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Pareto-Improving Subsidy and Prudential Incentive*

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Abstract

Directly subsidizing bank deposits increases franchise value and promotes prudent lending. Subsidization can be made net present value neutral for the regulator by requiring banks to make upfront payments equal to the capitalized value of future subsidies they stand to receive. While compensating the regulator for the cost of the subsidy, upfront payment also imposes a quasi-speed limit on the expansion of deposits that typically precedes a switch to riskier investment strategies, discouraging market-stealing deviations. The results yield new insights into the relationship between prudential regulation and the management of deposit insurance funds: Quarterly deposit insurance premiums reduce franchise value, effectively taxing prudent lending and subsidizing gambling. Replacing quarterly assessments with upfront payments of equal present value would reverse this perverse incentive, subsidizing prudent lending and taxing gambling, while leaving the present value of deposit insurance fund balances unaltered. Thus improving prudential incentives allows capital requirements to be lowered, further increasing banks’ franchise value. Through imperfect competition for depositors, this value is partly shared with depositors in the form of higher deposit interest rates. Although the practical aim is to make prudential regulation more robust, rather than fine-tuning to eke out efficiency gains, the results suggest the potential for strictly Pareto-improving revision to bank regulation: By requiring banks to prepay a portion of their deposit insurance assessments, it is possible to increase the value of deposit insurance funds, increase the franchise value of banks, improve prudential incentive, and raise deposit interest rates for savers, all at the same time.

JEL: G2, H2, E4, L5

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This paper argues that prudential regulation can be made more efficient and more robust by directly subsidizing deposits at insured banks. Subsidization promotes prudent lending in a way that places minimal informational and enforcement burdens on regulators; it is a blunt instrument that makes risky investment strategies generally less attractive by increasing franchise value (the capitalized value of future profits), which banks stand to lose if their risky investment strategies lead to insolvency. When banks are required to make upfront payments equal to the capitalized value of subsidies they stand to receive in the future, two distinct incentive effects can be identified: a relative reduction in the present value of a risky investment strategy at any given deposit interest rate and a reduction in the incentive to raise the deposit interest rate and expand deposits prior to switching from prudent lending to riskier investing. Prudential incentive can thus be improved at no cost either to banks or to the regulator. Moreover, improving prudential incentive in this way takes pressure off of capital requirements, which can then be lowered, increasing the franchise value of prudent lending for banks and leading (through imperfect competition for deposits) to higher equilibrium deposit interest rates for savers.

Prudential regulation in the United States and other member countries of the Basel Committee on Banking Supervision has become increasingly dominated by minimum capital requirements over the last three decades, and still greater emphasis has been placed on capital in the wake of the 2008 financial crisis. The greater reliance of regulatory schemes on capital adequacy requirements leaves the financial industry dangerously exposed to any weakness in this one instrument. For example, risk-based capital requirements place a large informational burden on regulators to determine the riskiness of different assets, and there is the potential for serious consequences when regulators greatly underestimate the risk associated with a large class of assets, such as mortgage-backed securities. Mathias Dewatripont and Jean Tirole (1994) point out that risk assessments typically focus on the credit risk of individual loans, ignoring correlation and market risk. David Jones (2000) discusses how banks may purposefully exploit shortcoming in capital regulation to lower their effective risk-based capital requirements without decreasing the riskiness of their portfolios and to increase their reported capital ratios without increasing
their ability to absorb losses. In light of the limitations of minimum capital requirements, supplementary policy instruments are potentially valuable.

This paper proposes directly subsidizing deposits as a supplement to reasonable capital adequacy requirements – and as a more efficient alternative to greatly increasing such requirements – as part of a robust prudential regime. Two variants of deposit subsidization are considered:

First, the deposit subsidy can be implemented without any compensating transfer from banks to offset its cost. This uncompensated subsidy would drive equilibrium deposit interest rates up as it lowers the unit cost of mobilizing deposits to finance prudent lending. This increases efficiency, since imperfect competition and binding minimum capital requirements distort equilibrium interest rates downward, causing deposits to be underutilized as a store of value. Because competition is imperfect, only part of the subsidy is passed on to depositors by the raising of interest rates; the balance of the subsidy increases franchise value. Although the subsidy also raises the present value of riskier investment strategies, there is a disproportionately greater increase in the present value of prudent lending because riskier investment strategies run a greater risk of insolvency, placing part of the value of future subsidies at risk. This marginal inducement to prudent lending allows minimum capital requirements to be lowered without adversely affecting banks’ portfolio decisions. This lowers the shadow cost of binding capital requirements, which further reduces the distortion in equilibrium interest rates as banks pass on part of the cost reduction to depositors in the form of higher interest rates. The release of equity capital to other uses may also improve efficiency if the social opportunity cost of equity capital exceeds the return on prudent lending.

