Universal Banking, Asymmetric Information and the Stock Market
(Should there be a new Glass-Steagall?)
Work in Progress

Sanjay Banerji Parantap Basu

Nottingham University, UK, Durham University, UK

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Hallmark of Universal Banking

- A universal bank can sell insurance, hold equity in non financial firms and underwrite securities in addition to its commercial banking activities.
- Hallmark of U banking is that such a bank accepts deposits which could ensure intertemporal consumption smoothing and could trade in equities which leads to efficient risk sharing.
- In the USA, the practice of U banking was outlawed following the Glass-Steagall Act in 1933 and it was reinstituted following Gramm-Leach-Bliley Act in 1999.
- In recent years, such a financial institution has been a subject of heated debate again, (Benzoni and Schenone, 2010, Ber et al. (2001), Duarte-Silva (2010), Kang and Lee (2007)).
- Regulators in the UK and the USA are contemplating to curb multifarious activities of these institutions, (FT, April 11, 2011) .

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- Research Question: Did the institution of universal banking via Gramm-Leach-Bliley Act of 1999 heighten risk in the financial markets? If so, why?
- The source of the risk could be the conflict of interest between banker/underwriter and the household shareholder because the former may have superior information about the project performance.
- What happens when U banks have private information about project outcome?
- For example, if JP Morgan had risky loans with GM, they can try to inflate lemon shares of troubled GM to outside public who may be unaware of GM's situation.

- Our paper is a theoretical analysis of the impact of such conflict of interests originating from informational advantage of universal banks on the aggregate stock market performance.
- In particular, we analyze the effect of such conflict of interest on the pricing of stocks and the resulting market risk premium given that the rational financial market already expects that banks could sell lemon securities in the wake of bad news.
- We also examine how such additional risks of buying lemons influence (a) the composition of ownership claims between firms and banks (b) amount of deposits by households and (c) volume of loans disbursed by the universal banks to their client.

Key Results

- Absent information friction, universal banking leads to optimal outcome. Stocks are valued at fair prices. The risk premium is zero. A stand alone banking system (Glass-Steagall) fails to share risk efficiently.
- With information frictions,
  - presence of lemon stocks lowers the stock market price and results in a risk premium.
  - consumption risk rises and to mitigate this household undertakes more saving which means greater commercial banking activity
  - bank's extra income from selling lemon stock is channelled to greater loan pushing
  - aggregate investment and output falls in the presence of greater lemon stocks

Environment

- A continuum of identical agents in the unit interval who live only for two periods.
- At $t = 1$, a stand-in agent is endowed with y units of consumption goods, and she also owns a project requiring a physical investment of k units of capital in the current period which produces a random cash flow/output in the next period as follows:
- The production of output is subject to two types of shocks in the model: (i) a binary aggregate shock which is transmitted to intermediaries/agents via a probabilistic signal. A signal conveys news about the state which could be good (h) and bad (l) with probabilities σ_h and $1 - \sigma_h$ respectively.
- If the signal is h, then agents continue with their production plans. If it is l that triggers widespread liquidation of the current projects and the projects are liquidated at a near zero continuation value (m).
- If the signal is h, agents are subject to idiosyncratic risk. Some projects could still succeed with probability $1 - p$.

- To sum up the random output in next period has the following representation:
- $$\begin{aligned} &m \text{ with probability } 1-\sigma_h \\ &\theta_g g(k) \text{ with probability } \sigma_h p \\ &\theta_b g(k) \text{ with probability } \sigma_h (1-p) \end{aligned}$$

$$\text{where } \theta_g > \theta_b$$

Banks

- Competitive U bank offers a package to the household which includes, a loan size f, contingent payments $(d_i,\ i = g, b)$, In return, the household must put in a deposit (s) at the bank and undertake a physical investment (k) in the project.
- After writing such a contract and before the realization of the random shock, banks may experience liquidity shock (C) which necessitates banks to sell their ownerships claims $(\theta_i g(k) - R_i)$ to the public in a secondary market at a price q. Let n be the number of such securities.
- Let x and nx denote the states of liquidity shock and no such shock within probabilities γ and $1 - \gamma$.
- This interim period when the secondary market opens is dated as 1.5.

