

Incentive Compensation for Risk Managers when Effort is Unobservable

Paul Kupiec

The American Enterprise Institute

Indices of Riskiness: Management and Regulatory Implications

Federal Reserve Bank of Atlanta

Georgia State University Center for the Economic Analysis of Risk

Zurich University Department. of Banking and Finance

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Financial Institution Compensation Practices Remain in the Spotlight



- New EU rules on bank bonuses
 - Variable pay limited to 100% salary with 3-year deferral
 - Up to 200% if shareholders approve
 - Can go up to 2.5x salary with 5-year deferral
 - Applies to
 - Bankers working in the EU
 - Worldwide staff of banks HQ in EU
 - “Material risk takers” earning more than 500,000 euro or anyone that receives a bonus of at least 75,000 euro that comprises at least $\frac{3}{4}$ of total salary.
- Banks have responded raising base salaries while keeping total pay package largely unchanged
 - Some have added other perks: cars, monthly “allowances,” forgivable loans
 - Same total pay...less in the form of incentive compensation
- UK Treasury has taken the EU to court on this rule

UK Complaint

- **Unfit for purpose, and lack of evidence base**
 - Bonus cap was introduced without an assessment or underpinning evidence.
 - Its effects are likely to run counter to the stated objectives of the legislation, which are to ensure banks are safer, more stable, and prudentially sound.
 - Will lead to increases in fixed pay, which is harder to cut in times of stress, and more difficult to claw back and there is no evidence this will improve financial stability.
- **Unlawful delegation of tasks to the EBA**
 - The European Banking Authority does not have the authority to set a cap as it is a policy issue and not a technical detail.
- **Invalid legal base**
 - The disclosure provisions on individuals' pay contravene the legal base of the Regulation, which expressly excludes legislation "affecting the rights and interests of employed persons".
- **Lack of legal certainty**
 - The proposals have been rushed into effect without the necessary implementing legislation, including the rules determining whom the cap will apply to.
- **Failure to protect personal data**
 - No analysis has been conducted to ascertain whether certain pay disclosure provisions intrude too far on the right to privacy and infringe principles governing data protection; and
- **Wrongful application outside the EEA [European Economic Area]**
 - **Source: Wall Street Journal Sep 25, 2013 "Six Reasons George Osborne Has Taken the Bonus Fight to Court"**

FI Comp Practices in the US

- Troubled Asset Relief Program (TARP)
- Office of the Special Master for TARP Executive Compensation
 - Ken Feinberg
 - No salary restrictions
 - Limited IC
 - New “clawback” power
 - No golden parachutes



Banking Regulators React



- Issued joint IC guidance in June 2010
- Dodd-Frank Act passes late June 2010
 - Section 956 requires financial regulators to issue rules on IC
 - IC should not create inappropriate risk or material potential losses for covered institutions
 - IC must balance risk and financial results so as not to create imprudent risks
 - Final IC rules have not yet been issued
 - March 2011 NPR issued but never finalized

DFA Section 956 IC NPR

- 4 acceptable ways to “balance” IC risk in FIs
 - Risk-adjust IC awards using quant or qualitative judgment
 - Defer IC payments beyond performance period & adjust payout for interim losses
 - Base IC on long-term performance targets w/ deferral
 - Reduce IC sensitivity to short-term performance
 - Make IC a concave function of performance target

Federal Reserve Horizontal Review

- October 2011 summary of FRB review of IC practices at large BHCs
- Includes specific IC guidance
- *Topic 6: IC for Risk Managers*

“...a conflict of interest is created if the performance measures applied to them (risk managers), or the bonus pool from which awards are drawn, depend substantially on the financial results of the lines of business or business activities that such staff oversee.

...Thus, risk management and control personnel should be compensated in a way that makes their incentives independent of the lines of business whose risk taking and incentives compensation they monitor and control.”

FRB Guidance is a Puzzle...



- How can IC properly align risk manager incentives when IC pay is de-coupled from the performance of activities managers control?
 - Contract theory:
 - IC payments must be targeted on performance measures the manager can influence
 - Linking IC payments to things outside risk manager control is unlikely to create proper incentives

Overview of My Findings

- I consider optimal risk manager IC when effort is unobservable & not contractible
 1. Optimal IC must be linked to performance
 2. Risk manager IC performance targets must be linked to the outcomes of risk manager's function
 - Loan underwriters (PD) and mitigation managers (LGD) need different IC targets

