Universal Banking, Asymmetric Information and the Stock Market

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ABSTRACT

The paper shows that attempts to sell stocks of borrowing firms by the universal banks upon private information result in: (i) discounting of stock prices, (ii) a higher fraction of ownership in the borrowing firm and a greater loan size, (iii) an increase in consumption risk and precautionary savings of households. Hence, the size of the commercial banking activity increases under asymmetric information at the expense of a higher consumption risk borne by the households. The magnitude of the resulting risk premium is shown to be highly sensitive to the probability of an aggregate negative shock perceived by the market.

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I. Introduction

A universal bank can sell insurance, hold equity in non financial firms and underwrite securities in addition to its commercial banking activities. The hallmark of universal banking is based on the premise that such a system could ensure household's intertemporal consumption smoothing when the bank undertakes depository acitivities while it could lead also to efficient risk sharing when it trades in securities. In recent times, such a financial institution has been a subject of heated debate. Regulators in the UK and the USA are contemplating to curb multifarious activities of these institutions, especially in areas where commercial banks enter the business of underwriting equities.[1] The current discussion partly mirrors the similar debate that took place in mid 90's prior to the repeal of Glass-Steagall Act.[2]

The aim of our paper is to demonstrate that the institution of universal banking works best in the absence of any information friction. When the banker/underwriter holds private information about the potential success or failure of the project in which the bank has an equity stake, it gives rise to a typical lemon problem in the stock market because the rational financial market already expects that banks could sell lemon securities in the wake of bad news. All stocks are sold at a discount which means the emergence of a positive market premium whose magnitude depends on the probability of a lemon. The macroeconomic effects of this information friction is that consumption volatility increases. To mitigate this consumption risk, households undertakes more saving. Banks make extra profit from selling lemon stocks which is channelled to greater loan pushing. Thus commercial banking activity booms while aggregate investment and output decline because of a higher risk adjusted market interest rate.

Our model provides a theoretical analysis of the effect of information asymmetry between bankers/underwriters of stocks and shareholders on the aggregate stock market risk premium. While there is an extensive literature that focuses on the quality of underwriting exclusively related to investment banking side, hardly any effort is directed to analyze how such conflict of

[1] The Financial Times (11th April, 2011) wrote "Global banking regulation took a step towards convergence after the Independent Commission on Banking proposed measures that will bring the UK's financial rules closer to the US. — The suggested changes are similar to regulations in the US, where banks are limited in the amount of deposits they can use for investment and commercial banking. The commission has recommended that large universal banking groups in Britain, should ringfence their retail banking operations in the UK, safeguarding depositors and essential payment services if other parts of the group run into trouble."

[2] See Benston (1990,1994), Barth et al. (2000), Krozner and Rajan (1994, 1997), Puri (1996), Gande et. al (1997) among many others who contributed to this lively debate.

interest impacts the aggregate stock market risk premium by altering the structure of financial contracts.[3]Our results provide insights about the current debate on the financial crisis whether the institution of universal banking in the USA via Gramm-Leach-Bliley Act of 1999 heightened risk in the financial markets. In particular, questions arise whether some opportunistic banks may dupe investors by selling "lemon securities" at an inflated price thus lowering the general confidence.[4]

We analyze the effect of informational asymmetry on the stock market by introducing two salient features in our simple two period model. First, we allow three kinds of shocks to hit the economy: (i) an aggregate shock that motivates household's precautionary savings decision, (ii) an idiosyncratic project shocks that allows banks and household/borrower to efficiently share risks, (iii) a negative liquidity shock exclusively experienced by universal banks. Second important feature of the model is a secondary stock market which opens before the resolution of the idiosyncratic shock only when banks are subject to a liquidity shock. Once hit by such a liquidity shock, banks may sell their claims to potential buyers in this secondary market. The presence of a secondary share market combined with banks suffering liquidity shock paves the way to accommodate conflict of interests between banks and share holders in the presence information asymmetry. After receiving bad news about a project, a universal bank may sell equities of the lemon borrowing firms to the uninformed household/shareholder with a pretense that it has suffered a liquidity crunch. The demand for such speculative stock purchase comes from the households who form an optimal portfolio of safe bank deposits and risky shares based on risk-return trade-off.[5]

[3] We focus on traditional banks engaged in the process of transforming riskier loans to relatively safer deposits, which also hold equity in the borrowing firms as an outcome of optimal risk sharing mechanism. On the other hand, the extant literature brings in either certification effects or economies of scope or transmission of information to outsiders as the salient features of universal bankingFor example, see Kanatas and Qi (1998, 2003) for the trade-off between economies of scope embedded within Universal banking versus deteriorations of quality of projects and innovations, Puri (1996, 1999) for the added role of certification of banks while underwriting debt securities versus conflicts of interests in equity holding, and Rajan (2002) for efficiency of universal banking related to competitiveness of the institutions. Our approach, on the other hand, is based on risk transforming role of financial intermediation placed in the framework of optimal financial contracts where banks issue less risky deposits to finance riskier loan by lending to large number of projects with uncorrelated risks. See, for example, Azariadis (1993, page 238-244), Bhattacharya and Thakor (1993) and Diamond (1984) and Gurley and Shaw (1960) for exposition of this view.

[4] The literature is divided about the efficacy of universal banking system. See Benston (1994) for an excellent survey. Colvin (2007) analyzes two banking case studies for the Dutch system and alludes to the failure of the universal banking environment.

[5] Our paper is thus closer in spirit to the recent analysis of conflict of interest in other areas of financial services industry rooted in the informational problems. See Mehran and Stultz (2007) (and other papers in the volume) for a comprehensive analysis of such conflicts pertinent to financial services industry originating from asymmetry of information.

Our simulation results show that in the presence of informational asymmetry, the stock market premium is extremely sensitive to investor's perception about the relative proportion of lemons in the stock market. This anticipation is very much governed by the probability of a negative aggregate shock to the economy. Even a minute increase in such a probability could have a major effect on the stock market premium and the real interest rate. On the other hand, changes in the probability of a liquidity crisis or project failure (which have idiosyncratic effects on banks and individuals) have little effects on the stock market and the aggregate economy.

Although our paper shows the inefficient functioning of the financial markets under universal banking in the presence of informational asymmetry, this does not necessarily imply that such an arrangement should be replaced by non universal banking where banks are barred from trading in securities. We show that non universal banking system fails to strike an efficient consumption risk sharing even under full information. The reason for this first order failure of the non universal banking environment under full information is due to regulations which prevent banks from sharing consumption risk by holding and trading securities in the wake of a liquidity shock. The policy implication of our paper is that a universal banking could work efficiently if there is full disclosure of negative information and/or a tax on trading to discourage sale of potential lemon sharesb y bank underwriters. This could lead to a near full risk sharing in consumption except for cases of aggregate risk.

The paper is organized as follows. The following section lays out the model and the environment. Section 3 solves a baseline model of universal banking with full information about the states of nature. Section 4 introduces the asymmetric information about the states and the consequent conflict of interest between banks and the stockholders. Section 5 reports the results from a simulation experiment based on our model. Section 6 concludes.

