Borrower's Moral Hazard, Risk Premium, and Welfare: A Comparison of Universal and Stand-alone Banking Systems

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Abstract

Does the unification of retail and investment banking necessarily heighten risk in financial markets? Using a simple two period intertemporal model with borrower's moral hazard and uninsured risk, we argue that the integration in financial service markets under universal banking could give rise to a greater risk sharing arrangement. This could eliminate the stock market premium attributed to borrower's moral hazard. Absent any other frictions, we show that there is an unambiguous output and welfare gain from switching to a universal banking system from retail banking because of this efficient risk sharing. This welfare gain is higher in economies prone to greater information friction caused by borrower's moral hazard.

Key words:
Moral hazard, Information Friction, Risk Premium
JEL Classification Codes: G21, G12

1. Introduction

Following the great depression in the US, the Glass-Steagall Act of 1933 imposed a separation between investment banking and commercial banking activities. The former primarily deals with the activity of underwriting of securities while the latter engages in the business of taking deposits and making loans. Thus financial intermediaries could not participate in both equity and debt markets simultaneously. A series of financial reforms, beginning in the late eighties and culminating in the Gramm-Leach-Bliley Act of 1999 (referred as GLB Act hereafter), had put an end to this separation between commercial banking and investment banking, leading to a greater integration in financial services market.

In recent times, bank's multifarious activities under the umbrella of universal banking has been a subject of a heated debate. The 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] In light of the current debate about the financial crisis a natural question arises whether this financial integration heightened the risk in the financial markets emanating from moral hazard of borrowers?[2] The answer to this question requires a careful theoretical analysis of the relative performance of a fully integrated financial system with respect to a stand-alone system where both systems are vulnerable to the problem of moral hazard.

There are two distinct types of moral hazard in the context of banking system. The first type refers to borrower's moral hazard where a bank cannot observe efforts

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[1] The Financial Times (21th December, 2012) reported " In a 146-page assessment of the government's planned Vickers reforms, the 10-member panel endorses the central idea that "universal" banks should be made to erect a protective "ringfence" around their high-street banking activities........ The report also raises the prospect of a ban on proprietary trading – whereby banks trade securities for their own account – in line with the incoming Volcker rule in the US." In an earlier report (April 21st, 2011), the newspaper also discussed about "global convergence" of the policy makers views regarding separation of various segments of activities that fall under the purview of Universal Banking.

[2] A voluminous literature now exists explaining the anatomy of the US financial crisis. For a lucid exposition of the origin and progression of the US financial crisis, see Choi (2013).

chosen by the borrower. The second type of lender's moral hazard, known as risk shifting, is the selection of risky borrowers by banks unobserved by depositors.[3] In this paper, we exclusively focus on the first type. We analyze issues of risk sharing and the stock market premium (equity risk premium) in this context.[4]

We address the following questions in this paper: (a) does an integrated financial market exacerbate or mitigate risk emanating from moral hazard between borrowers and the financial institutions? In other words, which system (stand-alone or the universal banking) handles the issue of borrower's moral hazard better? (b) How is this risk priced in the equity issued by firms in each system? (c) What is the real effects of financial integration, which include investment, output and consumer welfare?

The primary issue under moral hazard is how to provide insurance to risk-averse agents without jeopardizing their incentives to work harder. This trade-off between risk-sharing and efficiency of effort is resolved via optimal financial contracts between borrowers and financial intermediaries. While both stand-alone and integrated (or universal) banking systems strike optimal contracts to resolve the twin problems of insurance and provision of effort, the latter has more instruments which are more effective in an environment with multiple financial markets such as equity and debt. The integrated system can also take into account the feedback effects between these two markets on the borrower's portfolio choice between debt, loan (savings) and equity and their consequent impact on the allocation decisions such as consumption, investment and work efforts.[5] Thus overall risk undertaken by risk-averse agents is smaller in magnitude in an integrated system. We argue that in the presence of borrower's moral hazard, the banking unification *per se* cannot heighten risk premium in financial markets. It will indeed give rise to an efficient risk sharing among

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[3]For a comprehensive treatment on this issue, see Freixas and Rochet (1997).

[4]Banerji and Basu (2012) explore the implications of lender's moral hazard issue emanating from asymmetric information.

[5]It is well known that integration between two branches of activities could generate diversification effects resulting in reduction of risk. What the extant literature does not focus is the interrelation between moral hazard, stock market risk and diversification which we do in this paper.

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lenders and borrowers and eliminate the risk premium caused by borrower's moral hazard.[6] In addition, such a financial integration enhances efficiency by decreasing the wedge between expected marginal productivity of capital and the risk free rate, which results in a rise in investment, output and welfare.

Although a large number of papers deal with the issue of universal banking just after passing of GLB act, very little work is done about the riskiness of universal banking vis-a-vis stand alone banking system which is the main focus of our paper. Boyd, Chang and Smith (1998) model moral hazard between banks vis-à-vis depositors and regulatory agency like FDIC. They show that banks' equity stakes in borrowing firm might make moral hazard problems severe. Our paper differs from Boyd et al. (1998) on several counts. First, in our model, information friction arises due to moral hazard of the borrower as opposed to costly state verification. Second, unlike them, deposit insurance is not an issue in our context. Instead, we focus on the conflict between incentives and risk sharing latent in financial contracts. In light of this conflict, we evaluate the riskiness of alternative banking systems.