Second, banks can be required to pay upfront fees equal to the capitalized value of the deposit subsidies they stand to receive in the future, compensating the regulator for the cost of the subsidy. In this case, there is no net effect on unit cost and therefore no direct effect on the equilibrium deposit interest rate. This compensated subsidy still has the effect of encouraging prudent lending, since the
capitalized value of future subsidy payments appears larger to a bank that takes on minimal insolvency risk by making prudent loans than to a bank that takes on higher insolvency risk to increase the return on its investments. Note that this can still be described as the effect of raising franchise value: Since banks pay the upfront fee immediately and regardless of their portfolio decision, it is regarded as a sunk cost when making the portfolio decision. A bank that has paid its fee and is contemplating switching its portfolio to riskier assets still has more to lose in the event of insolvency.

The compensated subsidy sets up a potential Pareto improvement: The subsidy by itself is value neutral for the regulator and leaves banks that intend to make prudent loans no better- or worse-off after the upfront fee is paid, but it gives banks strictly greater incentive to make prudent loans. A Pareto improvement can then come by lowering the minimum capital requirement. Since binding capital requirements are costly for banks, lowering capital requirements decreases the unit cost of mobilizing deposits to finance prudent lending, increasing franchise value. Through imperfect competition for deposits, part of this value is passed on to depositors by the raising of equilibrium interest rates, leaving both banks and depositors strictly better off.

Both compensated and uncompensated subsidies could be implemented through the management of deposit insurance funds. Reducing quarterly deposit insurance premiums is functionally the same as subsidizing deposits. For example, reducing assessments by 12.5 basis points per quarter across all risk classes would lower the cost of mobilizing $100 of deposits by 50 cents per year. At times when deposit

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1 In order for the subsidy to be value neutral to banks and the regulator, each must apply the same discount rate, which is an entirely reasonable characterization of reality. For the regulator, the discount rate would reflect an underlying long-term market rate, adjusted for the risk of insolvency for the average insured bank, the same discount rate that the average bank would use to value an annuity that it stands to receive conditional only on its own solvency. If the prepayment is equal to the capitalized value of the subsidy for this average bank, then a bank facing a lower-than-average insolvency risk would be made better off by the subsidy and a bank facing higher-than-average risk of insolvency would be made worse off—and such a bank would reveal their high-risk status if they chose to protest that the discount rate applied is too low.

2 There is little if any controversy that capital adequacy requirements are costly for banks. For example, Admati, DeMarzo, Hellwig, and Pfleiderer (2011), while making the case that bank equity capital is not socially expensive, acknowledge that equity capital is expensive from banks’ private perspective. This is due at least in part to features of the regulatory landscape, such as the deductibility of interest expense on business tax returns and the suppression of deposit interest rates by government-provided deposit insurance at actuarially generous rates. I abstract from all such complexities for the sake of expositional simplicity.
insurance funds are considered more than adequate, it would be better from the standpoint of prudential regulation to reduce premiums, even below zero for lower risk classes, rather than pay dividends to banks all at once. When deposit insurance funds are depleted, an excellent way to restore the fund would be to require banks to prepay a portion of their future assessments.

Although not unprecedented, prepayment has not been considered for its incentive effects as a potentially useful instrument of prudential regulation. At the end of 2009, the Federal Deposit Insurance Corporation (FDIC) required banks to prepay their quarterly deposit insurance premiums through the end of 2012 in order to restore the Deposit Insurance Fund, which had been depleted by the unusually high number of bank failures during the acute stage of the financial crisis. From the standpoint of prudential regulation, it would have been better to collect a given amount upfront not by eliminating assessments for three years but instead by reducing assessments by some amount permanently.  

In the United States, the Dodd-Frank Wall Street Reform and Consumer Protection Act, promulgated in July 2010, calls for the FDIC to adopt a restoration plan should the balance of the Deposit Insurance Fund dip below 1.35 percent of estimated insured deposits and to provide dividends to the banking industry should the fund balance exceed 1.5 percent of insured deposits. The present analysis suggests that a broad interpretation of these dividends would best serve the interests of prudential regulation. Instead of cash or securities, dividends might take the form of a prepaid expense, permanently relieving banks of part of their future deposit insurance assessments, with no cash changing hands upfront. If it is essential to reduce fund balances immediately, perpetual interest-free loans in amounts tied to the volume of deposits mobilized would accomplish this while improving prudential incentives.  

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3 Given a target amount the fund would like to immediately raise, premiums could be lowered by a certain amount such that the capitalized value to banks (capitalized cost to the fund) of the assessment reduction is equal to the target upfront payment.