II. The Model

A. Households

We consider a simple intertemporal general equilibrium model in which there is 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. The production of output is subject to two types of binary shocks: (i) an aggregate shock, (ii) an idiosyncratic shock. The aggregate shock is transmitted to intermediaries/agents via a probabilistic signal. A signal conveys news about the state which could be high (h) and low (l) with probabilities σ_h and $1-\sigma_h$ respectively. A low signal (a recessionary state) triggers widespread liquidation of the current projects and the project is liquidated at a near zero continuation value (m).[6] If the signal is h, agents are still subject to *idiosyncratic* shock which manifests in terms of a project success with probability p and failure with probability $1-p$.[7]

To sum up, the random output in next period has the following representation:

m with probability $1-\sigma_h$

$\theta_g g(k)$ with probability $\sigma_h p$

$\theta_b g(k)$ with probability $\sigma_h(1-p)$

where $\theta_g > \theta_b$

B. Banks

Competitive universal banks offer a contract that stipulates (a) deposits (s) , (b) loans (f), and (c) contingent payments (d_i, $i = g, b$). After writing such a contract and before the realization of the random shock, banks may experience a liquidity shock (C) which necessitates banks to sell their ownerships claims ($\theta_i g(k) - d_i$) to the public in a secondary market at a price q.[8] Let n be the number of such securities. Let x and nx denote the states of liquidity shock and no such shock with probabilities γ and $1-\gamma$.This interim period when the secondary market opens

[6] This assumption is made in order to preserve a simple structure for analysis. Instead of assuming a fixed salvage value, we could have alternatively proceeded with a lower probability of success in individual projects in the event of a low aggregative signal and this would not change our results.

[7] Since this type of risk is distributed independently across infinite number of projects, the law of large number holds in an economy populated by continuum of agents so that p fraction of individuals is more successful than the rest. On the other hand, no such law holds for a low aggregate state.

[8] We only allow the banks to have a liquidity shock and exclude individuals to have similar problem because it makes the exposition simpler and also owing to the fact that the primary purpose of the paper is to investigate the consequence of banks' holding of tradable financial assets on the rest of the economy under both full information and asymmetric information. In particular, we show later how the private information gathered by banks regarding the aggregate state has both financial and real effects. In this scenario, allowing individuals to incur liquidity problems will add further noise in the financial market and will actually strengthen our results.

is dated as 1.5.[9]

At this interim date 1.5, the bank may also acquire an early signal about the aggregate shock. If the signal is high (h) with probability σ_h, the project's value upon continuation is greater than the same under liquidation. If the signal is low, it means that banks get early information that most of the projects will turn out to be a lemon with negligible value (close to zero m).[10]

At $t = 2$, uncertainties get resolved and all agents receive pay-off according to the contracts written at date $t = 0$, which, in turn, depends on (a) resolution of individual uncertainty and (b) occurrences of liquidity shocks of banks . The Figure 1 summarizes the time-line in terms of a flow chart.

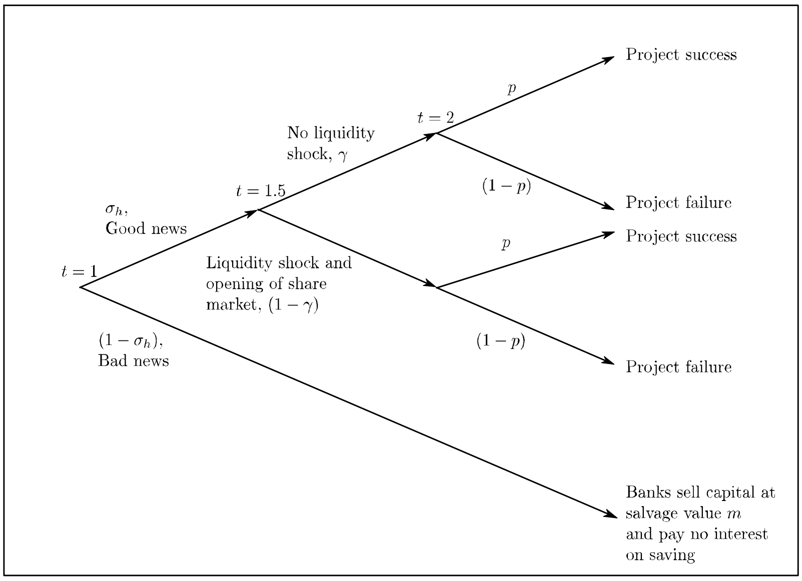

Figure 1 : Timeline for Universal Banking

A few comments are in order to justify the existence of multiple shocks in the model. The presence of idiosyncratic shocks to individual projects induce banks and individuals to allocate risk optimally among themselves. Banks divide ownership claims in the borrowing firms between themselves and the household/share holders which is a typical feature of universal banking. This division of ownership serves as a mechanism for risk sharing with the households. Second, the

[9]Under universal banking, banks or intermediaries can hold securities which are otherwise unrestricted and tradable compared with the system where banks can only hold debt securities which cannot easily be traded in the financial/debt market.

[10]The rationale behind such assumption is that since banks lend and monitor a large number of projects across the economy, they gather expertise to collect information relevant not only to a single project but can extract information about the overall economy better than the households. This is a standard function of banks who are also known as "informed lenders" (see Freixas and Rochet, 2008). However, the main difference between the universal and non universal banking is that the former can take its informational advantage by selling stocks to others before the bad event realizes while the latter cannot do such things because they are not allowed to hold equity in the borrowing firms.

introduction of liquidity shock by banks directly provides rationale for banks selling stocks to investors in the secondary market at date 1.5 when the bank could receive bad news about the project and sell such lemon stocks with a pretense of a liquidity shock. Finally, the aggregate shock also gives the rationale for households to hold claims in the form of bank deposits (i.e., its demand for deposits in addition to holding financial claims via optimal contracts). Household's saving also provides liquidity to the stock market when it opens at the intermediate date 1.5. Saving thus performs two roles: (i) consumption smoothing, (ii) liquidity for speculative purchase of shares.

The expected profit of the bank is thus:

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

We just note that the loan servicing cost is $r\sigma_h$ because banks do not pay any interest on savings in a low signal state which occurs with probability $1 - \sigma_h$. Hereafter, we assume that banks issue just enough shares to cover the liquidity crunch which means $n = C/q$.

C. Preferences

The utility function of each household/ borrower/depositor is additively separable in consumption at each date and is of the form:

$$U = u(c_1) + v(c_2) \tag{2}$$

where c_1= consumption in period i, $i = 1, 2$, $u(\cdot)$ and $v(\cdot)$ are: (a) three times continuously differentiable, (b) concave, and (c) have a convex marginal utility function. Hence, agents are risk-averse and in addition have a precautionary motive for savings.

Apart from the current period, in period 2 there are 5 possible states and the expected utility of an agent from consumption that occur in all such contingencies is given by:

$$\begin{aligned} EU &= [u(c_1) + \sigma_h\gamma\{pv(c_{2g}^{nx}) + (1-p)v(c_{2b}^{nx})\} \\ &\quad +\sigma_h(1-\gamma)\{pv(c_{2g}^{x}) + (1-p)v(c_{2b}^{x}\}] \\ &\quad +(1-\sigma_h)u(c_l) \end{aligned} \tag{3}$$

The superscripts x and nx stand for liquidity or no liquidity shock for banks[11] and the subscript $2g$ and $2b$ stand for good and bad project outcomes (idiosyncratic shocks) at date 2 with the good news about aggregate shock (subscript h) and the subscript l refers to the low aggregate state. The other notations are as follows:

- c_1 = consumption of the agent in the first period.
- c_{2j}^{nx} = consumption of the agent in the period 2 when the banks with high aggregate signal do *not* suffer liquidity shock (nx) and the individual state is $j = g$ or b , which means that cash flow is $\theta_j g(k)$.
- In a similar vein, c_{2j}^{x} = consumption of the agent in the period 2 when the banks with high signal suffer liquidity shock (x) and the individual state is j.
- c_l = consumption of the agent when the bank has received a low signal and face liquidation of the project.