Overview II

- Mispriced safety nets (deposit insurance, TBTF) reduce bank incentives to pay for risk management
 - Safety net subsidies distort bank incentives so that banks prefer to offer risk managers *too little* IC
- Regulatory guidance on risk manager IC is exactly backward!
 - Regulators need to encourage banks to increase risk manager IC,
 - link it to the performance of risk-managed activity
 - ensure that IC rewards appropriate performance targets

Outline of Talk

- Set up stylized model of risk management
- Find principal's optimal risk manager contracts when firm is financed with fairly-priced debt and equity
 - Solve problem when effort is contractible
 - This is the first best—the socially optimal solution
 - Solve asymmetric information case
 - when risk manager effort cannot be observed or contracted
 - Risk manager contracts must include IC
 - Risk management functions must be separated

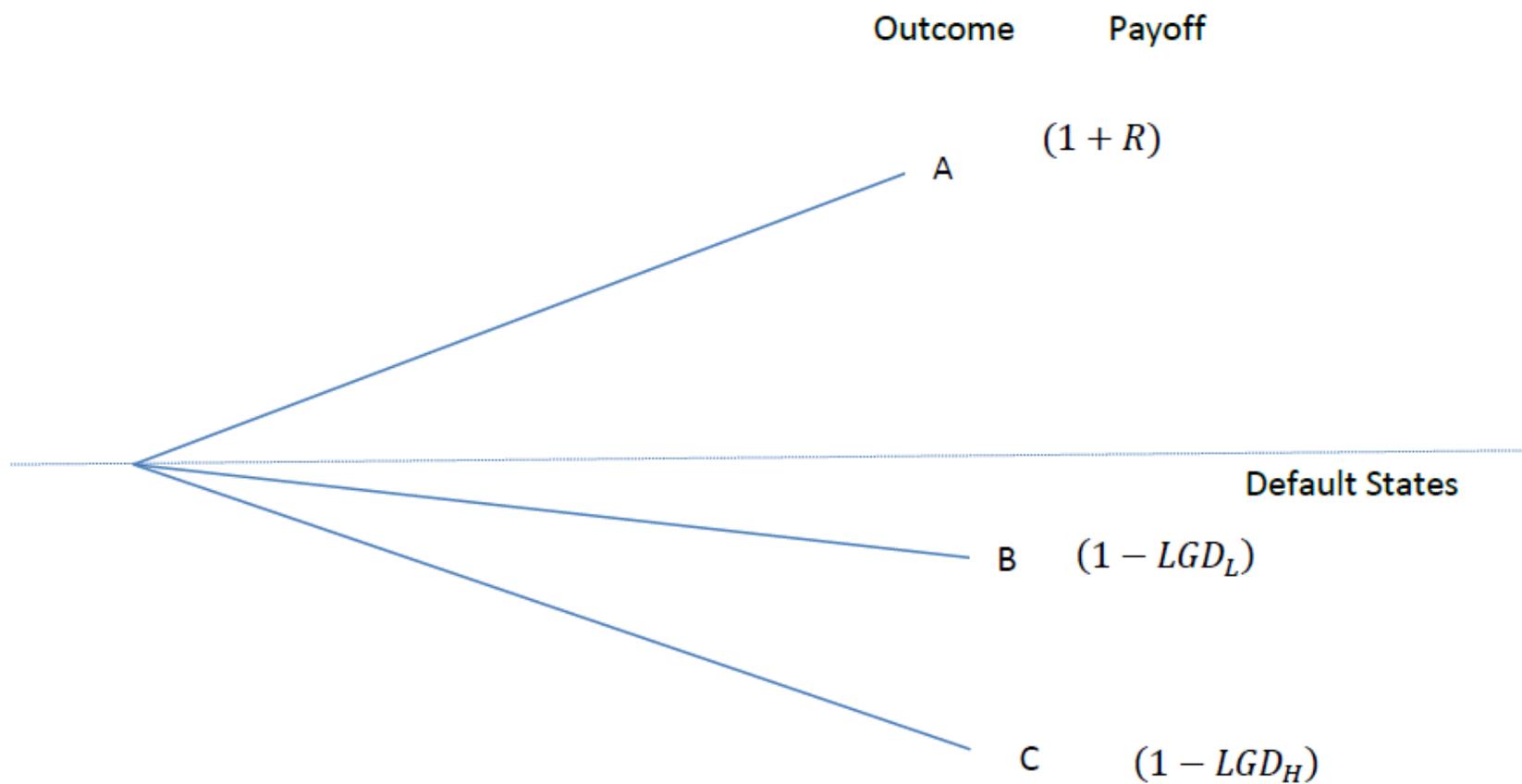
Outline III

- Introduce insured deposits funding (mispriced)
 - Safety net subsidy changes the bank's shareholder incentives
 - Paying for extra risk management services may no longer be preferred because better risk management:
 1. costs more
 2. reduces the deposit insurance subsidy the bank receives.
 - Banks may no longer choose to offer risk managers IC, but instead pay them the reservation wage
 - The bank chooses a socially sub-optimal level of risk management & a riskier investment portfolio.
- Regulators should encourage more risk management which means requiring banks to *enhance risk manager IC* over what banks will choose on their own