4 Issuing perpetual interest-free debt instead of a dividend of equal amount transfers the same net present value from the fund to the bank since the present value of interest on perpetual debt is equal to the principal of the loan. If the amount of the loan is tied to the volume of deposits mobilized, then it does not crowd out deposits the way rediscount loans would, but rather by effectively lowering the unit cost of mobilizing deposits acts like a deposit subsidy.
The explicit subsidization of deposits recommended here is not to be confused with any of the indirect and implicit benefits conferred on banks by government that are commonly referred to as subsidies, such as access to the discount window, deposit insurance, and the implicit guarantee that banks of a certain size will not be allowed to fail. By providing deposit insurance and backstopping banks as the lender of last resort, the Federal Reserve is safeguarding the stability of the banking industry, not specifically subsidizing the mobilization of consumer deposits in the sense, intended here, of driving a wedge between the interest rate received by depositors and that effectively paid out by banks. Deposit interest rates are lower than they would be in the absence of deposit insurance only to the extent that there is appreciable insolvency risk for which depositors do not insist on being compensated; this should not be the case under a successful prudential regime. This paper certainly provides no justification for “too-big-to-fail” as an implicit subsidy. Indeed, a bank that can expect to retain its charter when it becomes insolvent is immune to the incentive mechanism modeled here, and neither minimum capital requirements nor subsidies can prod such a bank toward prudent lending. Nor does this paper recommend such forms of direct subsidization as rediscount loans or loan guarantees. The subsidization of debt, including bank deposits, by the deductibility of interest expense on business tax returns is also different; because this subsidy applies to all debt, it cannot address the downward distortion in deposit interest rates and the consequent underutilization of bank deposits as a store of value.

The need for prudential regulation is linked to the desirability of government-provided deposit insurance. In an influential paper, Douglas Diamond and Philip Dybvig (1983) show how bank runs may arise and create real harm, absent any underlying problem; government-provided deposit insurance generates Pareto improvements by eliminating the inefficient equilibrium in which a bank run occurs. However, as in the moral hazard problem identified by Michael Jensen and William Meckling (1976), the bank may then find it profitable to make socially-inefficient gambles, because the bank reaps a high

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5 For a discussion of the perverse incentive effects of such policies, see Hellmann, Murdock, and Stiglitz (1997).
6 Admati, DeMarzo, Hellwig, and Pfleiderer (2011) and Poole (2009) discuss how the subsidization of debt has led to excessive leverage and financial market instability.
return when the gamble pays off while the deposit insurer bears the cost if it fails. I take deposit insurance and its attendant moral hazard problem as given and explore how a specific deposit subsidy can promote stability by encouraging prudent lending. I also emphasize how subsidization could be implemented through the management of deposit insurance funds, with transfers from banks to the fund paid early and all at once and transfers from the fund to banks paid over time.

The theoretical model is based on that of Thomas Hellmann, Kevin Murdock, and Joseph Stiglitz (2000); they consider the optimal form of prudential regulation with two instruments, capital requirements and deposit-rate controls, and find that freely-determined deposit rates are inconsistent with Pareto efficiency. The present paper introduces the deposit subsidy as yet another potentially useful policy instrument. Like deposit rate controls, subsidization encourages prudent lending by increasing franchise value, making it possible to lower capital requirements without endangering the prudent-lending equilibrium. Whereas deposit rate ceilings directly block market-stealing deviations to riskier lending portfolios, prepayment for subsidies indirectly makes the expansion of deposits to fund risky investments less attractive while still allowing the expansion of deposits to finance prudent loans. Subsidizing the mobilization of deposits can improve efficiency in a second way that deposit rate ceilings clearly cannot: It can reduce the downward distortion in deposit interest rates, promoting the efficient utilization of bank deposits as a store of value.

Lawrence Christiano and Daisuke Ikeda (2011) consider a model in which an interest rate subsidy raises the marginal return on banker effort, increasing banker effort and decreasing the probability of insolvency in equilibrium. In their model, the subsidy works not by increasing franchise value but by decreasing the probability of insolvency directly. With lower interest obligations, the bank can absorb greater investment losses without becoming the problem of the deposit insurer. Bankers thus internalize more of the risk they take on and therefore undertake greater effort to minimize that risk, further decreasing the probability of insolvency.
The theoretical link between financial market liberalization, the erosion of franchise value, and the severity of the moral hazard problem is set forth, along with empirical evidence from the United States in the 1970’s and 1980’s, by Michael Keeley (1990). Further empirical evidence is provided by Weisbrod, Lee, and Rojas-Suarez (1992), Demsetz, Sainedberg, and Strahan (1996), and Beck, Demirgüç-Kunt, and Levine (2006). Allen and Gale (2003) find that the relationship between competition and financial market instability may be subtler in more general models. For a more comprehensive analysis of the capital structure of banks and the existing regulatory framework, see Mathias Dewatripont and Jean Tirole (1994).