The first term, $u(c_1)$ in (3) is the utility from current consumption. The term $\sigma_h\gamma\{pv(c_{2g}^{nx}) + (1-p)v(c_{2b}^{nx})\}$ is the probability weighted utility when the aggregate news is good but banks do not suffer liquidity shock. Similarly, the term $\sigma_h(1-\gamma)\{pv(c_{2g}^{x}) + (1-p)v(c_{2b}^{x})\}$ is the probability weighted utility in a good aggregate state when banks suffer liquidity shock. The final term $(1-\sigma_h)u(c_l)$, is the weighted utility in the bad aggregate state when banks do not pay interest to depositors.

[11] Although individuals do not suffer any liquidity shock, banks' state of liquidity matter to them because it determines the state whether they will participate in the stock market or not.

D. Budget Constraints

The budget constraint in period 1 and all five contingencies in period 2 are:

$$
\begin{aligned}
c_1 &= y + f - s - k && (4) \\
c_{2g}^{nx} &= d_g + s(1+r) && (5) \\
c_{2b}^{nx} &= d_b + s(1+r) && (6) \\
c_{2g}^{x} &= d_g + (s-z)(1+r) + \frac{z}{q}\left(\bar{\theta}g(K) - \bar{d}\right) && (7) \\
c_{2b}^{x} &= d_b + (s-z)(1+r) + \frac{z}{q}\left(\bar{\theta}g(K) - \bar{d}\right) && (8) \\
c_l &= s - z && (9)
\end{aligned}
$$

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.

The equation (4) is the first period budget constraint which states that consumption of an agent is equal to endowment y plus fund received from bank f less the money stored as deposit s and expenditure on capital good k. The equations (5) and (6) capture agents' consumption (equal to income) in the good and bad states of production respectively when banks do not suffer any liquidity shocks. In these states of nature, individuals do not participate in the stock market in the intermediate period. In such states, the agent's income consists of two parts: (i) the contingent payments d_i depending on the state of production, ($i = g, b$), (ii) the principal and the interest income on deposits $s(1+r)$.

Equations (7) and (8) are the state dependent budget constraints when banks encounter liquidity shock and the project can be a success (g) or failure (b). When the houshold member invests z in stocks at a unit price q, it entitles him a claim of $(\frac{z}{q}).(\bar{\theta}g(K) - \bar{d})$ units of goods when the bank sells a mutual fund to the household bundling good and bad shares. An atomistic bank while stipulating an optimal contract for an atomistic household take the average variables, K and $\bar{d}$ as given. However, in equilibrium these two average variables are determined by aggregate consistency conditions.

Equation (9) shows that when the bank receives a bad news (state l) about the economy, the project is liquidated and the banks receive the liquidation value as it has the first priority over claims. Recall that in such a low signal state (which is a state of macroeconomic shock), banks are unable to make full payment and only return the deposits s to the households.[12]

III. Universal Banking under Full Information

As a baseline case, we first lay out the equilibrium contract in a full information scenario. For a given interest rate r and stock price q, each bank offers a package to the household which includes (i) the loan size f, (ii) payments to the same household d_i contingent on realizations of idiosyncratic states. In return, the household must put in a deposit s at the same bank and undertake a physical investment k in the project.[13]

Such a package is stipulated by the bank that solves the expected utility of the household subject to the condition that these universal banks offering such competitive contracts satisfy the participation constraint which means that they must break even.

Hence, the optimization problem is to maximize the expected utility (3) subject to the budget constraints given by (4) through (9) and zero profit constraint of the intermediary, i.e.

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

Since there is full information, the agent exactly knows the node at which the bank operates. Thus at a low signal state agents know that a stock market will not open at date 1.5. This immediately means that $z = 0$ at this low signal state.

A. Interest rate

We assume here that the real interest rate, r is fixed by a policy rule. Any discrepancy between borrowing f and lending s is financed by a net inflow of foreign funds (call it NFI) from abroad at this targeted interest rate.[14]The appendix provides the details of the market clearing conditions.

Proposition 1: The competitive equilibrium contract has the following properties:

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

[12] Nothing fundamentally changes in our model if we assume instead that banks return only a fraction of savings in a low aggregate state.

[13] The contingent claims d_i are not traded in a market. These are stipulated by optimal contracts and that is why there is no price attached to each such contingent claim.

[14] This is a simplifying assumption that rules out the second order effect of the financial operations of banks and households on the real interest rate. This simplification is made to understand the behaviour of household saving and bank loans in the presence of information friction. In the next section where we undertake simulation, we allow the interest rate to vary to equilibrate the loan market.

(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: $k = K$

Proof: Appendix A.

Discussion: (i), (iv), (v) and (vi) together determine $\{d, s, K, f\ \}$ and the equation (ii) determines q, given an exogenous r. Stocks have fair market value as seen in (ii) and the risk premium is thus zero. The risk neutral bank bears the whole idiosyncratic risks which explains why the market risk premium is zero. (i) and (ii) together state that conditional on the realization of high signal, an agent receives a constant sum d across all states of nature. 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) which highlights the precautionary motive for savings. (v) states that the expected marginal productivity of investment equals the risk adjusted interest rate, $\sigma_h^{-1} + r$. The physical investment K is lower if the probability of low aggregate state is higher (lower σ_h). (vi) states the equilibrium loan size obtained from bank's zero profit condition. Finally, (vii) states the aggregate consistency condition that sum of all individual capital capital stocks equals the aggregate capital and over a unit interval.

The results in the proposition 1 serve to capture the basic functioning of the universal banking in the simplest possible full information framework. The universal banks optimally share project risks by offering a riskfree payment d and the residual $\theta_j g(k) - d$ is kept by the bank.[15] Without any conflicts of interest (asymmetric information), this is a Pareto optimal contract. It eliminates idiosyncratic uncertainties in household consumption and makes stock price trade at a fair market value.[16]

[15] This contract is equivalent to: (i) agents holding a preferred stock (or any other instrument that ensures a constant sum in all contingencies within good aggregate state), and (ii) banks owning ordinary stocks and thus bear all the residual risks. Thus, banks holding of equity, a hallmark of universal banking, emerges as a mechanism of an optimum allocation of risk.

[16] Although banks are holding the residual claim in each state but our conclusions are not sensitive to this

IV. Universal Banking under Asymmetric Information

Using the baseline model of full information described in the preceding section, we now turn to the case of asymmetric information. The basic tenet of such informational asymmetry is that banks hold private information about the realization of the aggregate business cycle as well the liquidity shocks.[17] In other words, banks observe true realizations of both liquidity shocks and the realization of the signal 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 $t = 2$ after the transaction in intermediate stock market, if the stock market opens at date 1.5, agents cannot ascertain whether banks have received a low signal or simply suffered a liquidity shock. This gives rise to a typical lemon problem because universal banks with a low realization of the signal may sell off the equity held by them in the borrowing firm with a pretense of the liquidity shock. This problem of selling lemon stocks can emerge only in the universal banking system as opposed to the non universal system where banks are barred to hold equity in the borrowing firms.

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 the latter event is $\sigma_h(1 - \gamma)$.

result. In an earlier version of the paper, we had introduced borrowers' moral hazard which leads banks to hold contingent claims that vary across good and bad states. We dropped the issue of borrowers' moral hazard in this version because it does not add new insights and our main results are also unchanged with this modification.