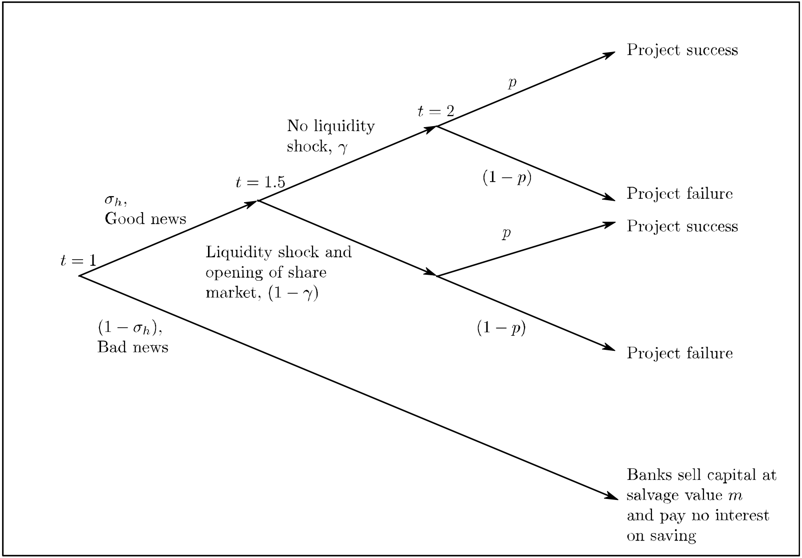

Fig 1: Timeline for Universal Banking

Role of Saving

- Saving performs two roles:
  - well known consumption smoothing
  - provides a buffer for speculative purchase of shares when banks sell shares in the secondary market.
- If there is no aggregate risk, saving deposit is a redundant asset because contingent claims will be enough to smooth consumption.

- Bank's Expected Profit

$$\begin{aligned}\pi^{bank} = \ & \sigma_h \gamma.[p\{\theta_g g(k) - d_g\} \\ & +(1-p).\{\theta_b g(k) - d_b\}] + \sigma_h (1-\gamma).(qn - C) \\ & +(1-\sigma_h)m - f.(1 + r\sigma_h)\end{aligned} \qquad (1)$$

- Hereafter, we assume that banks issue just enough shares to cover the liquidity crunch which means $n = C/q$.

- Household's state contingent consumptions

$$
\begin{aligned}
c_1 &= y + f - s - k & (2)\\
c_{2g}^{nx} &= d_g + s(1+r) & (3)\\
c_{2b}^{nx} &= d_b + s(1+r) & (4)\\
c_{2g}^{x} &= d_g + (s-z)(1+r) + \frac{z}{q}\left(\bar{\theta} g(K) - \bar{d}\right) & (5)\\
c_{2b}^{x} &= d_b + (s-z)(1+r) + \frac{z}{q}\left(\bar{\theta} g(K) - \bar{d}\right) & (6)\\
c_l &= s - z & (7)
\end{aligned}
$$

where $\bar{\theta} = p\theta_g + (1-p)\theta_b$, $\bar{d} = pd_g + (1-p)d_b$ and K = the average capital stock in the economy.

Optimal Contract Problem Facing the Household (Full Information Case)

- $$\begin{aligned} EU &= [u(c_1) + \sigma_h \gamma \{ p v(c_{2g}^{nx}) + (1-p) v(c_{2b}^{nx}) \} \\ &\quad + \sigma_h (1-\gamma) \{ p v(c_{2g}^{x}) + (1-p) v(c_{2b}^{x} \}] \\ &\quad + (1-\sigma_h) u(c_l) \end{aligned} \tag{8}$$

s.t. 2 through 7 and $\pi^{bank} \geq 0$.

Solution to the optimal contract

(i) Contingent Payments: $d_g = d_b = d$ (say) such that $\frac{\gamma u'(c_1)}{1+r\sigma_h} = v'(d + s(1+r))$

(ii) Share Price: $q = \frac{E\tilde{X}}{1+r}$ where $E\tilde{X} = \bar{\theta} g(K) - \bar{d}$.

(iii) Consumption: $c_{2g}^{nx} = c_{2b}^{nx} = c_{2g}^{x} = c_{2b}^{x} = d + s(1+r) > c_l = s$

(iv) Saving: $u'(c_1) = \left[\frac{(1-\sigma_h)(1+r\sigma_h)}{1-\gamma\sigma_h + r\sigma_h(1-\gamma)}\right] v'(s)$

(v) Investment: $\gamma\bar{\theta}\ g'(k) = \sigma_h^{-1} + r$ where $\bar{\theta} = p\theta_g + (1-p)\theta_b$ and

(vi) Loan: $f = \frac{\sigma_h\gamma(\bar{\theta} g(k) - d) + (1-\sigma_h)m + \sigma_h(1-\gamma)(qn - C)}{1+r\sigma_h}$

