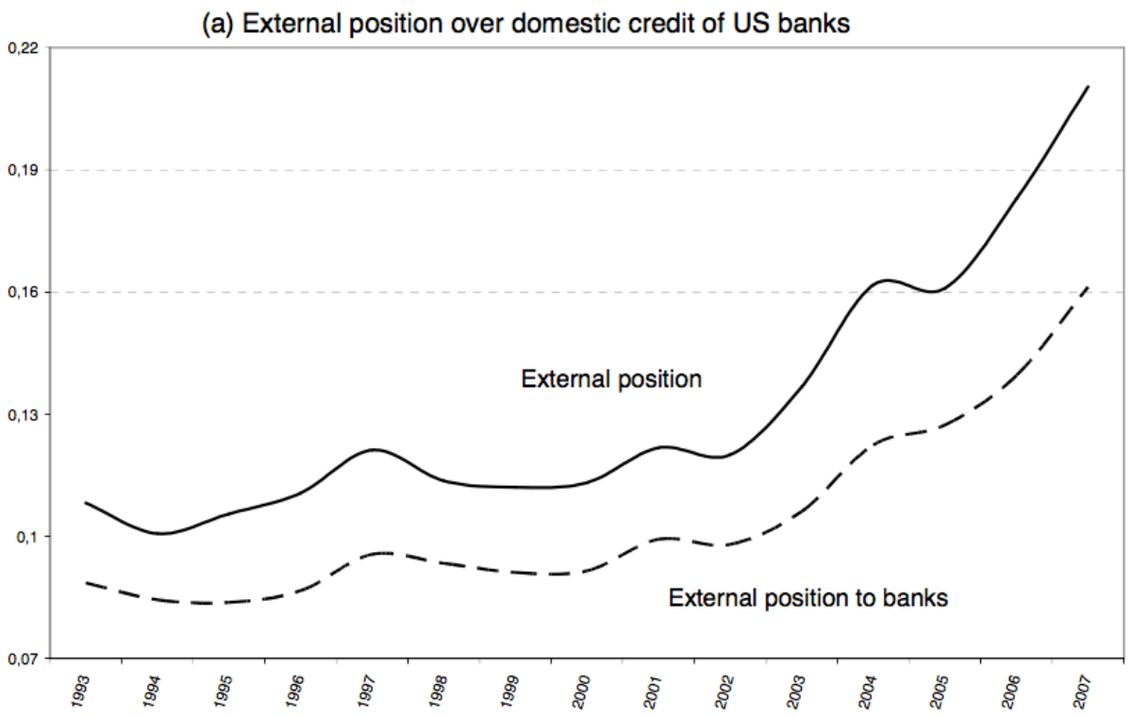
"changes in the structure of financial markets have enhanced their ability to handle risk in normal times"