The paper is organized as follows: Section 1 presents the model. Section 2 derives the regulated equilibrium and conditions under which it involves prudent lending. Sections 3 and 4 provide analysis of uncompensated and compensated subsidies, respectively. Section 5 concludes.

1. The Model

The basic setup is that of Thomas Hellmann, Kevin Murdock, and Joseph Stiglitz (2000): A bank operates for $T$ periods. In each period, the bank offers an interest rate on deposits of $r_i$ in monopolistic competition with other banks offering depositors $r_{-i}$. The total volume of deposits mobilized by the bank is $D(r_i, r_{-i})$, with the volume of deposits increasing in the bank’s own rate and decreasing in the competitors’ rate (i.e. $\partial D / \partial r_i > 0$ and $\partial D / \partial r_{-i} < 0$). I assume $D(\cdot)$ satisfies sufficient conditions for the concavity of the bank’s maximization problem and that own-effects are greater than cross-effects (i.e. $\partial D / \partial r_i > - \partial D / \partial r_{-i}$).

The bank chooses between two assets: the prudent asset, yielding a return $\alpha$, and the gambling asset, yielding a high return $\gamma$ with probability $\theta$ and a low return $\beta$ with probability $1 - \theta$. The bank’s portfolio choice involves moral hazard in that the prudent asset has a higher expected return, but the bank earns a higher private return if the gamble succeeds (i.e., $\gamma > \alpha > \theta \gamma + (1 - \theta) \beta$).
For every unit of deposits mobilized, the bank also invests some amount of its own capital $k$, so the total investment is $(1 + k)D(r_i, r_{-i})$. The opportunity cost of capital is $\rho$. I treat both $\alpha$ and $\rho$ as exogenous and assume that banks view capital as expensive: $\rho > \alpha$. This assumption is consistent with a situation where minimum capital requirements bind, one where, without capital requirements, banks would choose to increase leverage and select riskier portfolios to maximize the option value of deposit insurance.\(^7\) I assume that the minimum capital requirement binds, so that $k$ is not a choice variable for the bank. In each period that it is solvent the bank receives a subsidy $s$ per unit of deposits mobilized. Upfront fees that offset the cost of the subsidy are considered in Section 4.

The timing within each period is as follows: Given regulation $(k, s)$, banks simultaneously offer a deposit rate. Depositors then choose in which bank to place their funds. Banks then choose their asset portfolio. At the end of each period, the regulator inspects the balance sheets of all banks, and insolvent banks are closed.

When the bank chooses the prudent asset, per-period profit is

$$\pi_p(r_i, r_{-i}, k, s) = \mu_p(r_i, k, s)D(r_i, r_{-i}),$$

where $\mu_p(r_i, k, s) = \alpha (1 + k) - \rho k - r_i + s$ is the bank's profit margin per unit of deposits mobilized, net of its cost of capital.

When the bank gambles, expected per-period profit is

$$\pi_G(r_i, r_{-i}, k, s) = \mu_G(r_i, k, s)D(r_i, r_{-i}),$$

\(^7\) See Robert C. Merton (1977). The assumption here that the opportunity cost of capital exceeds the return on prudent lending and the treatment of both parameters as exogenous is simply intended to capture the shadow cost of binding capital requirements from banks' private perspective while abstracting from the reasons this is likely to be true in reality. Qualitatively similar results are available under more realistic assumptions at the cost of increased complexity. For example, the opportunity cost of equity capital may be decreasing in the amount of capital mobilized to reflect the effect of leverage on the risk premium.
where \( \mu_c(r_i, k, s) = \theta [\gamma (1 + k) - r_i + s] - \rho k \). With probability \( \theta \), the bank captures a high return on assets and repays its depositors. With probability \( 1 - \theta \), the bank cannot repay its depositors and is dissolved by the regulator.

Banks choose \( r_i \) to maximize their expected discounted profits \( V = \sum_{t=0}^{T} \delta^t \pi \), in the limit as \( T \to \infty \). That is, a prudent lender maximizes \( V_p(r_i, r_{-i}, k, s) = \pi_p(r_i, r_{-i}, k, s)/(1 - \delta) \) and a gambler maximizes \( V_g(r_i, r_{-i}, k, s) = \pi_g(r_i, r_{-i}, k, s)/(1 - \delta \theta) \) with respect to \( r_i \).