(vii) Consistency of Expectations: $k = K$

Discussion

- (i), (iv), (v) and (vi) together determine $\{d_i, s, k, f\}$ and the equation (ii) determines q, given an exogenous r.
- (i) and (ii) together state that conditional on realization of high signal, an agent receives a constant sum d across all states of nature. The risk neutral bank bears the whole idiosyncratic risks.
- Stocks have fair market value as seen in (ii) and the risk premium is thus zero.
- Although idiosyncratic risk is washed out in the high state h, in the low state individuals are still exposed to negative aggregate shock which explains the last inequality of (iii). The holding of deposit in the form of savings acts as an instrument to deal with this situation.
- If there is no aggregate risk, $\sigma_h = 1$, optimal saving is zero as seen from (iv).
- (v) states that the expected marginal productivity of investment equals the opportunity cost.

Case of Asymmetric Information

- The basic tenet of such informational asymmetry is that banks hold informational advantage (private information) about the realization of the aggregate business cycle as well the liquidity shocks.
- In other words, during the interim period (1.5) banks observe true realizations of both liquidity shocks (C) and an early signal (h, l) regarding the macro business cycle state but agents know only the distribution of liquidity shocks and the signals.
- Since interest payment on deposits take place at $t = 2$ and thus after the transaction in intermediate stock market, if the stock market opens at date 1.5, agents cannot ascertain whether the banks have received a low signal or simply suffered a liquidity shock.
- This gives rise to a typical lemon problem because universal banks with low signal (l) may sell the lemon equity in the borrowing firm to the public with a pretense that it has suffered a liquidity shock.
- Banks have an incentive to sell the lemon shares at an inflated price if they have this kind of private information.

- Think of the agent situated at the node $t = 1.5$. At this node, she only observes whether the stock market has opened or not. If the stock market does not open then she knows for sure (a) high signal has occurred and (b) no bank has suffered a liquidity shock. Of course, she could still either succeed or fail.
- Given that (a) and (b) happen with probability $\sigma_h \gamma$, the expected utility (up to this node) is:

$$\sigma_h \gamma [pv(d_g + s(1+r)) + (1-p)v(d_b + s(1+r))].$$

- Now if the equity market opens at the intermediate date 1.5 where a financial intermediary sells stocks, an agent concludes that either the bank has received a low signal (with a probability of $1 - \sigma_h$)) or the bank has received good news about the aggregate shock but it is still selling the stock because it has suffered a liquidity shock. The probability of such event is $\sigma_h(1-\gamma)$.
- Hence, an individual at the node in period 1.5 when she is observing someone selling the stocks will compute the probability $\left(\frac{\sigma_h(1-\gamma)}{\sigma_h(1-\gamma)+(1-\sigma_h)} = \frac{\sigma_h(1-\gamma)}{(1-\gamma\sigma_h)}\right)$ that the stock is not a lemon.

Optimal Contract Problem: Case of Asymmetric Information

$$\max_{\{d_g,d_b,s,z,l,k\}}[u(y+f-s-k)]+$$
$$\sigma_h\gamma[pv(d_g+s(1+r))+(1-p)v(d_b+s(1+r))]+$$
$$+(1-\gamma\sigma_h)\cdot\left(\frac{(\sigma_h(1-\gamma)}{(1-\gamma\sigma_h)}\right))[pv(d_g+(s-z)(1+r)\frac{z}{q}E\tilde{X})+$$
$$(1-p)v(d_b+(s-z)(1+r)+\frac{z}{q}E\tilde{X})]$$
$$+\ (1-\gamma\sigma_h)\left(\frac{(1-\sigma_h)}{(1-\gamma\sigma_h)}\right)v(s-z)$$

subject to

$$\pi^{bank}=\sigma_h\gamma\left[p\{\theta_g g(k)-d_g\}+(1-p)\{\theta_b g(k)-d_b\}\right]+$$
$$\sigma_h(1-\gamma)(qn-C)+(1-\sigma_h)(qn+m)-f(1+r\sigma_h)\geq 0$$

Two Observations

- The zero profit constraint now contains an additional term $(1 - \sigma_h)qn$ reflecting an extra income (expected) of the banks from trading of securities upon bad news.
- This happens because household does not observe whether bank has suffered a liquidity shock or the news is bad.
- This redistributive effect reflects the conflict of interests where banks can sell stocks upon bad news and households may make potential capital losses.