Model

- Financial institution can invest in a single loan
 - \$1 to invested
 - Loans are risky and may default
 - Some loans are riskier than others
- Firm must hire risk managers to perform 2 functions
 - Underwriting
 - Controlling PD; picking loan with smallest PD
 - Loss mitigation
 - Controlling LGD; picking loan with smallest expected LGD

Figure 1: Payoff Outcomes for Risky Loan Investment



Model

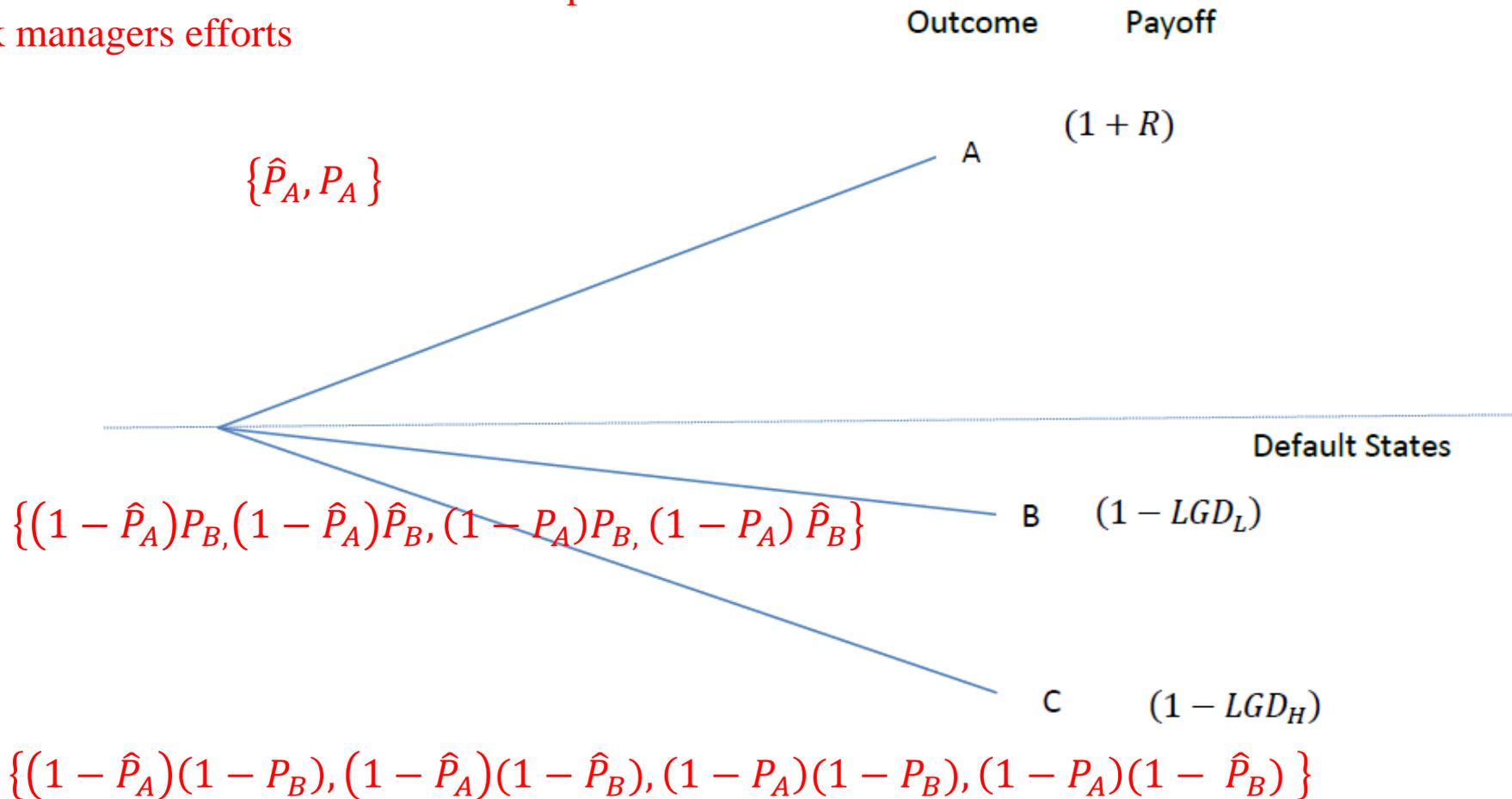
- The firm manager (principal) *must* hire risk managers (exogenous assumption)
 - Underwriting
 - Loss mitigation
- Why?
 - Regulators actually require this to meet safety and soundness minimum standards
 - Basle Committee “Principles for the Management of Credit Risk” Principles 15 & 16
 - Principal may have reasons beyond regulation
 - Signal to board that he/she is discharging fiduciary responsibility
 - Protect principal’s reputation if default losses occur
 - ...It’s the risk managers’ fault