In recent years, there are empirical papers appraising the riskiness of alternative banking systems for either Europe and US. Geyfman and Yeager (2009) found that there was some risk reductions under universal banking but it is not statistically significant. Lepitt et. al. (2009), found with a disaggregative analysis that risk shrank for relatively smaller banks due to increased fees in underwriting and investment banking activities. Demirgüç-Kunt and Huizinga (2010), on the other hand, found that while there was some reductions of risk at the lower level of non-deposit related activities, it rose after a certain level which gives rise to a U-shaped pattern of risks for the banks combining multiple activities. None of these papers explicitly focus on

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[6]For simplicity, we abstract from aggregate risk in this paper to demonstrate the inefficiency of the contracting arrangement in a stand-alone banking system. In the absence of aggregate risks, equity premium does not exist in a frictionless world. However, in the presence of information friction, financial intermediaries may not be able to write efficient contracts unless they have adequate number of instruments.. See Freixas and Rochet (1997) for a comprehensive study on the financial contracting and banking. We introduce information friction due to borrower's moral hazard under both regimes to examine its impact on prices of equity in a similar way dealt by Kahn (1990) and Kocherlakota (1998).

the relationship between stock market risk and borrower's moral hazard which is the main focus of our paper.

Our paper is a theoretical investigation whether universal banking can reduce stock market risk induced by borrower's moral hazard. We consider a scenario where borrowers are risk averse and risk neutral banks offer contracts to the risk averse agents with the goal to achieve efficient consumption risk sharing. In our model, the risk sharing under universal banking could be mimicked by a constrained social planning optimum. On the other hand, such efficient risk sharing is not possible in a non-integrated banking system due to the legal separation between retail and investment banking. To the best of our knowledge, our paper is the first paper which shows such equivalence between the risk sharing arrangement under universal banking and a constrained social planning optimum.

We also analyze the real effects of alternative banking arrangement on capital accumulation and output in a general equilibrium. We demonstrate that the investment and output are less in a stand-alone banking system compared to a universal banking system. This happens because in a stand-alone system, bankers do not control the borrower's trade in stocks as well as storage decision. An endogenous borrowing constraint stemming from the borrower's moral hazard thus restricts borrowing which gives rise to a spread between the expected marginal product and the real interest rate. The spread is driven by the stock market premium. A similar endogenous borrowing constraint also arises in a universal banking system but since the banker also stipulates the storage decision of the borrower in the contract, such a distortionary effect on capital accumulation is mitigated. Since consumption risk is efficiently shared under universal banking, there is an unambiguous welfare gain in switching from stand alone to the universal banking regime. This welfare gain is higher in economies which are more prone to the information friction induced by borrower's moral hazard. We demonstrate this formally by making explicit welfare comparisons using a parametric example based on our model.[7]

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[7]To the best of our knowledge, the only recent paper which analyzes the macroeconomic effects of retail and universal banking and makes a welfare comparison is Damjanovic, Damjanovic and

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We use a stylized two-period model without aggregate risk but only with idiosyncratic project risks and compare equity risk premium and the consequent impact on real allocation on capital under two alternative banking environments. In the first stand-alone banking system, a financial intermediary operates only in the domain of commercial banking (deposits and borrowing) but is prohibited from operating in equity markets by law. Loans and deposits are the only two contractual instruments available to the banker. In the second universal banking regime, the banker has several contractual instruments which stipulate the borrower's saving, loan, stock purchase and storage decisions. In both regimes, the only source of information friction is borrower's private information about his choice of efforts in production. In order to eliminate shirking under both regimes, financial intermediaries strike incentive compatible contracts, which partially insure individual consumption giving rise to an endogenous borrowing constraint.[8] Hence, the volatility of consumption across both states of nature is an outcome of the incentive constraint.[9] Yet, a positive equity risk premium emerges in an environment without aggregate risk where banks are not permitted to transact in the equity market. This premium disappears in a world of complete integration of financial services markets which is the hallmark of universal banking.

The paper is organized as follows: In the following section, we lay out the basic model. Section 3 develops the contracting environment of a stand-alone banking system. Section 4 does the same for a universal banking system. Section 5 works out a parametric example compares and contrasts the equity premia in two regimes

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Nolan (2012) in a DSGE framework. However, they do not address the effect of borrower's moral hazard on the stock market premium which is the central aim of our paper.

[8]In contrast with the extant literature dealing with borrowing constraint (Constantinides et al., 2002), our exercise highlights the role of the banking environment in explaining the size of the premium. Our model has a direct bearing on a growing body of literature exploring the link between asset market frictions and the premium. Such frictions tend to arise out of incomplete markets or borrowing constraints. Constantinides and Duffie (1996), and Heaton and Lucas (1996, 1997) looked for explanations for a high premium in terms of incomplete markets where individuals fail to insure their income in the presence of permanent shocks.