Proposition

The optimal contract under asymmetric information (suffix a) is:

(ia) Contingent Payments: $d_{ga} = d_{ba} = d_a$ (say) and

$$\frac{\gamma u'(c_1)}{1+r\sigma_h} = \gamma v'(c_{2a}^{nx}) + (1-\gamma)v'(c_{2a}^{x})$$

(iia) Share Price:

$$\frac{E\tilde{X}_a}{q} - (1+r) = \left(\frac{v'\{(s_a - z)\}}{v'\left\{ d_a + (s_a - z)(1+r) + \frac{z}{q} E\tilde{X} \right\}} \right) \frac{1-\sigma_h}{\sigma_h(1-\gamma)} > 0 \text{ where } E\tilde{X}_a$$

$$= \left(\frac{\bar{\theta} g(K) - \bar{d}_a}{n} \right)$$

(iiia) Consumption: $c_{2g}^{x} = c_{2b}^{x} > c_{2g}^{nx} = c_{2b}^{nx} > c_{la} = s_a - z$

(iva) Saving: $u'(c_{1a}) = \left[\frac{(1-\sigma_h)(1+r\sigma_h)}{1-\gamma\sigma_h + r\sigma_h(1-\gamma)} \right] v'(s_a - z)$

(va) Investment: $\gamma \bar{\theta} g'(k) = \sigma_h^{-1} + r$ *where* $\bar{\theta} = p\theta_h + (1-p)\theta_l$ *and*

(via) Loan: $f_a = \frac{\sigma_h \gamma(\bar{\theta} g(k) - \bar{d}_a) + (1-\sigma_h)qn + \sigma_h(1-\gamma)(qn - C)}{1+r\sigma_h}$

(viia) Consistency of Expectations: $k = K$

Comparison with Full Information Case

- Stocks are sold at a discount now and there is a positive risk premium which is higher when the probability of lemon is higher.
- Consumption smoothing across states x and nx is lost. Thus consumption volatility is higher in the a scenario.
- $d > d_a$, banks hold more expected cash flow because lemon claims can be sold off in a secondary market.
- $s < s_a$, households save more in a because of speculative trading in shares, greater commercial banking activity results.
- $f < f_a$: Greater loan pushing in a because banks have more cash flows.

Comparison with Glass-Steagall Banking

- Banks are not legally permitted to underwrite securities .
- Banks thus issue loans (f) to the household/entrepreneur and incur the same loan servicing cost as before.
- When banks suffer a liquidity shock C, banks instead of issuing securities in a secondary stock market, call off the loan and sell the capital at a salvage value m.
- Thus in this environment, in two states the bank liquidates the project early, namely low aggregate state, l and the liquidity shock state, s.
- Households trade in securities in a Lucasian fashion.

Banks

- Bank's zero expected profit condition is thus:
- $$E\pi = \gamma\sigma_h(p\phi_g + (1-p)\phi_b) + \\ (1-\sigma_h + \sigma_h(1-\gamma))m - \\ \sigma_h(1-\gamma)C - f.(1+r\sigma_h) \geq 0 \quad (9)$$
- First term: The bank receives payoffs ϕ_g and ϕ_b in good and bad projects only when the economy is in the high state with no liquidity shock.
- Second term: banks sell off the capital and do not pay interest in states l and s.
- Third term: the liquidity shock C hits the bank with the probability $\sigma_h(1-\gamma)$.
- The last term: banks pay interest with probability σ_h.

Households

- Household's flow budget constraints are, therefore:

$$
\begin{aligned}
c_1 &+ s + k + \xi q = y + q + f && (10)\\
c_{2g}^{nx} &= s(1+r) + \xi\theta_g g(k) - \phi_g && (11)\\
c_{2b}^{nx} &= s(1+r) + \xi\theta_b g(k) - \phi_b && (12)\\
c_2^s &= c_l = s && (13)
\end{aligned}
$$

Optimal Control Problem

- $Max \quad u(c_1) + \sigma_h \gamma [pv(c_{2g}^{nx}) + (1-p)v(c_{2b}^{nx}) + \sigma_h(1-\gamma)v(c_2^s) + (1-\sigma_h)v(c_l)$
- subject to (10) through (13) and (9).
- It is straightforward to check now that derivative of the maximand (**??**) with respect to the debt instruments ϕ_g and ϕ_b yields the following first order conditions:

$$\frac{u'(c_1)}{1 + r\sigma_h} = v'(c_{2g}^{ns}) = v(c_{2b}^{ns})$$

which means that $c_{2g}^{nx} = c_{2b}^{nx}$.

- Thus debt instruments can eliminate the idiosyncratic risks in a state of no liquidity shock.
- However, full consumption insurance is not possible because $c_{2g}^{ns} = c_{2b}^{ns} \neq s = c_2^s = c_l$.