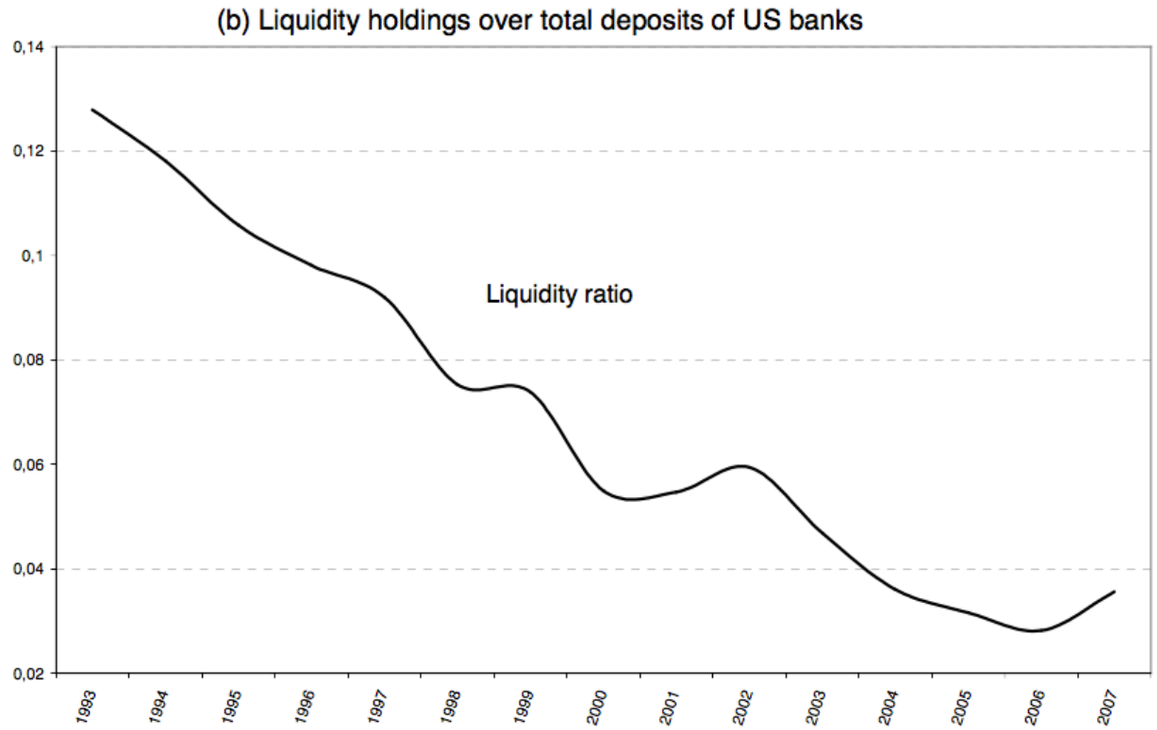
–**Larry Summers**
Financial Times, December 26, 2006

"some of the same innovations that contribute to risk spreading in normal times can become sources of instability following shocks to the system."

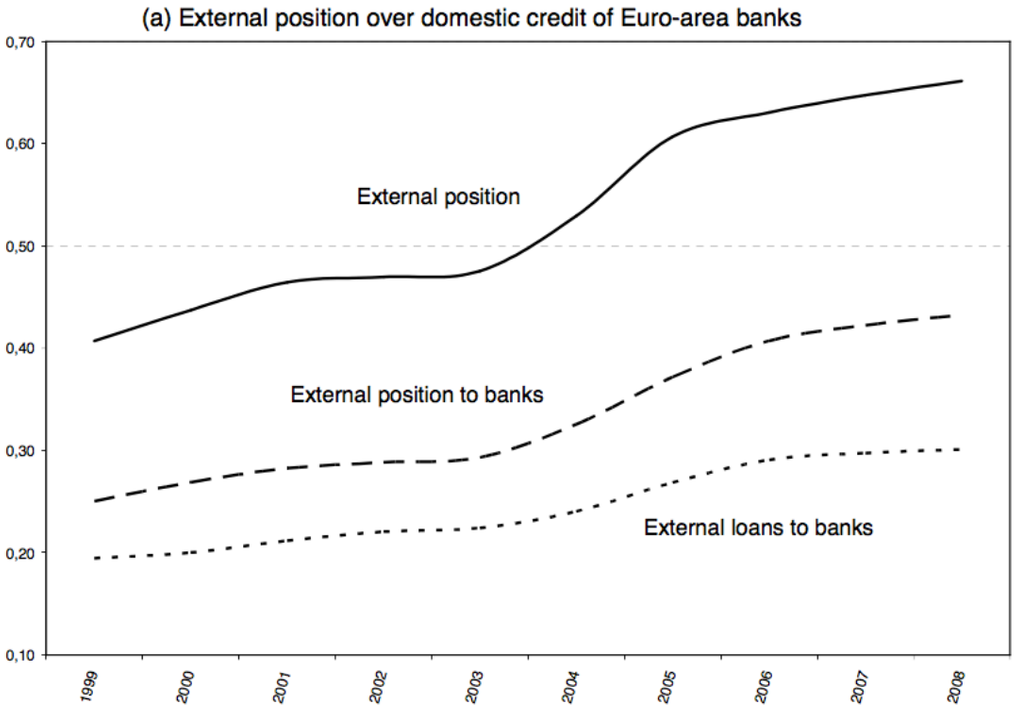
–**Larry Summers**
Financial Times, December 26, 2006