[9]In contrast with Constantinides et al. (2002), in our model such an incentive constraint makes the borrowing constraint endogenous.

as well as welfare. Section 6 concludes.

2. The Model

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 date 1, a stand-in agent is endowed with y units of consumption goods, and equity, which represents a claim to date 2 output. The value of this equity is Q, which is basically the date 1 value of date 2 output. This Q can be divided in shares. Suppose there are $\bar{x}$ such shares in supply. Out of these $\bar{x}$ shares, the agent keeps x and sells $\bar{x} - x$ at the spot price Q. The buying and selling of shares takes place in period 1. Since $\bar{x}$ is a constant, it can be normalized to unity. The representative agent's own share (x) gives him proceeds in the second period. The production technology together with the resolution of the state of nature outlined below determines his payoffs in period 2.

The agent invests k units of capital at date 1, which goes through a production process and results in output depending on the interaction between idiosyncratic risks and the agent's choice of effort. Individual's effort is a binary variable which takes a value equal to 0 for no effort and 1 for positive effort. If the agent exerts effort in period 1, then output will be $f(k)$ with probability p, and 0 with the complementary probability. This basically means that a fraction p of agents in the unit mass succeed while the remaining $1 - p$ fail. If they do not exert effort, output will be $f(k)$ and 0 with the corresponding probabilities q and $1 - q$ respectively where $p > q$. The disutility of effort is given by φ. The function $f(k)$ is increasing in k. All the risks in technology are idiosyncratic in nature. There is no aggregate risk.

There are competitive banks, which provide loans (l) to agents in the first period and charge a borrowing rate of interest. The intermediaries also accept a deposit (s) from individuals and offer a safe rate (r) to depositors. These loans are subject to default risk. If the project succeeds, the agent makes a repayment of (R) to the bank and if it fails he walks out paying nothing (due to limited liability). However, if project risks are independent and individuals are distributed in a continuum,

intermediaries can generate a safe rate of return (r) by invoking the law of large numbers.[10]

Household's budget constraints are thus given by

$$c_1 + s + k + xQ = y + Q + l \tag{1}$$

$$c_2^g = xf(k) - R + (1+r)s \text{ and } c_2^b = (1+r)s \tag{2}$$

where c_2^g = consumption in the second period if the project is successful, c_2^b =consumption in the second period when the project is unsuccessful, and s = individual's saving.

2.1. Preferences

The utility function facing each agent is additively separable in consumption at each date and is of the form:

$$u(c_1) + v(c_2) \tag{3}$$

where c_i= consumption in period i, $i = 1, 2$, $u(.)$and $v(.)$ are: (a) thrice continuously differentiable, (b) concave, and (c) have a convex marginal utility function. Hence, agents are risk-averse.

The expected utility of a representative agent given that he puts effort is:

$$U = u(c_1) + pv(c_2^g) + (1-p)v(c_2^b) - \varphi$$

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[10]The probability of all projects failing is close to zero because $(1\text{-p})^n$ approaches zero as the number of independent projects, n approaches infinity. By this, we assume no-bankruptcy for the banks. See Azariadis and Smith (1993) for a similar model of intermediation under adverse selection.

which, based on the budget constraints outlined in (1) and (2), can be rewritten as:

$$U = u(y + Q + l - s - k - xQ) + pv[xf(k) - R + (1 + r)s] + (1 - p)v[(1 + r)s] - \varphi \quad (4)$$

2.2. Information Friction and Partial Consumption Insurance

We now introduce informational frictions due to moral hazard in the spirit of Holmstrom (1979) as well as Kahn (1990) and Kocherlakota (1998). Throughout the paper, we assume that efforts exerted by individuals are unobserved by financial firms. The effort is value enhancing in the sense that it increases the probability of successful state from q to p, where $p > q$ but also extra effort is costly to individuals. Hence, financial contracts must incorporate enough incentives to elicit efforts from households. This requires household's net expected utility from expending efforts must exceed from the corresponding pay-off when they shirk. In other words, in order to alleviate the moral hazard problems, the relevant incentive constraint must satisfy the following condition:

$$u(y + Q + l - s - k - xQ) + pv(xf(k) - R + (1 + r)s) + (1 - p)v((1 + r)s) - \varphi \geq$$

$$u(y + Q + l - s - k - xQ) + qv(xf(k) - R + (1 + r)s) + (1 - q)v((1 + r)s)$$

which can be written more compactly as:

$$v(xf(k) - R + (1 + r)s) - v((1 + r)s) \geq \frac{\varphi}{p - q} \quad (5)$$

The interpretation of (5) is quite intuitive. It suggests that financial contracts must incorporate enough incentives such that household exerts effort. This constraint requires that the household's consumption is not perfectly smoothed out. It is well

known that full insurance of consumption would destroy individual incentive to exert higher levels of effort. This can be easily seen that the inequality (5) is violated if consumptions are equal in both states of nature. The intermediaries would thus issue a loan and charge a repayment such that consumption is only partially insured.[11] We will see later that this incentive constraint generates an endogenous borrowing constraint.