Information

- Principal only knows unconditional probabilities attached to loan payoffs
 - $\{P_A, (1 - P_A)P_B, (1 - P_A)(1 - P_B)\}$
- Risk managers can, with effort, differentiate between good loans and better loans
 - If underwriter exerts effort, can identify loans with $\hat{P}_A > P_A$, i.e., $\hat{PD} < PD$.
 - If loss mitigation manager exerts effort, the manager can identify loans with a higher probability of the low default loss state (state B)

Figure 1: Payoff Outcomes for Risky Loan Investment

Probabilities attached to each state depend on risk managers efforts



Risk Manager Utility

- To find better loans, risk managers must expend high effort which is costly for them

$$U(w, e) = v(w) - g(e), e \in \{es, elm\}$$

$$v'(w) > 0,$$

$$v''(w) \leq 0,$$

$$g(es_H) = g(elm_H) > g(0) = 0.$$

Indirect utility over income

Disutility of work effort

Risk manager either:

(1) come to work and earn the reservation wage and nothing more, $g(0)=0$

(2) come to work, expend high effort and earn the reservation wage + $g(\text{high effort})$

Two Risk Manager “Jobs”

- Assume risk managers can do either job equally well
 - Underwriting (select PD of loan)
 - Loss mitigation (select expected LGD of loan)
- Reservation wage is the same, \ddot{w} , for each job
- Disutility of “high effort” is identical
 - $g(es_H) = g(elm_H) > 0$

Optimal Contract when Effort is Observed

- When principal observes risk manager effort, contract can condition pay on effort:
 - Come to work, you get paid \ddot{w}
 - Come to work, expend high effort and earn
 - $\omega = \ddot{w} + g(es_H) = \ddot{w} + g(elm_H) > \ddot{w}$
- When principal can contract on the level of effort, the contracts are the first best solution for the principal (maximize expected profits)

Principal's Decision Rule

- Choose contracts that **maximize** expected profit:

– 4 choices

- No extra effort

$$(1 + R)P_A + (1 - LGD_L)(1 - P_A)P_B + (1 - LGD_H)(1 - P_B)(1 - P_A) - 1 - 2\ddot{w}$$

- Extra underwriting effort only

$$(1 + R)\hat{P}_A + (1 - LGD_L)(1 - \hat{P}_A)P_B + (1 - LGD_H)(1 - P_B)(1 - \hat{P}_A) - 1 - (\omega - \ddot{w}) - 2\ddot{w}$$

- Extra loss mitigation only

$$(1 + R)P_A + (1 - LGD_L)(1 - P_A)\hat{P}_B + (1 - LGD_H)(1 - \hat{P}_B)(1 - P_A) - 1 - (\omega - \ddot{w}) - 2\ddot{w}$$

- Extra effort on both risk management tasks

$$(1 + R)\hat{P}_A + (1 - LGD_L)(1 - \hat{P}_A)\hat{P}_B + (1 - LGD_H)(1 - \hat{P}_B)(1 - \hat{P}_A) - 1 - 2\omega$$

Example

Table 1: Risk Management Contract Stylized Example

Outcome	Outcome Payoff	Outcome Probability Conditional on Default	Outcome Unconditional Probability	Outcome Probability Conditional on Default and High Effort	Outcome Probability Conditional on High Effort
A	1.20		.80		.90
B	.95	.50	.10	.90	.09
C	.45	.50	.10	.10	.01

Table 2: Expected Loan Cash Flows as Function of Risk Manager Effort

Risk Manager Effort	Expected Loan Payment	Marginal Expected Payoff from High Loss Mitigation Effort	Marginal Expected Payoff from High Underwriting Effort
No Effort	1.10		
High Underwriting Effort	1.15		.05
High Loss Mitigation Effort	1.14	.04	
High Underwriting and Loss Mitigation Effort	1.17	.02	.03

What Does Extra Risk Management Effort Cost?