2. Regulated Equilibrium

Having set \( r_i \) and collected deposits \( D(r_i, r_{-i}) \), a bank will gamble if \( V_g(r_i, r_{-i}, k, s) > V_p(r_i, r_{-i}, k, s) \), which can be written as follows:

\[
\pi_g(r_i, r_{-i}, k, s) - \pi_p(r_i, r_{-i}, k, s) > (1 - \theta) \delta V_p
\]

The bank will choose the gambling asset if the one-period rent from gambling is greater than the franchise value forgone if the gamble fails, times the probability of failure. This condition can be used to determine the critical interest rate \( \hat{r}(k, s) \) such that the bank will gamble if \( r_i > \hat{r}(k, s) \):

\[
\hat{r}(k, s) = \left[ (1 - \delta) \left( \frac{\alpha - \theta \gamma}{1 - \theta} \right) + \delta \alpha - \delta \rho \right] k + \left[ (1 - \delta) \left( \frac{\alpha - \theta \gamma}{1 - \theta} \right) + \delta \alpha \right] + s
\]

A bank that intends to make prudent loans will choose

\[
r_p(k, s) = \arg\max_{r_i} V_p(r_i, r_{-i}, k, s).
\]

For a symmetric equilibrium (i.e., \( r_i = r_{-i} = r_p \)), using the first-order condition \( \partial V_p/\partial r_i = 0 \), we have

\[
\mu_p(r_p, k, s) \frac{\partial D}{\partial r_i} + \frac{\partial \mu_p}{\partial r_i} D(r_p, r_p) = [\alpha (1 + k) - \rho k - r_p + s] \frac{\partial D}{\partial r_i} - D(r_p, r_p) = 0.
\]

Letting \( \varepsilon = (\partial D/\partial r_i)(r_i/D) \) denote the own-rate interbank elasticity of deposits, so that \( D/(\partial D/\partial r_i) = (r_i/\varepsilon) \), we have
\[ r_p(k, s) = [\alpha(1 + k) - \rho k + s]\left(\frac{\varepsilon}{1 + \varepsilon}\right), \] (1)

which is decreasing in \( k \), since \( \rho > \alpha \). Part of the cost of the binding capital requirement is passed on to depositors in the form of lower interest rates.

No prudent-lending equilibrium exists if \( r_p(k, s) > \hat{r}(k, s) \), since a bank that intends to choose the prudent asset when setting \( r_i = r_p \) then finds it more profitable to gamble. However, even when the bank would prefer the prudent asset given \( r_p \), the bank may still anticipate a profitable deviation to the gambling asset at a higher interest rate. In this case the bank sets \( r_i > r_p \) in order to expand deposits by stealing market share, and then switches its portfolio to the gambling asset.

To see the potential for profitable market-stealing deviations, consider

\[
\frac{dV_G}{dr_i} \bigg|_{r_i=r_p, r_i=r_p} = \left( \mu_G(r_p, k, s) \frac{\partial D}{\partial r_i} - \theta D(r_p, r_p) \right)/(1 - \delta \theta).
\]

Using the first-order condition for \( r_p \) to replace \( D(r_p, r_p) \) by \( \mu_p(r_p, k, s)(\partial D/\partial r_i) \), this can be written

\[
\frac{dV_G}{dr_i} \bigg|_{r_i=r_p, r_i=r_p} = (\mu_G(r_p, k, s) - \theta \mu_p(r_p, k, s))\left(\frac{\partial D}{\partial r_i}\right)/(1 - \delta \theta),
\]

which is strictly positive if \( \mu_G(r_p, k, s) > \theta \mu_p(r_p, k, s) \). If \( r_p(k, s) = \hat{r}(k, s) \), so that the bank is indifferent between gambling and prudent lending after having set \( r_p \), then

\[
\mu_G(r_p, k, s) = \mu_p(r_p, k, s)(1 - \delta \theta)/(1 - \delta),
\]

which is strictly greater than \( \theta \mu_p(r_p, k, s) \), since \( (1 - \delta \theta) > \theta (1 - \delta) \). Therefore, \( V_G \) is increasing in the deposit interest rate, and the bank will want to set \( r_i > r_p \) and switch its portfolio to the gambling asset.

It follows that profitable market-stealing deviations will exist also for some \( \hat{r}(k, s) > r_p(k, s) \), and the necessary and sufficient condition for a robust prudent-lending equilibrium is not

\[ V_p(r_p, r_p, k, s) \geq V_G(r_p, r_p, k, s), \]

equivalent to \( \hat{r}(k, s) \geq r_p(k, s) \), but rather the stronger condition

\[
V_p(r_p, r_p, k, s) \geq V_G(r_p, r_p, k, s),
\]
\[ V_p(r_p, r_p, k, s) \geq V_G(r_D, r_p, k, s), \] where \( r_D = \arg\max_{r_i} V_G(r_i, r_p, k, s) \) is the rate set by the bank anticipating a deviation to the gambling asset. Figure 1 illustrates the potential for market-stealing deviations when the capital requirement is \( \bar{k} \) such that \( \hat{r}(\bar{k}, s) = r_p(\bar{k}, s) \) and depicts the efficient prudent-lending equilibrium with a capital requirement of \( \bar{k} \) such that \( V_p(r_p, r_p, \bar{k}, s) = V_G(r_D, r_p, \bar{k}, s) \).