3. Stand-alone Banking System

We now consider a non-integrated contractual arrangement in which financial intermediaries accept deposits and lend money to firms but their participation in the equity market is prohibited by legislation. This type of environment mirrors a typical stand-alone banking system where retail banking is separated from investment banking. Think of households owning their own investment banking firms and issuing shares to each other. Shares are claims to capital stock owned by the households. Banks are typically retails banks which use R, l, s as their contracting instruments in dealing with the households/borrowers. Share trading (x) is kept outside the purview of the financial contract stipulated by the bank, which is a distinguishing feature of the stand-alone banking system. The capital accumulation decision (k) of the households is also not used as a contracting instrument because it is prohibitively expensive for the retails banks to monitor the investment decisions of the households. Since share purchase, x and the storage, k are outside the the contract space, households are free to choose x and k.

Given the limited liability constraint and assuming that agents have exerted efforts, bank's expected profit is:

$$E\pi = p[R - (1+r)l] + (1-p)[0 - (1+r)l] = pR - (1+r)l \qquad (6)$$

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[11]It is straightforward to verify that in the presence of full information about entrepreneurial effort, full consumption insurance takes place. All the idiosyncratic project risks will be transferred from the risk averse households to the risk neutral financial intermediaries. The banks pool the risk by redistributing consumption between the lucky and unlucky households in an actuarially fair fashion, meaning $c_2^g = c_2^b = pf(k)$.

If there is free entry and exit, then zero expected profit of the intermediaries implies:

$$pR - (1+r)l = 0 \tag{7}$$

The competitive banks design an optimal contract with households with respect to their deposits with the bank (s), loans they receive (l), repayment of loans (R). Such an optimal contract maximizes the household's expected utility subject to zero profit condition given by (7) and the incentive compatibility condition (5). The zero profit condition appears due to the assumption that numerous intermediaries compete with each other that drives expected profit to zero. In other words, the household faces a menu of choices for s, l and R which satisfy bank's zero profit condition.

The household now solves two distinct sets of problems: (i) as an equity holder and entrepreneur (choosing x and k), and (ii) as a borrower and depositor (choosing s, l, R) . This separating role emerges due to a contracting environment that segregates retail and investment banking. Regarding (i), since households own their respective investment banks, they trade in securities with each other and invest in physical capital that solves the optimization problem free from any incentive constraint stipulated by the retail banks.

To solve (i), the household takes s, l and R as parametrically given and maximizes (4) with respect to x and k only. This yields the following familiar Euler equations:

$$x : -u'(c_1)Q + pv'(c_2^g)f(k) = 0 \tag{8}$$

$$k : -u'(c_1) + pv'(c_2^g)xf'(k) = 0 \tag{9}$$

Regarding (ii), the retail bank stipulates the following optimal contract problem for

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the household:

$$Max_{\{l,s,R\}} U = u(y + Q + l - s - k - xQ) + pv(xf(k) - R$$
$$+(1 + r)s) + (1 - p)v((1 + r)s) - \varphi$$

subject to (7) and (5). Note that while solving this optimal contract problem, the retail banks treat k and x as parametrically given because these are outside the purview of their savings and loan contracts.

The problem can be rewritten in the form of the following Lagrangian:

$$L_{\max\{l,s\}} = u(y + Q + l - s - k - xQ) + pv(xf(k) + (1 + r)(s - \frac{l}{p}))$$
$$+(1 - p)v((1 + r)s) - \varphi$$

$$+\mu\{v(xf(k) + (1 + r)(s - \frac{l}{p})) - v((1 + r)s) - \frac{\varphi}{p - q}\} \tag{10}$$

where μ is the Lagrange multiplier associated with (5). The first-order conditions are:

$$s : -u'(c_1) + (1 + r)[\{pv'(c_2^g) + (1 - p)v'(c_2^b)\} + \mu\{v'(c_2^g) - v'(c_2^b)\}] = 0 \tag{11}$$

$$l : u'(c_1) - (1 + r)v'(c_2^g)[1 + \frac{\mu}{p}] = 0 \tag{12}$$

Although household's two problems (i) investment banking and (ii) retail banking look seemingly separate, they are interdependent. The amount of shares transacted and the storage by households affect the incentive constraint (5), and thus it has

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an impact on the optimal contract problem (10). On the other hand, terms of contracts, given by (s, l, R), affect marginal utility of the household member and thus influence household's decisions to buy shares. This interdependence between the optimal contracting problems in credit market and the maximization problem of the household in equity market can be resolved by invoking a Nash equilibrium, in which all these variables are determined simultaneously which we describe now.

3.1. Characterization of Equilibrium

D1. Given r, s, Q, l, R, the household chooses the share holding x, and storage k which maximizes its expected utility (4) subject to the bank's zero profit condition (7).

D2. Given r, Q, k and x, competitive retail banks offer a menu of contracts, s, l, R which maximize household's expected utility (4) subject to the bank's zero profit condition (7) and incentive compatibility condition (4).