$v(w) = 1 - e^{-2w}$ Risk averse manager indirect utility

$\bar{w} = .02$ Risk manager's reservation wage

$g(es_H) = g(elm_H) = 0.02.$ Disutility of effort

$\omega \ni [1 - e^{-2\bar{w}}] = [1 - e^{-2*\omega} - g(es_H)] = 0.030518.$ High-effort wage

0.010518. Marginal cost of high effort when effort is observable & contractible

Example

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0.010518. Marginal cost of high effort when effort is observable & contractible

Offer both risk managers a high-effort contract $\omega = .030518$

Risk Manager Effort	Expected Loan Payments	Required Total Compensation	Principal Expected Profit
No Effort	1.10	0.04	0.06
High Underwriting Effort	1.15	0.050518	0.099482
High Loss Mitigation Effort	1.14	0.050518	.089482
High Underwriting and Loss Mitigation Effort	1.17	.061036	0.108964

Example II

$g(es_H) = g(elm_H) = 0.04$. Higher disutility associated with high effort

0.021262 Marginal cost of high effort

Risk Manager Effort	Expected Loan Payment	Marginal Expected Payoff from High Loss Mitigation Effort	Marginal Expected Payoff from High Underwriting Effort
No Effort	1.10		
High Underwriting Effort	1.15		.05
High Loss Mitigation Effort	1.14	.04	
High Underwriting and Loss Mitigation Effort	1.17	.02	.03

Only offer underwriter high-effort contract

Loss mitigation manager gets reservation wage

What if Effort is Not Contractible?

- I'll start with risk neutral managers...

$$v(w) = w.$$

High-effort wage when effort is observable

$$w_{RN} = \ddot{w} + g(es_H) = \ddot{w} + g(elm_H)$$

- Discuss later when managers are risk averse

Pure IC Contracts

- Single IC state-contingent payment when effort is unobservable
 - Underwriter contract terms
 - $\left\{ \left(A, \frac{w_{RN}}{\widehat{P}_A} \right), (B, 0), (C, 0) \right\}$
 - Loss mitigation manager underwriting terms
 - $\left\{ (A, 0), \left(B, \frac{w_{RN}}{(1-P_A)\widehat{P}_B} \right), (C, 0) \right\}$
 - Some pure IC contracts may not be feasible
 - Example in paper where $\frac{w_{RN}}{(1-P_A)\widehat{P}_B} > 1$ which is infeasible
 - Some pure IC contracts may violate incentive compatibility condition

Non Contractible Effort

- Risk managers must receive different contracts to induce high effort outcomes
 - When effort was observable and contractible both risk managers got the same contract terms
- Risk management functions must be separated and paid differently
- It may not be feasible to offer pure IC contracts and get high effort from both managers
 - Expected total risk manager contract compensation is still identical
 - Loss mitigation manager's bonus depends on effort expended by underwriter
 - Loss mitigation manager's bonus can be many times larger than the underwriter's bonus....

Pure IC Contract Example

$$v(w) = w,$$

Risk neutral manager utility

$$g(es_H) = g(elm_H) = .00125$$

Disutility of work

$$\ddot{w} = .01$$

Reservation wage

Optimal underwriter contract terms

$$(\text{State, IC}): \{(A, 0.0125), (B, 0), (C, 0)\}$$

Underwriter pure IC contract is feasible and incentive compatible

$$.8 * .0125 = .01 = \ddot{w}$$

Optimal loss mitigation manager contract terms when low underwriting effort:

$$(\text{State, IC}): \{(A, 0), (B, .0625), (C, 0)\}, \quad .0625 = .01125/.18$$

Loss mitigation manager pure IC contract is feasible and incentive compatible

$$.10 * .0625 = .00625 < .01, \dots \text{better to work}$$

Optimal loss mitigation manager contract terms when high underwriting effort:

$$(\text{State, IC}): \{(A, 0), (B, .125), (C, 0)\}, \quad .125 = .01125/.09$$

Loss mitigation manager pure IC contract is feasible, but it is NOT incentive compatible $.10 * .125 = .0125 > .01, \dots \text{better to shirk}$

Mixed Wage and IC Contracts

- By including a wage into the contract, the IC needed to induce high effort can be reduced
- Incentive compatibility constraint must be satisfied

E.G.: A loss mitigation contract that includes a fixed wage smaller than the reservation wage and an IC component

$$(\text{State, wage, IC}) : \{(A, \ddot{w} - \varphi_{LM}, 0), (B, \ddot{w} - \varphi_{LM}, \pi_{LM}), (C, \ddot{w} - \varphi_{LM}, 0)\}$$