[17]The banks can observe the aggregate shock at least in a partial manner because they lend it to agents economy-wide and collect/collate information from each borrower. Hence, they tend to have economy-wide information while each agent is too small to acquire aggregate signal. However, bank's signal about aggregate and idiosyncratic shocks need not be perfect and could be even noisy. For the sake of parsimony, simplicity, and without compromising our results below, we ignore the noisiness of bank's signal about aggregate shock and their private information about individual projects.

Hence, an individual at the node at date 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.

The optimal contract problem can be thus written as:

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

subject to

$$\pi^{bank} = \sigma_h\gamma\left[p\{\theta_g g(k)-d_g\}+(1-p)\{\theta_b g(k)-d_b\}\right]+\sigma_h(1-\gamma)(qn-C)+(1-\sigma_h)(qn+m)-f(1+r\sigma_h) \geq 0 \tag{10}$$

There are two important features of this optimal contract problem which require clarification. First, while writing a contract with the bank, household/shareholder takes into account that banks can sell off stocks in the midway (at date 1.5) upon bad news and thus they may incur capital losses. Second, the zero profit constraint (10) now contains an additional term $(1-\sigma_h)qn$ which is the extra expected income of the banks from selling securities upon bad news.

Proposition 2: The equilibrium contract under asymmetric information has the following properties:

(ia) Contingent Payments: $d_{ga} = d_{ba} = d_a$ (say) and $\frac{\gamma u'(c_1)}{1+r\sigma_h} = \gamma v'(c^{nx}_{2a}) + (1-\gamma)v'(c^{x}_{2a})$

(iia) Share Price: $\frac{E\tilde{X}_a}{q} - (1+r) = \left(\frac{v'\{(s_a-z)\}}{v'\left\{d_a+(s_a-z)(1+r)+\frac{z}{q}E\tilde{X}\right\}}\right)\frac{1-\sigma_h}{\sigma_h(1-\gamma)} > 0$ where $E\tilde{X}_a$ $=\left(\frac{\bar{\theta}g(K)-\bar{d}_a}{n}\right)$

(iiia) Consumption: $c^x_{2g} = c^x_{2b} \equiv c^x_{2a} = d_a + s_a(1+r) + \left\{\frac{E\tilde{X}_a}{q} - (1+r)\right\}\cdot z > c^{nx}_{2g} = c^{nx}_{2b} = c^{nx}_{2a}$ $= d_a + s_a(1+r) > c_{la} = s_a - z$

(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: $k = K$

Proof: Appendix B.

Discussions: We denote the subscript a as the solution of the variables under asymmetric information. (ia) shares the same feature as (i). Idiosyncratic risks are again borne by the risk neutral bank and household receives a riskfree payment d_a for its ownership claim to the project. The major difference from the baseline full information setting appears in (iia). Since banks can potentially sell lemon securities in the midway at date 1.5, the optimal contract embeds this possibility. (iia) shows that stocks sell at a discount in the sense that the price is less than the discounted value of the cash flow. To put it alternatively, a positive market risk premium emerges in equilibrium to reflect this lemon problem.

The intuition for (iia) goes as follows. If a household spends one unit to buy stock from a bank, the marginal utility gain is:

$$v'\left\{d_a + (s-z)(1+r) + \frac{z}{q}EX\right\}\left\{\frac{E\tilde{X}}{q} - (1+r)\right\}$$

which happens with the probability, $\sigma_h(1-\gamma)$ that he buys stocks from a "good bank suffering from liquidity crisis." On the other hand, the marginal cost is that if the purchased stock is a lemon, then he loses out on his savings and consequent marginal utility loss is $v'\{(s-z)\}$ which happens with probability $(1-\sigma_h)$. The equivalence between the marginal gain and loss in investing in stocks explains that the stocks are selling at a discount (or equivalently the emergence of risk premium) as shown in the equation (iia). Everything else equal, the greater the ratio of $\frac{1-\sigma_h}{\sigma_h(1-\gamma)}$(relative proportion of lemon), the lower would be the price of the stock.

The immediate implication of stocks selling at a discount is captured in proposition (iiia) which shows that the consumption flows of households are smoothed out only partially when banks sell their ownership claims upon bad news. The consumption in the states where households participate in the stock market exceed the consumption in states where they do not. (iva) and (va) are the usual first order conditions for saving and investment. (via) shows the equilibrium loan size based on the zero profit constraint that binds at the optimum.[18]

Comparison with the full information baseline reveals that the stock market risk premium arises purely due to information friction. Since shareholders are unable to ascertain whether

[18] The description of overall equilibrium is omitted as they mirror conditions laid out in the appendix, except that the variables now refer to the asymmetric information case.

banks sell off shares due to liquidity shock or arrival of bad news, additional premium is required to lure households to buy shares. The emergence of a risk premium (or stocks selling at a discount) prevents the agents from smoothing out consumption across nx and x states. In sharp contrast, a full insurance across nx and x is possible under full information setting because agents are perfectly informed about the nodes at which banks sell stocks.

The sale of stocks at a discount expost, certainly changes the structure of contracts between banks and the borrowing households and affects investment and commercial banking directly. The following proposition makes it evident.

Proposition 3: (i) $d > d_a$, (ii) $s < s_a$, (iii) $f < f_a$.

Proof: Please see Appendix C

Since $s < s_a$ and $f < f_a$, the immediate implication is that the equilibrium loan size is higher under asymmetric information. From (iii) and (iiia), it follows that the spread between the expected consumption in the high and low aggregate signals under adverse selection is greater than under full information.

The intuitive reasonings of the above results are as follows. Since risk averse individuals undertake greater risks in the equity market than before due to possibilities of buying lemons, they are compensated by lower equity stake in production, implying $d > d_a$. The additional risks of losing their investment in the bad aggregate state makes marginal utility of households in that state even higher. This prompts households to make more deposits at the bank for precautionary purposes. Finally, the loan size increases because banks make more profit from both equity holding $(\bar{\theta}g(k) - \bar{d}_a)$ and trading shares $((1 - \sigma_h)qn)$,which lure more competitive banks to enter the commercial banking industry. The end result is that the size of the commercial banking activity in the form of loans and deposits expands under asymmetric information. On the other hand, this spurt in commercial banking activity also leads to the increased volatilities of household consumption.

A few comments are in order before concluding this section. When banks sell stocks upon news, there is a redistributive element where banks receive $(1 - \sigma_h)qn$ from households who loose $(1 - \sigma_h)z$ (in equilibrium, $qn = z$). The inefficiency is thus rooted in two elements: q is traded at a discount (proposition 2) and precautionary savings (s) (proposition 3) increase and both lead to loss of welfare manifested in greater consumption risk (proposition 2). Here, a tax on trading can partially ameliorate this welfare loss.[19]

The results in proposition 3 are established in the neighbourhood of full information equilibrium. In the next section, we perform a sensitivity analysis with the aid of a simulation experiment to check the robustness of these results.

V. An Illustrative Simulation

There are three levels of risk in our model: (i) an aggregate business cycle risk (σ_h) facing all agents, (ii) an aggregate liquidity risk γ facing all banks, and (iii) idiosyncratic project risk p facing only the household entrepreneurs. The aim of this section is to ascertain the quantitative effects of these three risks on the stock market and the economy based on our stylized model. We assume logarithmic utility functions which mean $u(c_1) = \ln c_1$ and $v(c_2) = \ln c_2$. The production function is assumed to be Cobb-Douglas, meaning $g(k) = k^\alpha$ with $0 < \alpha < 1$.