D3. The share and loan markets clear meaning $x = 1$ and $s = l$.[12]

Proposition 1. *The households are credit constrained and risks are uninsured so that*

$$c_2^g > c_2^b$$

Proof. Appendix. ■

The incentive compatibility constraint deters full consumption insurance and leading to endogenous variations in consumption across good and bad states of nature. The financial intermediaries create such wedge by rationing the size of the loan.

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[12]While D1 and D2 capture micro economics of optimal contracting between households and financial intermediaries, D3 illustrates the general equilibrium component of the model. For similar approach towards financial contracting and general equilibrium, under adverse selection (as opposed to moral hazard here) see Azariadis and Smith (1993).

The household would always wish that they could save and borrow more. The incentive compatibility constraint is thus imposing an endogenous borrowing constraint on individuals.[13]

3.2. Equity Risk Premium

Denote the proportional equity risk premium in this non-integrated contract economy as EP^{NI} which , by definition, is equal to the ratio of the expected gross return to equity given by $\dfrac{pf(k)}{Q}$ and the (gross) risk-free interest rate, which is $(1+r)$. If the ratio exceeds unity, then the return on equity generates a premium over the safe saving deposits and if the ratio equals unity, then there is no risk premium. We have the following proposition.

Proposition 2. $EP^{NI} > 1$

Proof. Appendix. ∎

The equity risk premium in a stand-alone banking system with non-integrated financial markets is positive. It is determined by the shadow price (μ) of the incentive constraint. Households while participating in the stock market bear a greater uninsurable consumption risk than when they participate in the loan market. This is because the loan market transactions are under the purview of the optimal contract while the stock market transactions are not. The Lagrange multiplier, which is basically the shadow price of incentive compatibility constraint, drives a wedge between the perceived intertemporal marginal rate of substitution (IMRS) of the consumer/shareholders and consumer/depositors.[14]

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[13]The endogenous borrowing constraint arises due to the asymmetric information between the borrowers and lenders. Lenders cannot observe the effort of the borrower/entrepreneur. The severity of asymmetric information can affect borrower's access to finance. Monsour (2014) explores this empirically for the Gulf Cooperation Council (GCC) regions.

[14]One may as well interpret this stand-alone banking system as a scenario where the market is not complete. In an incomplete market environment typically the stochastic discount factor is not unique (see, Cochrane, 2001, p. 68 for a formal discussion). This might explain why the perceived IMRS of stocks holders differs from that of the depositors to support the same real allocation.

3.3. Real Effects of a Stand-alone Banking System

Since agents choose capital stock on their own, they do not internalize the incentive constraints in their capital accumulation decision. Hence, there is a gap between interest rate and the expected marginal product of capital, implying that capital is costlier than the risk free rate. The cost is determined by the shadow price (μ) of the incentive constraint which leads to underaccumulation of capital in a stand alone banking system. This can be easily checked from (9) and (12) by setting the stock market equilibrium condition $x = 1$. We have:

$$pf'(k) = (1+r)(1+\frac{\mu}{p}) > 1 + r \tag{13}$$

The endogenous credit constraint thus drives a wedge between interest rate and the expected marginal product of capital. The spread is determined by the stock market premium. This results in an underaccumulation of capital in comparison with the universal banking benchmark set forth next. We will see later that this underaccumulation of capital is at the very root of the lower welfare in a stand-alone banking system vis-a-vis universal banking arrangement.

4. Universal Banking

The essence of universal banking is that financial intermediary holds an equity position in the project of the households. This is in sharp contrast with the stand-alone banking scenario where households only hold equity positions to each other's projects and financial intermediaries specialize in savings and loan activities. Thus, the financial intermediaries in a universal banking scenario have unrestricted access to all markets. This is why we alternatively call this arrangement an integrated financial services market. Each intermediary can stipulate the number of shares to be purchased by the borrower/shareholder as well as determining its own equity position.[15] The universal banks, however, encounter the moral hazard of the borrowing

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[15] We will see later that the division of equity between the banks and the households is irrelevant in determining the real allocation.

firm exactly similar to the case discussed in the previous sub-section.

The budget constraints of the household in a universal banking scenario is thus:

$$c_1 + s + k + x^h Q = y + (1 - x^b)Q + l \tag{14}$$

$$c_2^g = x^h f(k) - R + (1 + r)s \text{ and } c_2^b = (1 + r)s \tag{15}$$

where x^h =household/entrepreneur's share to the tree Q and x^b =banker's share to the tree Q. If the project succeeds the profit of the bank is:

$$\pi^g = x^b f(k) + R - (1 + r)l \tag{16}$$

If the project fails, the profit is:

$$\pi^b = -(1 + r)l \tag{17}$$

The expected profit of the bank is:

$$E(\pi) = pR - (1 + r)l + px^b f(k) = 0 \tag{18}$$

which is zero in a free entry competitive equilibrium.