... and IC—a bonus in the state that the risk manager's effort impacts outcome

Optimal “Mixed Contract” Terms

$$\ddot{w} - \varphi_S + \hat{P}_A \pi_S - g(es_H) = \ddot{w}$$

Required terms for high effort for underwriter

$$\ddot{w} - \varphi_S + \hat{P}_A \pi_S - g(es_H) \geq \ddot{w} - \varphi_S + P_A \pi_S,$$

Incentive compatibility for underwriter

$$\left. \begin{aligned} \varphi_S^* &= \left[\frac{\hat{P}_A}{\hat{P}_A - P_A} - 1 \right] g(es_H) \\ \pi_S^* &= (\hat{P}_A - P_A)^{-1} g(es_H) \end{aligned} \right\}$$

Optimal mixed contract terms for underwriter

$$\ddot{w} - \varphi_{LM} + (1 - \hat{P}_A) \hat{P}_B \pi_{LM} - g(elm_H) = \ddot{w}$$

Required terms for high effort for loss mitigation manager

$$\ddot{w} - \varphi_{LM} + (1 - \hat{P}_A) \hat{P}_B \pi_{LM} - g(elm_H) \geq \ddot{w} - \varphi_{LM} + (1 - \hat{P}_A) P_B \pi_{LM},$$

Incentive compatibility for LM

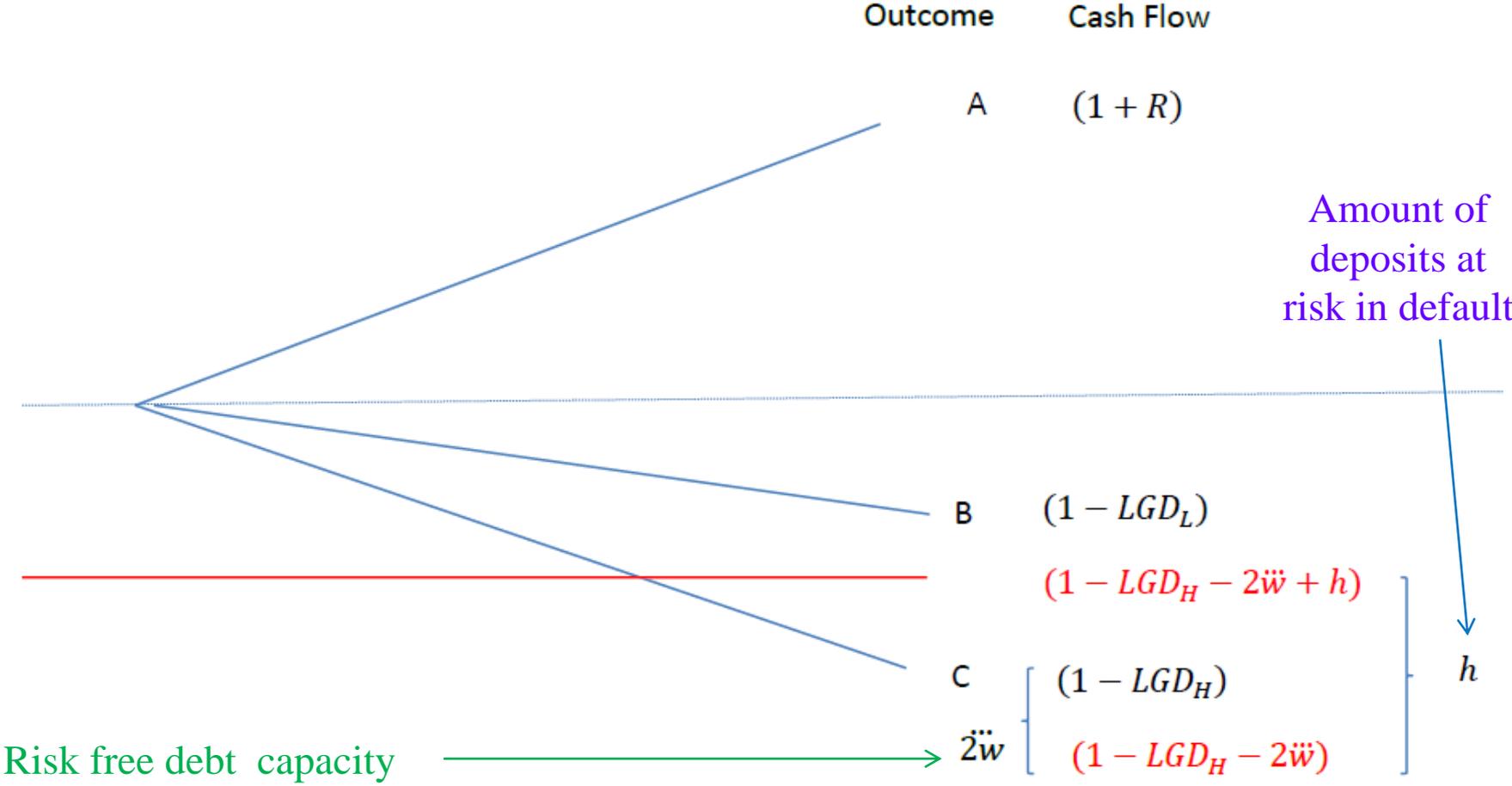
$$\left. \begin{aligned} \pi_{LM}^* &= [(\hat{P}_B - P_B)(1 - \hat{P}_A)]^{-1} g(elm_H) \\ \varphi_{LM}^* &= \left[\frac{\hat{P}_B}{\hat{P}_B - P_B} - 1 \right] g(elm_H) \end{aligned} \right\}$$