There are nine parameters in this stylized model, namely $y, \sigma_h, \gamma, p, \alpha$, θ_h, θ_l, C and m. The first period output y is normalized at unity with a view to to express relevant macroeconomic aggregates such as consumption c_1, saving s, and other relevant macroeconomic variables as a percent of the first period output (GDP). The average growth rate of the economy is then $\sigma_h \bar{\theta} k^\alpha + (1 - \sigma_h)m$, which can then be compared to the long run average growth rate of GDP. After fixing the capital share parameter α at its conventional value 0.36 and normalizing the low state total factor productivity (TFP) parameter, θ_l at unity, the high state TFP, θ_h is fixed to target a 3.5% long run average annual growth rate of GDP in the US during the same sample period 1960-2006.[20]

Among the three probability parameters, σ_h, γ, p , the probability of the high aggregate shock, σ_h is critical in determining the stock market discount. To see this clearly, set σ_h equal to unity which eliminates aggregate business cycle risk. It is straightforward to verify from (iv) of proposition 1 that saving, s is zero because in a riskfree aggregate state there is zero precautionary demand for saving. The stock market discount is also zero which can be easily verified from (iia) in proposition 2 by plugging a logarithmic utility specification. We fix σ_h to target a baseline 7% annual stock market discount based on the estimate of

[19] Though one has to note the deadweight losses due to taxes and the fact that it also penalizes the honest banks who sell upon liquidity. But a small tax can be welfare improving.

[20] In the context of our two period steady state model, the ratio of the second period to first period outputs approximates the long run average GDP growth rate.

Table 1: 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

Shiller.[21] The remaining two probability parameters γ, p, and the size of the liquidity shock C are fixed with a view to target a historical annual average the loan/GDP ratio of 5.47%, personal consumption/GDP ratio of 65% and a savings/GDP ratio of 5% during the pre financial crisis period 1960-2006.[22] The salvage value parameter m is fixed at a level very close to zero as per the analysis in the preceding section. In our baseline simulation, we treat the real interest rate r as exogenous. It is fixed at 1.31% which is computed by subtracting the 3-month T-bill rate (annualized) from the CPI rate of inflation. Table 1 reports the baseline parameters values used in the simulation.[23]

Table 2 reports the effect a change in the probability of a low signal state $(1-\ \sigma_h)$ on the stock market and the economy. The first row is the baseline case which is matched with the relevant historical average macroeconomic indicators.[24] Starting from a scenario of a near zero probability of a lemon state, a tiny (about one percent) increase in the probability of such a crisis state raises the premium by 48%. Household's precautionary saving propensity rises by 21% accompanied by a spurt in loan by 25%. The contingent payment d, however, declines significantly in response to a higher probability of a low signal state because banks have to generate enough cash flow to mitigate the liquidity shock and the low signal state. This means that banks hold a higher fraction of equity in their client firms.[25] This also explains why the stock price does not go down significantly even though stock market discount rises so sharply. All these results are in conformity with proposition 3.

The macroeconomic effects of a higher likelihood of a low signal state are lower investment and output. Consumption rate rises because households absorb the excess loan by consuming

[21] Note that in our context, the stock market discount is identical to the equity risk premium. For the period 1960-2006, the annual equity premium is also about 7% based on Robert Shiller's stock market database http://www.econ.yale.edu/~shiller/data.htm. This estimate is also in line with Mehra and Prescott (1985).

[22] The data for personal consumption, saving and real GDP and bank loans are collected from the Federal Reserve St. Louis database. It is difficult to find a good data counterpart for bank loans that comes closest to our model, F. We use the the commercial and industrial loans at all commercial banks which is likely to be an underestimate of the volume of loans issued by all universal banks.

[23] These baseline parameter values are chosen just to target some basic macroeconomic and financial aggregates. Given the stylized nature of this two period model, we do not aim to fully calibrate our model economy. The goal of this simulation is rather to illustrate the comparative statics effects of important parameters on the relevant financial aggregates. These comparative statics results are robust to alternative choice of parameter values.

[24] RP stands for the risk premium or the stock market discount which is close to the 7% estimate of Shiller. The baseline saving rate (s/y), bank loan rate (F/y), consumption rate (c_1/y) are also close to the targets.

[25] Note that bank's equity share is simply $\{1-(R/y)\}*100\%$.

Table 2: Effect of a change in the probability of low signal state: fixed interest rate case

σ_h	RP (%)	q	s/y (%)	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
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

more rather than investing.

The results of this simulation are based on a fixed interest rate assumption in the model. The excess demand for loanable funds as seen in Table 1 is assumed to be supported by the government by foreign borrowing from abroad. This is a convenient simplification and could be a good approximation for a small open economy. However, for a large economy like the U.S., this excess demand is bound to put upward pressure on the world real interest rate. In Table 2, we examine the robustness of our simulation results by allowing the real interest rate to vary. In this new scenario, the real interest rate equilibrates the loan market to ensure $s = f$. The interest rate rises to balance the shortfall of loanable funds. This lowers investment and intensifies the adverse output effect. All our key results continue to hold with greater force. The stock market discount, RP rises even more sharply in this scenario while loan pushing simultaneously occurs. The rise in the interest rate means greater discounting of stocks which explains why q falls more in this environment.

Table 3: Effect of a change in the probability of aggregate state: the variable interest rate case

σ_h	r (%)	RP (%)	q	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
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

The big effect of a very small probability of a low signal state on the financial market premium resembles the earlier results of Reitz (1988) and Barro (2009) who point out that the high risk premium could be due to the occurrence of a crisis state with a very small probability. However, Reitz and Barro did not explore the implications of this low crisis state when information frictions are present. The novelty of our results is that a minute such low signal probability could make the asymmetric information friction quite severe in the financial markets by heightening the stock market risk. This has adverse macroeconomic consequences because investment and output decline.

While a change in the probability of a crisis state has such negative effects, a change in the probability of a liquidity shock has very different effects. Tables 4 and 5 report the effects of a lower γ values from the baseline on the same aggregates. Given the same probability of the aggregate shocks, a higher probability of an adverse liquidity shock convinces investors that the shares sold in the stock market are less likely to be a lemon. This means a lower stock market discount. The urge for precautionary saving is also lower. On the other hand, banks loan less funds anticipating a greater likelihood of a liquidity shock. The aggregate output declines in a fixed interest economy due to less supply of intermediated capital. Since at a fixed interest rate, the reduction in loan outpaces the decrease in savings, in a flexible interest rate economy, the interest rate falls to equilibrate the loan market. The aggregate real effects on the economy (consumption, investment and output) are, however, negligible.

Table 4: Effect of a change in the probabiliy of liquidity crisis: fixed interest rate case

γ	RP (%)	q	s/y (%)	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
0.98	6.76	0.36	4.19	7.34	64.28	67.08	36.05	-
0.97	5.02	0.35	3.15	5.30	65.27	66.66	35.48	-0.57
0.96	4.16	0.35	2.62	3.88	65.83	66.35	34.91	-1.15
0.95	3.65	0.34	2.29	2.72	66.22	66.07	34.35	-1.72

Table 5: Effect of a change in the probabiliy of liquidity crisis: the variable interest rate case

γ	r (%)	RP (%)	q	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
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 6: Effect of a change in p: fixed interest rate case

p	RP (%)	q	s/y (%)	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
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

The same sensitivity analysis is performed by varying the probability of project success. The results are reported in Tables 6 and 7. In both cases, such a change has very little effect on the financial market premium and prices. In response to a higher project downside risk, banks

Table 7: Effect of a change in p: the variable interest rate case

p	r (%)	RP (%)	q	f/y (%)	d/y (%)	c_1/y (%)	k/y (%)	Output effect (%)
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

cut back loan while the saving hardly changes. This pushes interest rate downward. Since the expected project return $\bar{\theta}$ is lower, the capital stock falls.