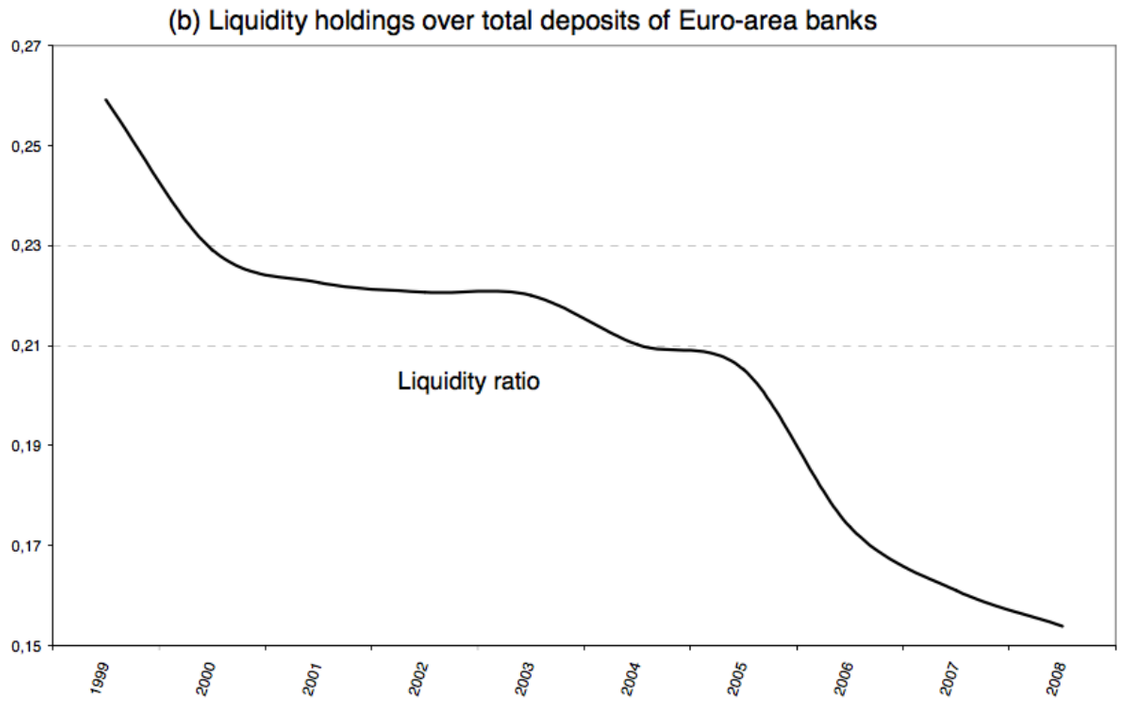
Motivation: US Bank





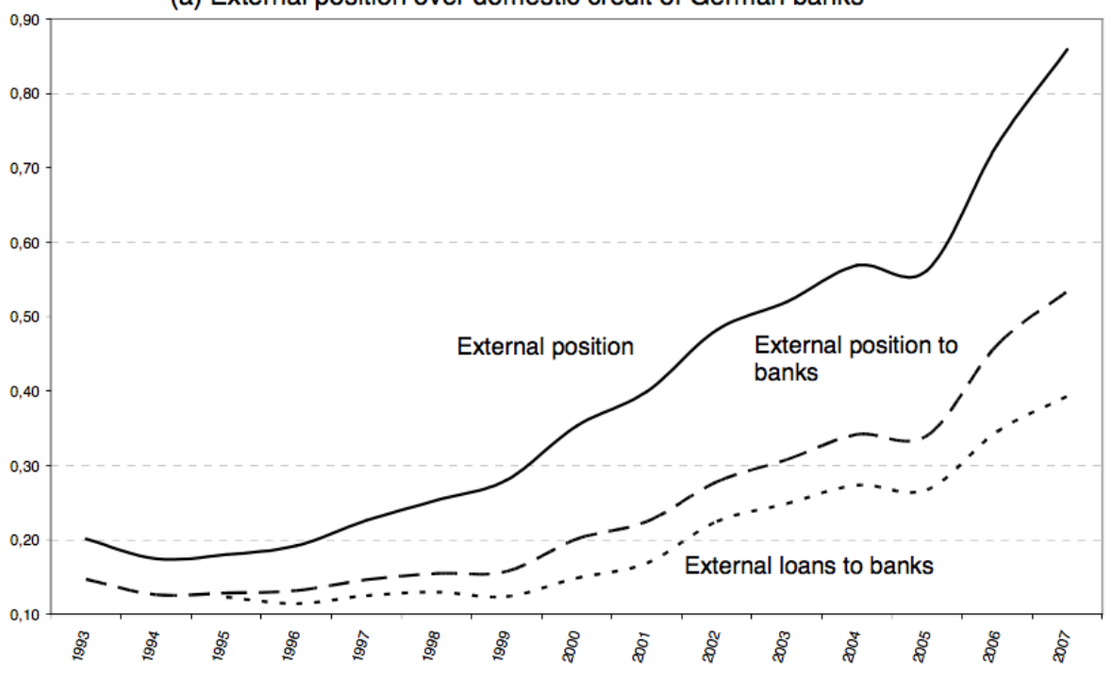
Motivation: Euro area



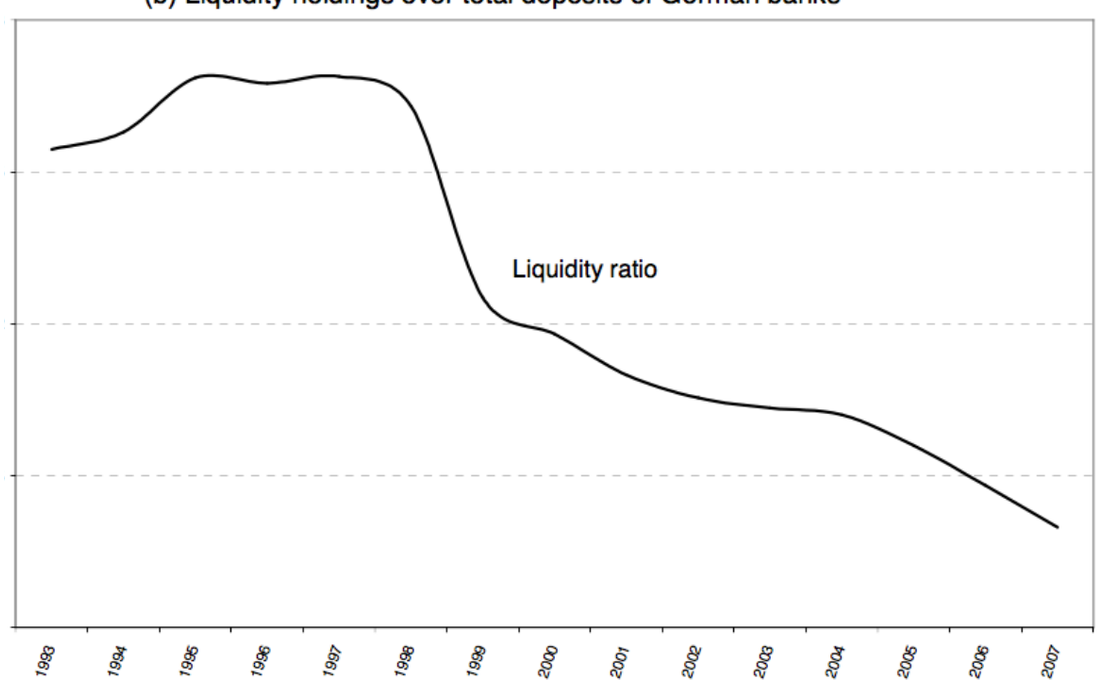


Motivation: Germany

(a) External position over domestic credit of German banks



(b) Liquidity holdings over total deposits of German banks



Two Forces

opportunities to borrow

vs.