![Diagram of incentive for market-stealing deviations](image)

Figure 1. Incentive for market-stealing deviations

Notes: If the minimum capital requirement is \( \bar{k} \) such that \( \hat{r}(\bar{k}, s) = r_p(\bar{k}, s) \), then the highest attainable iso-profit curve, conditional on prudent lending, is denoted by \( \tilde{V}_p \). The iso-profit curve associated with a deviation to the gambling asset while keeping \( r_i = r_p \) is denoted by \( \tilde{V}_G \) and intersects \( \tilde{V}_p \) at \( \hat{r} \). The shaded region indicates profitable market-stealing deviations: With \( k \geq \bar{k} \) (profit maximization requires \( k = \bar{k} \)), the bank can find a higher iso-profit curve by increasing the deposit interest rate. The lowest minimum capital requirement that can implement a prudent-lending equilibrium is \( \bar{k} \). At \( \bar{k} \), the highest attainable iso-profit curve, conditional on prudent lending, is denoted by \( \tilde{V}_p \). A deviation to the gambling asset while keeping \( r_i = r_p \) leads to strictly lower profits. The highest attainable iso-profit curve under a deviation to the gambling asset conditional on \( k \geq \bar{k} \) is denoted by \( \tilde{V}_G \). The same level of profits is attained along both \( \tilde{V}_p \) and \( \tilde{V}_G \), as illustrated by their intersection at \( \hat{r} \).
It will be useful to define a critical value $\bar{k}(s)$ such that

$$V_p(r_p, r_p, \bar{k}(s), s) \equiv V_G(r_D, r_p, \bar{k}(s), s)$$  \hspace{1cm} (2)$$

to be the lowest level of capital financing consistent with prudent lending. In order for banks to choose the prudent asset if $k > \bar{k}(s)$ and the gambling asset if $k < \bar{k}(s)$, which is assumed to be the relevant case, $V_G(r_D, r_p, k, s)$ must decrease more rapidly than $V_p(r_p, r_p, k, s)$ with respect to $k$. That is, we need $dV_p/dk > dV_G/dk$. Taking the total derivative of $V_p(r_p, r_p, k, s)$ with respect to $k$, we have

$$\frac{dV_p}{dk} = \frac{\mu_p(r_p, k, s)}{1 - \delta} \left( \frac{\partial D}{\partial r_i} + \frac{\partial D}{\partial r_{-i}} \right) \frac{dr_p}{dk} - \left( \frac{dr_p}{dk} + \frac{\alpha - \rho}{\rho} \right) D(r_p, r_p).$$

Using the first-order condition for $r_p$ to replace $D(r_p, r_p)$ by $\mu_p(r_p, k, s)(\partial D/\partial r_i)$, this can be written

$$\frac{dV_p}{dk} = \frac{\mu_p(r_p, k, s)}{1 - \delta} \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{dk} - \frac{\partial D}{\partial r_i} \frac{\alpha - \rho}{\rho} \right).$$

In similar fashion, using the first-order condition for $r_D$ to replace $\theta D(r_D, r_p)$ by $\mu_G(r_D, k, s)(\partial D/\partial r_i)$, the total derivative of $V_G(r_D, r_p, k, s)$ with respect to $k$ can be written

$$\frac{dV_G}{dk} = \frac{\mu_G(r_D, k, s)}{1 - \delta \theta} \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{dk} - \frac{\partial D}{\partial r_i} \frac{\rho}{\theta - \gamma} \right).$$

From (1), we have $dr_p/dk = -(\rho - \alpha) \varepsilon/(1 + \varepsilon)$. Therefore, since $(\rho / \theta - \gamma) > (\rho - \alpha)$ and $\partial D/\partial r_i > -\partial D/\partial r_{-i}$, both $V_p(r_p, r_p, k, s)$ and $V_G(r_D, r_p, k, s)$ are strictly decreasing in $k$.$^8$ Then, using (2) to replace $\left( \frac{\mu_p(r_p, k, s)}{1 - \delta} \right) / \left( \frac{\mu_G(r_D, k, s)}{1 - \delta \theta} \right)$ by $D(r_D, r_p)/D(r_p, r_p)$ and rearranging,

$$\frac{\mu_p(r_p, k, s)}{1 - \delta} \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{dk} - \frac{\partial D}{\partial r_i} \frac{\rho - \alpha}{\rho} \right) > \frac{\mu_G(r_D, k, s)}{1 - \delta \theta} \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{dk} - \frac{\partial D}{\partial r_i} \frac{\rho}{\theta - \gamma} \right).$$

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$^8$ The inequality $(\rho - \alpha) (1 - \theta) + (\alpha - \theta \gamma) > 0$ follows from $\rho > \alpha > \theta \gamma$. Rearranging, we have $(\rho - \alpha) + (\alpha - \theta \gamma) = (\rho - \theta \gamma) > \theta (\rho - \alpha)$, which is equivalent to $(\rho / \theta - \gamma) > (\rho - \alpha)$. 