Optimal mixed contract terms for loss mitigation manager

Subsidized Deposit Insurance Funding

- Bank can issue insured deposits up to a limit
 - Limit set by regulatory capital requirements
- Deposit insurance is provided for a fixed premium = 0
 - Because deposits are subsidized, principal will always choose to issue as many insured deposits as are permissible

Figure 2: Payoff Outcomes with Insured Deposit Funding



Deposit Insurance Subsidy

- Without deposit insurance deposits would sell for ($R_f = 0$)

$$(1 - LGD_H - 2\ddot{w}) + (P_A + P_B - P_A P_B)h$$

- With deposit insurance deposits sell for

$$(1 + LGD_H - 2\ddot{w} + h)$$

- Value of the deposit insurance subsidy

$$[1 - P_A - P_B + P_A P_B] h$$

Contracts w/Effort is Contractible

- Principal's profit w/o high risk manager effort
- $P_A(1 + R + LGD_H - h) + (1 - P_A)P_B(LGD_H - LGD_L - h) - LGD_H + h - 1 - 2\ddot{w}$.
- Profit under alternative contracting choices
 - principal chooses highest from following 3 choices:
- High underwriting effort:
- $\hat{P}_A(R + LGD_H - h) + (1 - \hat{P}_A)P_B(LGD_H - LGD_L - h) - LGD_H + h - (w - \ddot{w}) - 2\ddot{w}$.
- High loss mitigation effort:
- $P_A(R + LGD_H - h) + (1 - P_A)\hat{P}_B(LGD_H - LGD_L - h) - LGD_H + h - (w - \ddot{w}) - 2\ddot{w}$.
- High effort from both underwriting and loss mitigation
- $\hat{P}_A(R + LGD_H - h) + (1 - \hat{P}_A)\hat{P}_B(LGD_H - LGD_L - h) - LGD_H + h - 2\omega$.

Example: optimal contract with deposit insurance and observable effort

$$v(w) = 1 - e^{-2w},$$

Risk manager are risk averse

$$g(es_H) = g(elm_H) = 0.02.$$

Identical disutility of high effort

$$\ddot{w} = 0.02$$

Identical reservation wage

$$h = 0.30$$

bank will fund itself with 0.71 of insured deposits

$$\text{Total deposits} = .45 - .04 + .30$$

Risk Manager Effort	Expected Loan Payments	Expected Profit to Principal	Deposit Insurance Subsidy	Expected Profit w/o deposit Insurance
No Effort	1.10	.09	.03	.06
High Underwriting Effort Only	1.15	0.115008	.015526	.099482
High Loss Mitigation Effort Only	1.14	.095692	.00621	.089482
High Underwriting and Loss Mitigation Effort	1.17	.112174	.00321	.108964

Deposit Insurance Reduces Principal's Demand for Risk Management

- In the last example:
 - w/o deposit insurance, principal choose to offer both risk managers high-effort contracts
 - w/ deposit insurance, principal only wants to offer underwriter a high-effort contract; loss mitigation manager gets reservation wage
- High risk manager effort lowers the value of the deposit insurance subsidy
 - Less probability deposit insurer has to pay h
 - But deposit insurer picks up part of the high-effort wage premium (in state C)

Deposit Insurance & Demand for Risk Management

- Maximum wage principal is willing to pay loss mitigation manager when equity & debt are fairly priced (*i.e. no subsidized deposit insurance*)

$$\omega_{LM}^{Max} = (1 - P_A)(\hat{P}_B - P_B)(LGD_H - LGD_L) + \ddot{w}$$

- Maximum wage principal is willing to pay loss mitigation manager with subsidized deposit insurance

$$\omega(ins)_{LM}^{Max} = \frac{(1 - P_A)(\hat{P}_B - P_B)}{P_A + \hat{P}_B(1 - P_A)} (LGD_H - LGD_L - h) + \ddot{w}$$