opportunities to lend

increases incentive

decreases incentive

Goals

- understand how integration affects liquidity risk
- understand how integration affects the banks' investment decisions and response to equilibrium liquidity
- provide a possible theoretical explanation to the financial crisis

Building Blocks

- risk-sharing model among (competitive) banks in different regions

- two-region version of Diamond & Dybvig(1983)

- similar to Allen & Gale(2000) “Financial Contagion”

  - **except** we allow for *fully state-contingent* deposit contracts

Setting

two regions: A & B [ex-ante identical]

- three dates: t = 0, 1, 2,
- single consumption good [numeraire]
- continuum of consumers [ex-ante identical]
  - endowment of one unit at t = 0

Timing

t = 0
per region

Contract*

Endowment

Investment

*TBD

Consumers

- consumer utility function

$$u(\bullet) \in C^1$$

$$u'(\bullet) \geq 0 \qquad \lim_{c \to 0} u'(\bullet) = \infty$$

$$u''(\bullet) < 0$$

- preference shock

$$\theta \in \{0,1\} \qquad \begin{array}{ll} \theta = 1 & \text{“early”} \\ \theta = 0 & \text{“late”} \end{array}$$

- expected utility function

$$E\left[\theta u(c_1) + (1-\theta) u(c_2)\right]$$

Bank Technology

*perfectly elastic supply

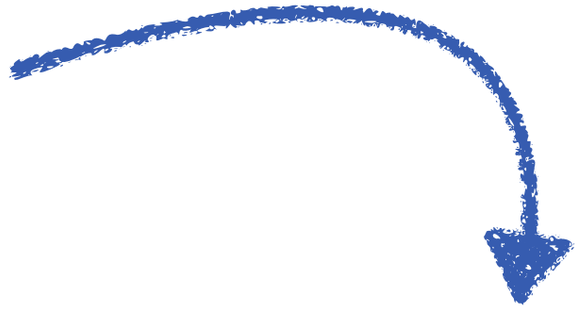
	t = 0	t = 1	t = 2
Short	[1]	1	
		[1]	1
Long	[1]		R

R > 1

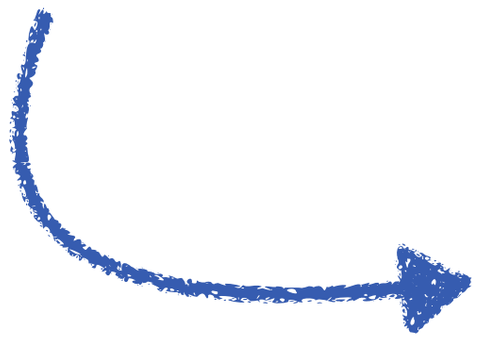
Timing

t = 1
per region

Liquidity Shock



Preference Shock



World States

Shocks

regional liquidity shock

$$i = A, B$$

- fraction of regional population

$$\omega^i = \{\omega_L, \omega_H\}$$

- *realized* [`t = 1`] & *publicly observed*

agent preference shock

- randomly assigned
- privately observed

$$\theta = 1$$

*fraction of consumers

Shocks

regional liquidity shock

- magnitude $\omega_H > \omega_L$
- probability of shock value $\Pr(\omega_L) = \Pr(\omega_H) = \frac{1}{2}$
- expected value of regional shock $\omega_M \equiv \boldsymbol{E}\left[\omega^i\right] = \frac{\omega_H + \omega_L}{2}$

States

- allows for various degrees of correlation between regional shocks

- four state of the world

$$\mathbf{S} \in \mathcal{S} = \{\mathrm{HH},\mathrm{LH},\mathrm{HL},\mathrm{LL}\}$$