The upshot of this simulation is that among the three risks mentioned here, the aggregate risk has the strongest effect on the stock market discount and the price. The effect of this aggregate risk is highly nonlinear in nature. A small change in the probability of a low signal state impacts the financial market hugely. Why does the low signal state have such a pronounced effect on the stock market while the other probabilities have such little effects? The intuition can be understood by recalling the first order condition (iia) in proposition 2 that shapes up the risk premium. Recall that the crucial component of the risk premium is the proportion of lemon, $(1-\sigma_h)/(1-\gamma)\sigma_h$. This proportion is extremely sensitive to a change in the probability of a low signal, σ_h. To see this, given the baseline value of $\gamma = 0.98$, if σ_h changes from 1 to 0.99, the proportion of lemons changes from zero to 0.5. Thus a 1% increase in the probability of a low signal state boosts the proportion of lemons by 50%. On the other hand, a comparable 1% change in the probability of adverse liquidity shock γ has insignificant effect on the proportion of lemons. Note also that the probability of the project success has no effect on the proportion of lemon and this explains why the risk premium is so insensitive to a change in p.

VI. Non Universal Banking

In this section, we describe the working of a non universal banking system as in the Glass-Steagall era where banks are legally mandated not to issue securities. We demonstrate that since banks cannot diversify away the liquidity shocks by trading securities, full consumption risk sharing fails even under full information.

Consider a Glass-Steagall banking environment where banks can only hold debt and do not issue securities while households issue securities to each other. Banks operate as a depository and loan institution. It issues loan (f) to the household/entrepreneur and incur the same loan servicing cost as before. The environment is the same as in the universal banking scenario except that banks cannot issue securities to mitigate the liquidity shock. As in the universal banking scenario, there is a state of aggregate liquidity shock where all banks suffer a liquidity shock C. However, unlike universal banking scenario, 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.

Bank's zero expected profit condition is thus:

$$E\pi = \gamma\sigma_h(p\phi_g + (1-p)\phi_b) - (1 - \sigma_h + \sigma_h(1-\gamma))m - \sigma_h(1-\gamma)C - f.(1 + r\sigma_h) \geq 0 \quad (11)$$

The expected profit of the bank reflects the following facts. First, the bank receives pay-offs ϕ_g and ϕ_b in good and bad projects only when the economy is in the high state with no liquidity shock. This explains the first term. Second, banks sell off the capital and do not pay interest in states l and s, which explains the second term. Third, the liquidity shock C hits the bank with the probability $\sigma_h(1-\gamma)$ which explains the third term. Finally, the last term captures the fact that banks pay interest with probability σ_h.

For the household, we assume that a stand-in household holds a fractional claim ξ to the value of the stock q at date 1 and issues out $(1-\xi)q$ to others. In equilibrium only a single stock is traded (which means $x = 1$). The rest of the institutional arrangement is the same as in the universal banking scenario.

Household's flow budget constraints are, therefore:

$$c_1 + s + k + \xi q = y + q + f \quad (12)$$

$$c_{2g}^{nx} = s(1+r) + \xi\theta_g g(k) - \phi_g \quad (13)$$

$$c_{2b}^{nx} = s(1+r) + \xi\theta_b g(k) - \phi_b \quad (14)$$

$$c_2^s = c_l = s \quad (15)$$

The optimal control problem is:

$$Max \quad u(c_1) + \sigma_h\gamma[pv(c_{2g}^{nx}) + (1-p)v(c_{2b}^{nx}) + \sigma_h(1-\gamma)v(c_2^s) + (1-\sigma_h)v(c_l) \quad (16)$$

subject to (12) through (15) and (11).

It is straightforward to check now that derivative of the maximand (16) 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 $c_{2g}^{ns} = c_{2b}^{ns} \neq s = c_2^s = c_l$.

The failure of full consumption under full information stands in sharp contrast with universal banking. In case of universal banking, the presence a secondary stock market mimics a complete market scenario and enables the household to strike consumption insurance through the efficient operation of the stock market. On the other hand, in a non universal banking, the financial markets are fundamentally incomplete due to insufficient number of financial instruments. This makes full consumption insurance impossible.[26]

VII. Conclusion

The univeersal banking system has been subject to controversy, especially in the wake of current financial crisis. The critics argue that such a system could inflict excessive risks on the financial system. In this paper, we attempt to evaluate the nature of such risks and the consequent impact on overall banking activities. While we find that discounting of stocks, volatilities in consumption and pushing of loans and excessive savings could emerge if hidden information is pervasive and the probability of bad aggregate shock is high, a non integrated system is nevertheless inefficient provider of allocation of idiosyncratic risks. 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.

[26] In a companion paper with borrower's moral hazard (Banerji and Basu, 2010), we arrive at similar conclusion.

Appendix

A. Equilibrium Conditions

In equilibrium, three conditions hold:

1. Each bank stipulates an optimal contract laid out in proposition 1 with each household taking the average capital stock, K and average contingent payments $\bar{d}$ as given.

2. Expectations are consistent which means $k = K$.

3. All markets clear which means:

- In the contingent claims market at date 1, each bank's state contingent shares are given by $\frac{\theta_g g(k)-d_g}{\theta_g g(k)}$ and $\frac{\theta_b g(k)-d_b}{\theta_b g(k)}$. while household's shares are given by $\frac{d_g}{\theta_g g(k)}$ and $\frac{d_b}{\theta_b g(k)}$

- In the secondary share market at date 1.5, the demand for shares equals the supply which means $z = C$.

- Goods markets clear at each date which mean

  - At date 1, $c_1 + k = y + NFI$

  - At date 2,

$$\sigma_h(p\theta_g + (1-p)\theta_b]g(k) + (1-\sigma_h)m - \sigma_h(1-\gamma)C(1+r) - NFI(1+r\sigma_h) = Ec_2 \equiv$$

$$\sigma_h\gamma[pc_{2g}^{nx} + (1-p)c_{2b}^{nx}] + \sigma_h(1-\gamma)[pc_{2g}^{x} + (1-p)c_{2b}^{x}] + (1-\sigma_h)c_l \quad (17)$$

The following remarks about market clearing conditions are in order: First the contingent claims d_i are not traded in a market. These are stipulated by optimal contracts and that is why there is no price attached to each such contingent claim. Second, the secondary shares are traded in a market that opens at date 1.5. The demand for such shares is z which is the amount a household agent apportions from her savings. The supply is the amount that banks issue consequent on a liquidity shock. We assume that given q, banks issue shares exactly worth the amount of the exogenous liquidity crunch C. This means that $qn = z = C$