Given Q and r, the universal bank thus solves an optimal contract problem for the household as follows:

$$Max_{\{l,s,k,R,x^h,x^b\}} U = u(y + Q(1 - x^b) + l - s - k - x^h Q)$$
$$+ pv(x^h f(k) - R + (1 + r)s) + (1 - p)v((1 + r)s) - \varphi$$

subject to the zero profit condition:

$$pR - (1 + r)l + px^b f(k) = 0 \tag{19}$$

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and the incentive compatibility condition :

$$v(x^h f(k) - R + (1+r)s) - v((1+r)s) \geq \frac{\varphi}{p-q} \tag{20}$$

which can be rewritten after substituting out R using the zero profit condition:

$$L_{\max\{l,s,k,x^h,x^b\}} = u(y + Q + l - s - k - (x^h + x^b)Q)$$

$$+pv((x^h + x^b)f(k) + (1+r)(s - \frac{l}{p})) + (1-p)v((1+r)s) - \varphi$$

$$+\mu[v((x^h + x^b)f(k) + (1+r)(s - \frac{l}{p})) - v((1+r)s) - \frac{\varphi}{p-q}]$$

First-order conditions are:

$$s : -u'(c_1) + (1+r)[\{pv'(c_2^g) + (1-p)v'(c_2^b)\} + \mu\{v'(c_2^g) - v'(c_2^b)\}] = 0 \tag{21}$$

$$l : u'(c_1) - (1+r)v'(c_2^g)[1 + \frac{\mu}{p}] = 0 \tag{22}$$

$$k : -u'(c_1) + v'(c_2^g)(x^h + x^b)pf'(k)[1 + \frac{\mu}{p}] = 0 \tag{23}$$

$$x^h, x^b : -u'(c_1)Q + pv'(c_2^g)f(k)[1 + \frac{\mu}{p}] = 0 \tag{24}$$

Substituting out μ the following first order conditions are obtained:

$$x^h, x^b : \quad \frac{1}{u'(y-k)} = \frac{Q}{pf(k)} \left[\frac{p}{v'(c_2^g)} + \frac{1-p}{v'(c_2^b)} \right] \tag{25}$$

$$l : \quad \frac{1}{u'(y-k)} = \frac{1}{1+r} \left[\frac{p}{v'(c_2^g)} + \frac{1-p}{v'(c_2^b)} \right] \tag{26}$$

$$k : \quad \frac{1}{u'(c_1)} = \frac{1}{pf'(k)} \left[\frac{p}{v'(c_2^g)} + \frac{1-p}{v'(c_2^b)} \right] \tag{27}$$

Note that the first order conditions do not depend on the division of equity (x^h, x^b) between banks and the households which resembles Modigliani-Miller neutrality result. This irrelevance of capital structure is due to the fact that banks act like a social planner in allocating resources to maximize household's expected utility and thus how the ownership claim is shared between banks and households has no real effects. This point will be made clear in proposition 4 later.

4.1. Characterization of Equilibrium

C1. Given r, Q, the universal banker chooses l, s, R, x^h and x^b optimally which satisfy the above first order conditions.

C2. Loan and Equity markets clear meaning $s = l$ and $x^h + x^b = 1$.

From these first-order conditions, we immediately deduce the following proposition.

Proposition 3. *The price of equity is:* $Q = \frac{pf(k)}{1+r}$ *and the equity premium is zero.*

The proof directly follows from (22) and (24). The zero equity risk premium results from the fact that there is no aggregate risk in this model. All the idiosyncratic individual risks are properly contracted. The presence of borrowing constraints and uninsurable risk, *per se*, thus cannot explain the existence of equity premium, as long as all project risks are contracted in advance. A social planner can as well allocate the consumption risk for an economy like this. In fact, the financial intermediary in this universal banking arrangement reproduces the outcome of a social planning

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problem so that the resulting outcome is constrained Pareto efficient. The following proposition makes it evident.

Proposition 4. *The following social planning problem is isomorphic to the present optimal contract environment.*

$$Max \quad u(c_1) + pv(c_2^g) + (1-p)v(c_2^b) \qquad \text{((P))}$$

$$\text{s.t.} \quad c_1 + k = y \qquad (28)$$

$$pc_2^g + (1-p)c_2^b = pf(k) \qquad (29)$$

and

$$v(c_2^g) - v(c_2^b) \geq \frac{\varphi}{p-q}$$

Proof: Appendix.

5. A Parametric Example

In this section, we present a parametric example to gain further insight into the macro financial effects of information friction caused by borrower's moral hazard. Assume the following parametric specifications of the utility and production functions:

$$U = \ln c_1 + p \ln c_2^g + (1-p) \ln c_2^b - \varphi \qquad (30)$$

and

$$f(k) = ak. \qquad (31)$$

where a is a positive total factor productivity (TFP) term. Using this specification, we get the following closed form solution for the proportional equity premium EP^{NI}. The appendix provides an outline of the derivation.

$$EP^{NI} = \frac{\lambda}{1 + p(\lambda - 1)} \qquad (32)$$

where

$$\lambda = \exp\left(\frac{\psi}{p - q}\right) \qquad (33)$$

and the capital stock is given by:

$$k^{NI} = \left[\frac{1 + p(\lambda - 1)}{1 + p(\lambda - 1) + \lambda}\right] y \qquad (34)$$

The Lagrange multiplier is directly proportional to the ratio of consumption in good and bad states which keeps the household just indifferent between shirking and not shirking. In the context of the logarithmic utility function, this ratio is positively related to the disutility of effort ψ . The higher the disutility of effort ψ, the greater the value of λ. Thus λ is a measure of *informational friction*. Note that a higher informational friction raises the uninsurable risk for all the households. Since the household, while participating in the share market, bears even a greater uninsurable consumption risk, the equity risk premium is monotonically increasing in the informational friction parameter λ. When ψ is zero, λ equals unity, in which case the equity risk premium vanishes due to the absence of informational friction. The greater the λ, the larger the output loss and higher the premium.