- Thus Glass Steagall banking fails to achieve full consumption insurance even under full information.
- This is a first order failure of Glass-Steagall banking because financial markets are fundamentally incomplete due to insufficient number of financial instruments which makes full consumption insurance impossible.

Computation and Sensitivity Analysis

Table: Baseline Parameters

α	y	θ^l	θ^h	σ_h	γ	p	m	C	r
0.36	1.00	1.00	1.973	0.999	0.98	0.51	0.001	0.01	0.013

Table: Effect of a change in the probability of low signal state: fixed interest rate case

σ_h	RP (%)	q	$\frac{s}{y}$ (%)	$\frac{F}{y}$ (%)	$\frac{R}{y}$ (%)	$\frac{c_1}{y}$ (%)	$\frac{k}{y}$ (%)	$\triangle y\%$
0.999	6.76	0.36	4.19	7.34	64.28	67.08	36.05	-
0.990	54.43	0.36	25.03	31.90	47.11	71.31	35.55	-1.39
0.980	109.07	0.32	38.62	47.66	35.62	74.03	35.00	-2.95

Table: Effect of a change in the probability of aggregate state: the variable interest rate case

σ_h	r (%)	RP (%)	q	$\frac{F}{y}$ (%)	$\frac{R}{y}$ (%)	$\frac{c_1}{y}$ (%)	$\frac{k}{y}$ (%)	$\triangle y\%$
0.999	4.69	7.02	0.32	4.14	65.09	65.74	34.23	-
0.990	9.12	58.74	0.30	24.58	47.99	68.34	31.66	-2.79
0.980	12.43	121.09	0.26	38.45	35.28	70.17	29.83	-4.85

- A minute change in probability of crisis state $(1- \sigma_h)$ makes big difference in risk premium.
- Such a change makes the probability of lemon, $(1- \sigma_h)/(1-\gamma)\sigma_h$ change a lot.

Table: Effect of a change in the probabiliy of liquidity crisis: the variable interest rate case

γ	r (%)	RP (%)	q	$\frac{F}{y}$ (%)	$\frac{R}{y}$ (%)	$\frac{c_1}{y}$ (%)	$\frac{k}{y}$ (%)	$\triangle y\%$
0.98	4.69	7.02	0.32	4.14	65.09	65.74	34.23	-
0.97	3.61	5.16	0.33	3.12	65.83	65.74	34.25	0.00
0.96	2.66	4.23	0.33	2.61	66.17	65.80	34.19	-0.06
0.95	1.75	3.67	0.33	2.29	66.33	65.88	34.11	–0.15

Table: Effect of a change in p: fixed interest rate case

p	RP (%)	q	$\frac{s}{y}$ (%)	$\frac{F}{y}$ (%)	$\frac{R}{y}$ (%)	$\frac{c_1}{y}$ (%)	$\frac{k}{y}$ (%)	$\triangle y\%$
0.51	6.76	0.36	4.19	7.34	64.28	67.08	36.05	-
0.50	6.76	0.35	4.20	6.95	64.26	67.06	35.69	-1.01
0.49	6.76	0.34	4.19	6.57	64.24	67.04	34.32	-2.01
0.48	6.76	0.33	4.19	6.18	64.22	67.02	34.96	-3.02

Table: Effect of a change in p: the variable interest rate case

p	r (%)	RP (%)	q	$\frac{F}{y}$ (%)	$\frac{R}{y}$ (%)	$\frac{c_1}{y}$ (%)	$\frac{k}{y}$ (%)	$\triangle y\%$
0.51	4.69	7.02	0.32	4.14	65.09	65.74	34.23	-
0.50	4.28	6.99	0.32	4.15	64.98	65.89	34.11	-0.80
0.49	3.87	6.96	0.32	4.15	64.87	66.02	33.97	-1.59
0.48	3.47	6.93	0.31	4.15	64.75	66.17	33.83	-2.39

Conclusion

- The universal banking system has been subject to controversy, especially in the wake of current financial crisis. Does such a banking institution inflict excessive risks on the financial system? Should we return to Glass-Steagall?
- Our theoretical model predicts that discounting of stocks, volatilities in consumption and pushing of loans and excessive savings could emerge if hidden information is pervasive in the U banking system.
- The policy implication is that a stricter disclosure of regimes together with small taxes on trading of stocks can reduce the adverse impact of the universal banking and can improve the efficiency of the entire banking sector.
- Return to Glass-Steagall banking is not desirable because it has a first order failure to achieve consumption risk sharing.