- $\omega_{LM}^{Max} - \omega(ins)_{LM}^{Max} > 0$, and increasing in h

Demand for Underwriting Risk Management

Maximum principal willingness to pay for high underwriting effort w/o deposit insurance

$$\omega_S^{Max} = (\hat{P}_A - P_A)[R + LGD_L P_B + LGD_H(1 - P_B)] + \ddot{w}$$

Maximum principal willingness to pay for high underwriting effort w/ DI

$$\omega(ins)_S^{Max} = B (\hat{P}_A - P_A)[A - h(1 - P_B)] + \ddot{w}$$

$$A = R + LGD_H - P_B(LGD_H - LGD_L) \quad B = (\hat{P}_A + (1 - \hat{P}_A)P_B)^{-1}$$

In most “usual” cases, DI lowers the principal’s maximum willingness to pay

$$\omega_S^{Max} - \omega(ins)_S^{Max} \geq 0 \Leftrightarrow h \geq (1 - \hat{P}_A)A$$

Or,
$$\boxed{(\hat{P}_A - P_A)(1 - P_B)h} \geq \boxed{(1 - \hat{P}_A)(1 - P_B)(\omega_S^{max} - \ddot{w})}$$

Change in value of DI subsidy

Part of high-effort premium paid by deposit insurer

Optimal Contracts when Effort is Unobservable and Agents are Risk Neutral

- When effort is unobservable, to get high-effort, principal will have to offer IC
 - Feasibility constraint may require “mixed” contracts---part wage, part IC

- Optimal loss mitigation terms

$$\pi_{LM}^* = [(\hat{P}_B - P_B)(1 - P_A)]^{-1} g(elm_H), \text{ and, } \varphi_{LM}^* = g(elm_H) P_B (\hat{P}_B - P_B)^{-1}.$$

- Optimal underwriter contract terms

$$\pi_S^* = (\hat{P}_A - P_A)^{-1} g(es_H), \text{ and } \varphi_S^* = g(es_H) P_A (\hat{P}_A - P_A)^{-1}$$

How much does DI pay for high effort?

Expected loss mitigation high-effort cost for the principal with DI, effort non contractible & mixed contract

$$\pi_{LM}^*(1 - P_A) - \varphi_{LM}^*(P_A + (1 - P_A)\hat{P}_B)\hat{P}_B$$

Expected loss mitigation high-effort cost for the principal with DI & effort contractible

$$(\omega - \ddot{w})(P_A + (1 - P_A)\hat{P}_B)\hat{P}_B.$$

The difference is positive

$$g(elm_H)(P_A + (1 - P_A)\hat{P}_B) + g(elm_H)\left(1 - (P_A + (1 - P_A)\hat{P}_B)\right) > 0.$$

When effort is unobservable, the principal has to pay IC. This shifts the high effort cost from State C to State B. Deposit insurer picks up the bill in state C.

So unobservable/non-contractible effort makes high effort more expensive for the principal and so principal may demand less risk management.

Principal's cost of high-effort underwriting

The difference between the principal's cost of the expected high-effort premium for underwriting:

cost with DI and non-contractible labor
less cost with DI and contractible labor

$$g(es_H)2P_A (\hat{P}_A - P_A)^{-1} D - g(es_H) \hat{P}_A (\hat{P}_A - P_A)^{-1} (D - 1) > 0,$$

$$D = (\hat{P}_A + (1 - \hat{P}_A)P_B), 0 < D < 1$$

Because the principal has to pay IC in State A to get high-effort, the contract increases the principal expected cost of high underwriting effort

- The underwriter contract payments are shifted from state C (when DI pays) to state A.

Summarizing DI & Demand for Risk Management

- Subsidized deposit insurance decreases demand for risk management even when effort is contractible and managers are risk neutral because risk management reduces the principal's deposit insurance subsidy.
- When effort is also non-contractible, even with risk neutral managers, demand for risk management falls further because the required IC payments shift expected cost of effort from DI to the principal.
- Modeling risk managers as risk averse (instead of risk neutral) just increases the cost of risk management to the principal

So what will banker do?

- Banks will demand less risk management
-  More risk managers will get reservation wage, not IC contracts
-  Banks become riskier as they optimize the value of their safety net subsidy

What Should Regulator Do?

- Regulators need to encourage banks to do more risk management
 - More high-effort risk manager contracts
- Regulators need to encourage banks to offer risk managers IC contracts, where IC performance is targeted appropriately on the performance of the activity the risk manager controls
- Current regulatory IC guidance is completely backward!