A similar calculation for the log utility function shows that the capital stock (k^I) under universal banking is:

$$k^I = \frac{y}{2} > k^{NI} \qquad (35)$$

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Comparing (35) with (34), it easy to verify that $k^I > k^{NI}$ because $\lambda > 1$. There is underaccumulation of capital in a non-integrated banking system compared to universal banking system. The universal banking system enhances productive efficiency and also reduces risks. This is consistent with our earlier results.

5.1. Welfare comparison of two banking systems

We are now ready to make a formal consumer welfare comparison of these two banking arrangements. We stick to the above log utility specification which enable us to get closed form solutions for decision rules. Define household's expected utility under the universal banking system with integrated financial markets as W_u and the corresponding expected utility in a stand-alone banking system as W_s. We have the following proposition.

Proposition 5. $W_u > W_s$

Proof: Appendix.

The social welfare under universal banking system is unambiguously higher than in the stand alone arrangement. This is not surprising because we have shown earlier that there is underaccumulation of capital in a stand-alone banking system compared to the universal banking system. In addition, the consumption under universal banking can be supported by a constrained social planning problem.

Figure 1 plots the welfare differential $(W_u - W_s)$ between universal banking and the stand alone banking systems for a range of values for the information friction parameter λ. The idiosyncratic probability of project success p is fixed at 0.5. There is greater welfare gain from a switch to the universal banking regime in economies where the information friction is higher. [16]

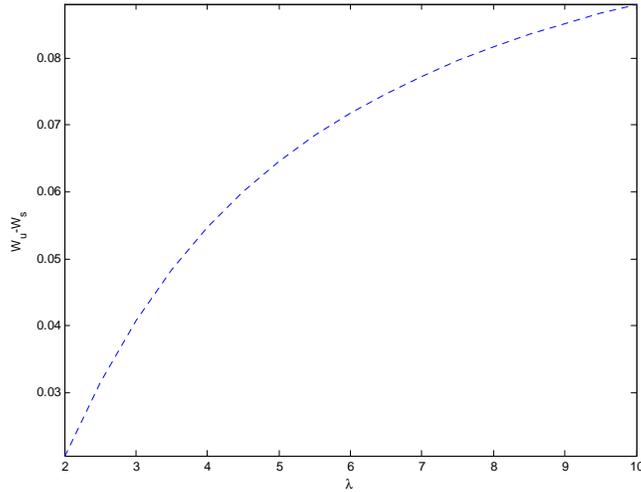[16]This monotonicity property is robust to alternative choices of p.

Fig 1: Welfare gain from a switch to the universal banking system for alternative λ values

6. Conclusion

The unification of commercial and investment banking in the United States is often attributed to the heightened financial risk in the context of present financial crisis. In this paper, we argue that if financial contracts are efficiently designed, such a unification in fact might lead to better risk sharing and thus a lower stock market premium. In reality, investment banks perform far more complex tasks than what we consider in this paper. They involve underwriting of wide class of securities, including stocks, bonds and options, repurchase of shares and pricing of IPOs. Complexities of financial contracts partly depend on the degree of informational asymmetry between banks and the firms. Instead of going into such details, which are specific to individual cases, we discuss the ability of a bank to intervene simultaneously in debt and equity markets.

Our model does not necessarily imply that the universal banking should replace the stand-alone banking system. The lesson from this stylized model is that the policy maker should analyze carefully the source of information friction in the banking

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system before implementing a banking reform. If borrower's moral hazard is the pre-dominant source of information friction, perhaps a proper financial contract within the purview of universal banking system could promote economic efficiency. Our model only restricts attention to moral hazard between borrowing firms and banks. It abstracts from a second type of informational friction which emanates from the selection of borrowers by banks unobserved by depositors. Banerji and Basu (2012) argue that efficient risk sharing may not be possible in such an environment due to conflict of interest between banks and shareholders. Future extension of our work would be to evaluate alternative banking systems when both types of information frictions are present. It may be also worthwhile to extend our model to dynamic setting with repeated moral hazard.