- assume probability, $\mathbf{p}$, for mixed shocks $p \in (0,1]$

Table 1: Regional liquidity shocks

State S	A	B	Probability
HH	ω_H	ω_H	$(1-p)/2$
LH	ω_L	ω_H	$p/2$
HL	ω_H	ω_L	$p/2$
LL	ω_L	ω_L	$(1-p)/2$

Contracts

- fully state-contingent

$$\left\{ y, \left\{ c_t^s \right\}_{s;t=1,2} \right\}$$

- utility maximizing for consumer
  - Diamond & Dybvig (run equilibrium)
- investment liquidity decision

liquid asset = y illiquid asset = (1-y)

- implemented,
  1. aggregate shock S is observed
  2. consumers reveals preference shock

"early" $(c_1^s, 0)$ "late" $(0, c_2^s)$

Bank Autarky

- analogue of autarky in D & D economy
- bank only allowed to serve consumers in that region & no financial agreements with other banks
- other region liquidity shock becomes irrelevant
- problem: find optimal deposit contract only contingent on local liquidity shock

Bank Autarky: region A

HH = HL
LH = LL → s = {H,L} → $\left\{y, \left\{c_t^s\right\}_{s\in\{H,L\};t=1,2}\right\}$

Problem:

$$\max_{y,\{C_t^s\}} \frac{1}{2}\left[\omega_H u(c_1^H)+(1-\omega_H)u(c_2^H)\right]+\frac{1}{2}\left[\omega_L u(c_1^L)+(1-\omega_L)u(c_2^L)\right]$$

s.t. $\omega_s c_1^s \le y,$ liquidity

$s=L,H$

$(1-\omega_s)c_2^s \le R(1-y)+(y-\omega_s c_1^s),$ reserve

Bank Autarky

Proposition 1 *The optimal allocation under autarky satisfies*

$$c_1^H < c_1^L \leq c_2^L < c_2^H.$$

No funds are rolled over between periods 1 *and* 2 *in state* H*. If positive rollover occurs in state* L *then* $c_1^L = c_2^L$*.*

postive rollover  $(y - \omega_s c_1^s) > 0$

Financial Integration

- analogue of “smoothing effect” in D & D economy
- insure against regional liquidity shock by trading *contingent credit lines* with banks in other regions
- coinsurance in states HL & LH
- consider decentralized banking system

Financial Integration

- competitive banking sector
- state - contingent credit $(m_1, m_2) \in R^2_+$

Problem:

choose deposit contract and credit line to maximize utility of consumer in region

Financial Integration

$$\max_{y,\{C_t^s\},(m_1,m_2)} \quad p\left(\frac{1}{2}\left[\omega_H u(c_1^{HL})+(1-\omega_H)u(c_2^{HL})\right]+\frac{1}{2}\left[\omega_L u(c_1^{LH})+(1-\omega_L)u(c_2^{LH})\right]\right)$$
$$+(1-p)\left(\frac{1}{2}\left[\omega_H u(c_1^{HH})+(1-\omega_H)u(c_2^{HH})\right]+\frac{1}{2}\left[\omega_L u(c_1^{LL})+(1-\omega_L)u(c_2^{LL})\right]\right)$$

$$\omega_H c_1^{HL} \le y + m_1,$$
$$(1-\omega_H)c_2^{HL} \le R(1-y)+(y+m_1-\omega_H c_1^{HL})-m_2,$$

→ **borrow** LC & RC

$$\omega_L c_1^{LH} \le y - m_1,$$
$$(1-\omega_L)c_2^{LH} \le R(1-y)+(y-m_1-\omega_L c_1^{LH})+m_2,$$

→ **lend** LC & RC

$$\omega_s c_1^{ss} \le y,$$
$$(1-\omega_s)c_2^{ss} \le R(1-y)+(y-\omega_s c_1^{ss}), s=H,L$$

→ **symmetric** LC & RC

Conclusion

by reducing aggregate uncertainty in "normal" states of the world, *financial integration* is in fact welfare increasing, but it also induces banks to reduce their liquid holdings, which in turn leads to an increase in the severity of a systematic crisis when it does occur.