Third, about the date 1 goods market clearing conditions, one needs to note that since interest rate is exogenous, the imbalance between saving (s) and loan (f) has to be financed by net foreign investment ($NFI \equiv f - s$) which explains the presence of the term NFI on the right hand side. Finally, the date 2 goods market clearing condition basically means that the right hand side term which is the consumption plus the foreign debt retirement aggregated across all individuals must balance the corresponding left hand side term which is the aggregate output net of the liquidity shock including the interest payment on it. Since this shock is exogenous, it appears like a tax on date 2 output. This explains the presence of the term $\sigma_h(1-\gamma)C(1+r)$ on the left hand side of (17).[27]

B. Proof of Proposition 1

Plugging consumption of individual agents in each contingency outlined above in the expected utility function, we get:

$$\begin{aligned} Max\ EU &= [u(y+f-s-k)] + \sigma_h\gamma[pv\{d_g + s(1+r)\} + (1-p)v\{d_b + s(1+r)\}] \\ &\quad + \sigma_h(1-\gamma)[pv\{d_g + (s-z)(1+r) + \frac{z}{q}\tilde{EX}\} + (1-p)v\{d_b + (s-z)(1+r) + \frac{z}{q}\tilde{EX}\}] \\ &\quad + (1-\sigma_h)v(s) \end{aligned}$$

subject to:

$$\pi^b = \sigma_h\gamma[p\{\theta_g g(k) - d_g\} + (1-p)\{\theta_b g(k) - d_b\}] + (1-\sigma_h)m - f.(1+r\sigma_h) = 0$$

First order conditions with respect to d_g,d_b,s,f,k and z respectively are :

$$d_g : \frac{\gamma u'(c_1)}{1+r\sigma_h} = \gamma v'(c_{2g}^{nx}) + (1-\gamma)v'(c_{2g}^{x}) \tag{A1}$$

$$d_b : \frac{\gamma u'(c_1)}{1+r\sigma_h} = \gamma v'(c_{2b}^{nx}) + (1-\gamma)v'(c_{2b}^{x}) \tag{A2}$$

[27] It is easy to verify that the Walras law holds here so that if all but one market clears, then adding all the budget constraints would ensure that the remainder market must clear as well. To see this, one can plug the budget constraints (4) through (9) and the zero profit condition ((vi) in Proposition 1 into the date 2 aggregate demand for good (Ec_2)and by using the secondary market equilibrium condition ($q^s n = C = Z$) in the resulting expression will verify that the market for goods at date 2 automatically clears.

$$s \quad : \quad \frac{u^{'}(c_1)}{1+r\sigma_h} = \gamma\sigma_h[pv^{'}(c_{2g}^{nx}) + (1-p)v^{'}(c_{2b}^{nx})] \qquad \text{(A3)}$$
$$+(1-\gamma)\sigma_h[pv^{'}(c_{2g}^{x}) + (1-p)v^{'}(c_{2b}^{x})](1+r) + (1-\sigma_h)v^{'}(c_l)$$

$$k : u'(c_1)[\sigma_h\gamma\overline{\theta}f^{'}(k) - (1+r)] = 0 \qquad \text{(A4)}$$

$$z : [pv^{'}(c_{2g}^{x}) + (1-p)v^{'}(c_{2b}^{x})](\frac{E\tilde{X}}{q} - (1+r)) \geq 0 \qquad \text{(A5)}$$

(i) We will show now that $d_h = d_l = d$.

Let us suppose that $d_h > d_l$. Let us make the adjustment such that d_h is reduced and d_l is increased so as to reduce the gap in such a way that the zero profit constraint is not affected, i.e. $[pd_h + (1-p)d_l]$ is constant. Hence, $[p(d_g - \Delta_1) + (1-p)(d_b + \Delta_2)]$ is a constant so that $(1-p)\Delta_2 = p\Delta_1$.

Now, evaluate the expected utility with small increments that satisfy the above equality.

$\Delta EU = \sigma_h[\gamma\{-pv^{'}(c_{2g}^{nx})\Delta_1 + (1-p)v^{'}(c_{2b}^{nx})\Delta_2\} + (1-\gamma)\{-pv^{'}(c_{2g}^{x})\Delta_1 + (1-p)v^{'}(c_{2b}^{x})\Delta_2\}]$

$\Rightarrow$

$$\Delta EU = \sigma_h[\gamma\{v^{'}(c_{2b}^{nx}) - v^{'}(c_{2g}^{nx})\} + (1-\gamma)\{v^{'}(c_{2b}^{x}) - v^{'}(c_{2g}^{x})\}](1-p)\Delta_2 > 0 \qquad \text{(A6)}$$

Since, $c_{2l}^{ns} < c_{2h}^{ns}$ it implies that $v^{'}(c_{2b}^{nx}) - v^{'}(c_{2g}^{nx}) > 0$ (due to concave utility function) and since $c_{2b}^{x} < c_{2g}^{x}$, $v^{'}(c_{2b}^{x}) - v^{'}(c_{2g}^{x}) > 0$ and $\Delta_2 > 0$ because d_b was increased.

Hence, adjustment can be made until $v^{'}(c_{2b}^{nx}) - v^{'}(c_{2g}^{nx}) = 0$ and $v^{'}(c_{2b}^{x}) - v^{'}(c_{2g}^{x}) = 0$. Hence, $c_{2b}^{nx} = c_{2g}^{nx}$ and $c_{2b}^{x} = c_{2g}^{x}$ which implies $d_g = d_b$.

One can start with the reverse inequality $d_g < d_b$ and make the opposite adjustments to reach this equality.

Proof of (ii) and (iii): From (A5), it follows that $(\frac{E\widetilde{X}}{q} - (1+r)) = 0$ and plugging the result in $c_{2g}^{x} = d_g + (s-z)(1+r) + \frac{z}{q}E\widetilde{X}$ and $c_{2b}^{x} = d_b + (s-z)(1+r) + \frac{z}{q}E\widetilde{X}$ and using the result from (i) that $d_g = d_b = d$ yields $c_{2g}^{nx} = c_{2b}^{nx} = c_{2g}^{x} = c_{2b}^{x} = c_2(say)$.

(iv): The equation (A3) can be written as

$$\frac{u'(c_1)}{1+r\sigma_h} = \sigma_h[p\{\gamma v^{'}(c_{2g}^{nx}) + (1-\gamma)v^{'}(c_{2g}^{nx})\} + (1-p)\{\gamma v^{'}(c_{2b}^{nx}) + (1-\gamma)v^{'}(c_{2b}^{x})\}](1+r) + (1-\sigma_h)v^{'}(c_l)$$

Plugging (A1) and (A2), $\frac{u^{'}(c_1)}{1+r\sigma_h} = \sigma_h\frac{u^{'}(c_1)(1+r)}{1+r\sigma_h} + (1-\sigma_h)v^{'}(c_l)$ and by rearrangement, we get:

$$u^{'}(c_1) = [\frac{(1-\sigma_h)(1+r\sigma_h)}{1-\gamma\sigma_h+\gamma\sigma_h(1-\gamma)}]v^{'}(s)$$

The proposition (v) follows from the straightforward differentiation with respect to k and the binding zero profit constraint of the intermediary together with (i) yields the last proposition.