A. Appendix

Proof of Proposition 1: It can be shown that incentive constraint binds with equality, which means $\mu > 0$ (see, also the proof of proposition 2 below to see why $\mu > 0$). Hence, from the constraint it follows immediately that $\hat{c}_2^g > c_2^b$. We can verify now from (12) that

$$u'(c_1) - (1+r)v'(c_2^g) > 0 \tag{A.1}$$

implying that individuals would be better-off with additional borrowing.   (End of proof)

Proof of Proposition 2: Define the proportional equity premium as:

$$EP^{NI} = \frac{pf(k)}{Q(1+r)} \tag{A.2}$$

Using (8) and (12), we get:

$$Q = \frac{pf(k)}{[1 + \frac{\mu}{p}](1+r)} \tag{A.3}$$

Plugging (A.3) into (A.2) we get:

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$$EP^{NI} = 1 + \frac{\mu}{p} \tag{A.4}$$

From (11) and (12) and we get,

$$\mu = \frac{p(1-p)[v'(c_2^b) - v'(c_2^g)]}{(1-p)v'(c_2^g) + pv'(c_2^b)} > 0 \tag{A.5}$$

because $c_2^g > c_2^b \Rightarrow v'(c_2^b) > v'(c_2^g)$ which means $\mu > 0$. (**End of Proof**)

Proof of Proposition 3: Substitute the equilibrium conditions $s = l$, $x^h + x^b = 1$, into the household's date 1 budget constraint (14) to obtain $c_1 + k = y$. Next use the date 2 budget constraints (15) for good and bad states to observe:

$$pc_2^g + (1-p)c_2^b = px^h f(k) - pR + (1+r)l$$

Next plug in the zero expected profit condition (19) to obtain

$$pc_2^g + (1-p)c_2^b = pf(k)$$

which is the social planner's second period resource constraint.

In the next step, check that the first order condition of the social planning problem (P) is given by (27).(**End of proof**)[17]

B. Appendix

B.1. Derivation of key equations

Equations (32) through (35)

Using (11) and (12), we could rewrite the first-order condition in an inverse Euler equation form:

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[17]It is instructive to note that the first order condition of this social planning problem resembles the Pareto optimal contract condition in Rogerson (1985) although Rogerson's setting is quite different from ours.

$$\frac{(1+r)}{u'(c_1)} = \frac{p}{v'(c_2^g)} + \frac{(1-p)}{v'(c_2^b)} \tag{B.6}$$

Then by using the logarithmic utility we get:

$$pc_2^g + (1-p)c_2^b = (1+r)c_1 \tag{B.7}$$

Note first that the first order conditions for stock and storage are:

$$x: -Q/c_1 + (p/c_2^g)ak = 0 \tag{B.8}$$

$$k: -(1/c_1) + (p/c_2^g)xa = 0 \tag{B.9}$$

Using (B.8) and (B.9) with asset market equilibrium ($x = 1$) one gets: $Q = k$ implying a unit Tobin's q. From (B.9) and the date 1 resource constraint (1) together with the loan market clearance, $s = l$, this means that,

$$c_2^g = ap(y - k) \tag{B.10}$$

Use of the incentive constraint (5) means

$$c_2^g = \lambda c_2^b \tag{B.11}$$

which upon substitution in (B.7) gives:

$$\lambda c_2^b + apk = apy \tag{B.12}$$

Using (1), (2), (7) and the loan market clearing condition, $s = l$, one gets:

$$c_2^g = ak + (1+r)(1 - \frac{1}{p})s \tag{B.13}$$

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$$c_2^b = (1+r)s \qquad \text{(B.14)}$$

and

$$c_1 = y - k \qquad \text{(B.15)}$$

Using (B.11), (B.13), (B.14) and the loan market equilibrium condition $s = l$ gives:

$$l = \frac{pak}{(1+r)[1+p(\lambda-1)]} \qquad \text{(B.16)}$$

which upon plugging into (B.14) together with $s = l$ gives:

$$c_2^b = \frac{apk}{1+p(\lambda-1)} \qquad \text{(B.17)}$$

which upon substitution in (B.12) gives:

$$k^{NI} = \frac{1+p(\lambda-1)}{1+\lambda+p(\lambda-1)}y \qquad \text{(B.18)}$$

This proves (34). The equity premium expression (32) can be obtained by using (A.4), (A.5) and (B.11).

Use (27) and (29) to get (35). Use (29) and the incentive constraint (5) to get $c_2^b = \frac{apk}{p\lambda+1-p}$ which upon plugging in (B.7) and using (B.11) yields $k^I = y/2$. The inequality in (35) is evident by noting that $\lambda > 1$.

B.2. Proof of Proposition 5

Given the log utility specification (30), it is straightforward to compute the expected utility under the stand-alone banking environment. Simply plug in the consumption and investment decision rules into (30) to obtain:

$$W_s = (1+p)\ln\lambda + 2\ln y - 2\ln(1+\lambda+p(\lambda-1)) + \ln ap - \varphi \qquad \text{(B.19)}$$

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Next plugging the consumption decision rules under universal banking into the expected utility function, we get:

$$W_u = 2\ln\frac{y}{2} + p\ln\lambda + \ln\frac{ap}{(p\lambda + 1 - p)} - \varphi \qquad \text{(B.20)}$$

Thus using (B.19) and (B.20), we get the welfare differential

$$W_u - W_s = -\ln\left[\frac{4\lambda(p\lambda + 1 - p)}{(\lambda - 1)^2(1 - p)^2 + 4\lambda(p\lambda + 1 - p)}\right] > 0$$

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