C. Proof of Proposition 2

From (A6) in equation (3), it still follows that under optimality, the following conditions hold:

$\Delta EU = \sigma_h[\gamma\{v^{'}(c_{2b}^{nx}) - v^{'}(c_{2g}^{nx})\} + (1-\gamma)\{v^{'}(c_{2b}^{x}) - v^{'}(c_{2g}^{x})\}] = 0$, which of course, satisfies

$$v^{'}(c_{2b}^{nx}) - v^{'}(c_{2g}^{nx}) = 0$$

and

$$v^{'}(c_{2b}^{x}) - v^{'}(c_{2g}^{x}) = 0 \tag{B1}$$

On the other hand, the first order condition for z is:

$$v^{'}\{d_a + (s_a - z)(1+r) + \frac{z}{q_a}E\tilde{X}_a\}\{\frac{E\widetilde{X}}{q_a} - (1+r)\}\{\sigma_h(1-r)\} = v^{'}\{(s_a - z)\}(1-\sigma_h)$$

Since $v'(c_l) > 0 \Rightarrow \frac{E\widetilde{X_a}}{q_a} - (1+r) > 0 \Rightarrow c_{2g}^{x} > c_{2b}^{nx}$. Hence, (B1) can hold if

$$c_{2g}^{x} = c_{2b}^{x} > c_{2g}^{nx} = c_{2b}^{nx} \tag{B2}$$

The proposition (ia) follows from the above result and the two first order conditions with respect to $\{d_g, d_b\}$

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

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

The proposition (iia) follows directly from the first order with respect for z, which is,

$$v'\{d_a + (s_a - z)(1+r) + \frac{z}{q_a}E\tilde{X}_a\}\{\frac{E\widetilde{X}_a}{q_a} - (1+r)\}\{\sigma_h(1-\gamma)\} = v'\{(s_a - z)\}(1-\sigma_h)$$

The proposition (iiia) follows from (B2) and (ia).

The rest of the propositions can be shown exactly in the similar way as in the earlier section.

D. Proof of Proposition 3

All variables are evaluated at their full information values obtained in the proposition 1. This means that we start from a full information equilibrium with zero information friction. Thus at date 1, in the absence of information friction, $c_1 = c_{1a}$. Given the same r, it means that $k = k_a$. From the date 1 resource constraint (4), it follows that $f - s = f_a - s_a$. .

Starting from this scenario of no information friction, with the onset of information friction, z and the risk premium terms turn positive from 0. Given $c_1 = c_{1a}$, from proposition 1(iv) and proposition 2(iva) it follows that $v'(s) = v'(s_a - z)$ which means that $s < s_a$.

Next use the fact that $c_{2a}^x > c_{2a}^{nx}$ from proposition 2(iiia) together with the strict concavity of the utility function to observe that

$$v^{'}(c_{2a}^{nx}) > \gamma v^{'}(c_{2a}^{nx}) + (1-\gamma)v'(c_{2a}^{x})$$

Since our starting point is full information equilibrium, based on proposition1(i) the left hand side of the above inequality is $\frac{\gamma u'(c_1)}{1+r\sigma_h}$. Since $s < s_a$, to preserve the equality in the risk sharing condition proposition 2(ia), $d > d_a$.

Finally given the same k, and the fact that $d > d_a$, it follows from proposition 1(vi) and proposition 2(via) that $f < f_a$. //

References

[1] Azariadis, C. (1993). *Intertemporal Macroeconomics.* Oxford: Blackwell Publishers.

[2] Banerji, S. and P. Basu (2010). Universal banking and the equity risk premium. *Discussion Paper* (http://www.dur.ac.uk/parantap.basu/sanjay.pdf).

[3] Barro, R (2009), "Rare Disasters, Asset Prices and Welfare Costs," American Economic Review, 99(2), 243-264.

[4] Barth, J. R., R.D. Brumbaugh, and J.A. Wilcox (2000). The repeal of Glass-Steagall and the advent of broad banking. *Journal of Economic Perspectives 14*(2), 191–204.

[5] Benston, G.J. (1990). The Separation of Commercial and Investment Banking: The Glass-Steagall Act Reconsidered. New York: Oxford University Press.

[6] Benston, G.J. (1994). Universal banking. *Journal of Economic Perspectives 8*(3), 121-143.

[7] Benzoni, L. and C. Schenone (2010). Conflict of interest and certification in the U.S. IPO market. *Journal of Financial Intermediation 19*(2), 235-254.

[8] Ber, H., Y. Yafeha, and O. Yosha (2001). Conflict of interest in universal banking: Bank lending, stock underwriting, and fund management. *Journal of Monetary Economics 47*(1), 189-218.

[9] Bhattacharya, S., and A. V. Thakor (1993). Contemporary banking theory. *Journal of Financial Intermediation 3*(1), 2–50.

[10] Colvin, C.L. (2007). Universal banking failure? An analysis of the contrasting responses of the Amsterdamsche Bank and the Rotterdamsche Bankvereeniging to the Dutch financial crisis of the 1920s. *LSE Economic History Working Paper Series*, No. 98/07.

[11] Diamond, D. W. and Dybvig, P. H. (1983). Bank runs, deposit insurance and liquidity. *Journal of Political Economy 91*(3), 401-419.

[12] Diamond, D.W. (1984). Financial intermediation and delegated monitoring. *Review of Economic Studies 51*(3), 393–414.

[13] Duarte-Silva, T. (2010). The market for certification by external parties: Evidence from underwriting and banking relationships. *Journal of Financial Economics 98*(3), 568-582.

[14] The Financial Times (11th April, 2011). Proposals bring UK industry closer to US rules. Retrieved from http://www.ft.com/cms/s/0/fe2134a4-6484-11e0-a69a-00144feab49a.html.

[15] Freixas, Xavier and J.C. Rochet (2008). *Microeconomics of Banking*, 2nd edition. Massachusetts: MIT Press.

[16] Gande, A., M. Puri, A. Saunders, and I. Walter (1997). Bank underwriting of debt securities: Modern evidence. *Review of Financial Studies 10*(4), 1175-1202.

[17] Gurley and Shaw (1960). *Money in a Theory of Finance*. Washington: Brookings.

[18] Kanatas, G. and J. Qi (1998). Underwriting by commercial banks: Incentive conflicts, scope economies, and project quality. *Journal of Money, Credit, and Banking 30*(1), 119-133.

[19] Kanatas, G. and J. Qi (2003). Integration of lending and underwriting: Implications of scope economies. *Journal of Finance 58*(3), 1167-1191.

[20] Kang. J-K. and W-L. Liu (2007). Is universal banking justified? Evidence from bank underwriting of corporate bonds in Japan. *Journal of Financial Economics 84*(1), 142-186.

[21] Kroszner, R.S. and R.G. Rajan (1994). Is the Glass Steagall Act justified? A study of the U.S. experience with universal banking before 1933. *American Economic Review 84*(4), 810-832.

[22] Kroszner, R.S. and R.G. Rajan (1997). Organization structure and credibility: Evidence from commercial bank securities activities before the Glass-Steagall Act. *Journal of Monetary Economics 39*(4), 475-516.

[23] Mehra, R., and E.C. Prescott (1985). The equity premium: A puzzle. *Journal of Monetary Economics 15*(2), 145–161.

[24] Mehran, H. and R. Stulz (2007). The economics of conflicts of interest in financial institutions. *Journal of Financial Economics 85*(2), 267-296.

[25] Puri, M. (1996). Universal banks in investment banking: Conflict of interest or certification role?. *Journal of Financial Economics 40*(3), 373-401.

[26] Puri, M. (1999), Universal banks as underwriters: Implications for the going public process. *Journal of Financial Economics 54*(2), 133-163.

[27] Rajan, Raghuram (2002). An investigation into extending bank powers. *Journal of Emerging Market Finance 1*(2), 125-156.

[28] Reitz, T.R (1988), "The Equity Risk Premium: A Solution," Journal of Monetary Economics, XXII, pp. 117-131.