13
is equivalent to

\[
\left( \frac{\partial D}{\partial r_i} \left( \frac{\epsilon}{1 + \epsilon} (\rho - \alpha) + \frac{\partial D}{\partial r_i} (\rho/\theta - \gamma) \right) \right) > \left( \frac{\partial D}{\partial r_i} \left( \frac{\epsilon}{1 + \epsilon} \right) (\rho - \alpha) + \frac{\partial D}{\partial r_i} (\rho - \alpha) \right).
\]

Letting \( \eta \) represent the cross-rate interbank elasticity of deposits, this can be written

\[
\frac{\eta}{r_p} \left( \frac{\epsilon}{1 + \epsilon} \right) (\rho - \alpha) + \frac{\epsilon}{r_D} (\rho/\theta - \gamma) > \left( \frac{\eta}{r_p} \left( \frac{\epsilon}{1 + \epsilon} \right) + \frac{\epsilon}{r_p} \right) (\rho - \alpha). \quad (3)
\]

Although the elasticities \( \epsilon \) and \( \eta \) on the right-hand side are for \( r_i = r_{-i} = r_p \) and those on the left-hand side are for \( r_i = r_D \) and \( r_{-i} = r_p \), it is reasonable to assume that \( D(\cdot) \) is such that

\[
\frac{\epsilon}{r_p} + \frac{\eta}{r_p} \left( \frac{\epsilon}{1 + \epsilon} \right) \alpha > \frac{\epsilon}{r_D} + \frac{\eta}{r_D} \left( \frac{\epsilon}{1 + \epsilon} \right) \alpha \quad \text{(4)}
\]

for any constant \( \alpha \), with \( |\alpha| \leq 1 \), since own effects dominate cross effects and \( r_D > r_p \) from the market-stealing incentive. Therefore, in order for a higher minimum capital requirement to make the prudent asset more attractive relative to the gambling asset, the effect of \( (\rho/\theta - \gamma) > (\rho - \alpha) \) must dominate that of \( (\epsilon/r_p) > (\epsilon/r_D) \). Going forward, it is assumed that the elasticities \( \epsilon \) and \( \eta \) are both finite and that the conditions (3) and (4) both hold.\(^9\)

3. Uncompensated Deposit Subsidies

This section examines the potential for deposit subsidization to raise the equilibrium deposit interest rate and allow minimum capital requirements to be lowered without jeopardizing the prudent-lending equilibrium when the regulator bears the cost of the subsidy.

\(^9\) Dividing both sides of condition (3) by \( (\rho - \alpha) \), we obtain condition (4) with \( \alpha = 1 \) but with \( \epsilon/r_D \) multiplied by \( (\rho/\theta - \gamma)/(\rho - \alpha) > 1 \), which must be enough to reverse the direction of the inequality if increasing the minimum capital requirement is to improve prudential incentives for banks, which is assumed to be the relevant case. It is plausible for condition (4) to be satisfied with \( \alpha = 1 \) since \( \partial D/\partial r_i > -\partial D/\partial r_{-i} \) was assumed. The dominant effect of raising the own interest rate is surely to reduce \( \epsilon/r_i \), with secondary effects on \( \eta \) and \( \epsilon/(1 + \epsilon) \) possibly mitigating but not overcoming this primary effect. Any additional diminution of the cross-rate term, as by \( \alpha < 1 \), only strengthens the inequality.
The introduction of a subsidy shifts both \( \hat{r} \) and \( r_p \) upward, \( \hat{r} \) by the full vertical distance \( s \) (i.e. \( \hat{r}(k, s) = \hat{r}(k, 0) + s \)), and \( r_p \) by \( s\varepsilon/(1 + \varepsilon) \), as can be seen from the expressions derived in Section 2:

\[
\begin{align*}
\hat{r}(k, s) &= \hat{r}(k, 0) + s = \left[\gamma(1 + k) - \rho k + s\right]\left(\frac{\varepsilon}{1 + \varepsilon}\right) \\
r_p(k, s) &= \left[1 - \delta\right]\left(\frac{\alpha - \theta y}{1 - \theta}\right) + \delta\alpha\left(1 + k\right) - \delta\rho k + s.
\end{align*}
\]

Starting from a prudent-lending equilibrium without subsidization, the equilibrium deposit interest rate will rise with the introduction of the subsidy \( s \) by \( s\varepsilon/(1 + \varepsilon) \), and the new equilibrium will also involve prudent-lending. It follows that any equilibrium deposit interest rate can be implemented in a prudent-lending equilibrium by an appropriate subsidy. This result is stated formally in the following proposition:

**Proposition 1:** Fix a prudent-lending equilibrium involving capital requirement \( k_0 \) and no subsidy, so that the equilibrium deposit interest rate is \( r_p(k_0, 0) \). Then it is possible to implement a deposit interest rate \( r^* > r_p(k_0, 0) \) in a prudent-lending equilibrium with a deposit subsidy

\[
s = \left(r^* - r_p(k_0, 0)\right)(1 + \varepsilon)/\varepsilon.
\]

Proof: Keeping \( k_0 \) as the capital requirement, we want to set the subsidy, \( s \), such that \( r_p(k_0, s) = r^* \). Since the introduction of \( s \) causes \( r_p \) to rise by \( s\varepsilon/(1 + \varepsilon) \) when \( k \) is held constant, it can be seen that \( s \) must be set equal to \( (r^* - r_p(k_0, 0))(1 + \varepsilon)/\varepsilon \). All that is left is to check that the new equilibrium gives no bank an incentive to deviate to the gambling asset. Since \( k_0 \) was assumed to implement a prudent-lending equilibrium with \( s = 0 \), it will suffice to show that \( V_G(r_p, r_p, k_0, s) \), where \( r_p(k_0, s) = \arg\max_{r_p} V_G(r_i, r_p, k_0, s) \), does not increase disproportionately with \( s \), compared to \( V_p(r_p, r_p, k_0, s) \). That is, we need to verify that \( dV_p/ds \geq dV_G/ds \). The stronger result \( dV_p/ds > dV_G/ds \) follows from \( V_p(r_p, r_p, k_0, 0) \geq V_G(r_p, r_p, k_0, 0) \), the first-order condition for \( r_p \), and the assumption that condition (4) is satisfied. First we have
\[
\frac{dV_p}{ds} = \left[ \mu_p(r_p, k_0, s) \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{ds} + \frac{\partial D}{\partial r_{-i}} \frac{dr_p}{ds} \right) + \left( 1 - \frac{dr_p}{ds} \right) D(r_p, r_p) \right] / (1 - \delta). \tag{10}
\]

But the first-order condition for \( r_p \) implies \( \mu_p \frac{\partial D}{\partial r_i} = D(r_p, r_p) \), and we can write

\[
\frac{dV_p}{ds} = \mu_p(r_p, k_0, s) \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{ds} + \frac{\partial D}{\partial r_{-i}} \frac{dr_p}{ds} \right)\bigg|_{r_i = r_p}.
\]

Similarly, with \( r_D(k, s) = \operatorname{argmax}_{r_i} V_G(r_i, r_p, k, s) \), we have \( dV_G / ds \)

\[
= \left[ \mu_G(r_D, k_0, s) \left( \frac{\partial D}{\partial r_i} \frac{dr_D}{ds} + \frac{\partial D}{\partial r_{-i}} \frac{dr_D}{ds} \right) + \theta \left( 1 - \frac{dr_D}{ds} \right) D(r_D, r_p) \right] / (1 - \delta \theta).
\]

But the first-order condition for \( r_D \) implies \( \mu_G \frac{\partial D}{\partial r_i} = \theta D(r_D, r_p) \), and we can write

\[
\frac{dV_G}{ds} = \mu_G(r_D, k_0, s) \left( \frac{\partial D}{\partial r_i} \frac{dr_D}{ds} + \frac{\partial D}{\partial r_{-i}} \frac{dr_D}{ds} \right)\bigg|_{r_i = r_D}.
\]

We need to show

\[
\frac{\mu_p(r_p, k_0, s)}{1 - \delta} \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{ds} \right)\bigg|_{r_i = r_p} \geq \frac{\mu_G(r_D, k_0, s)}{1 - \delta \theta} \left( \frac{\partial D}{\partial r_i} \frac{dr_D}{ds} \right)\bigg|_{r_i = r_D}.
\]

For any \( s \) such that \( V_p(r_p, r_p, k_0, s) \geq V_G(r_D, r_p, k_0, s) \), we have

\[
\frac{\mu_p(r_p, k_0, s)}{1 - \delta} / \frac{\mu_G(r_D, k_0, s)}{1 - \delta \theta} \geq D(r_D, r_p) / D(r_p, r_p),
\]

and it will suffice to show

\[
D(r_D, r_p) / D(r_p, r_p) > \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{ds} \right)\bigg|_{r_i = r_D} / \left( \frac{\partial D}{\partial r_i} \frac{dr_p}{ds} \right)\bigg|_{r_i = r_p}
\]

which is equivalent to

\[\text{\footnotesize 10 Recall } \mu_p(r_p, k, s) = \alpha(1 + k) - r_p + s - \rho k \text{ and } \mu_G(r_D, k, s) = \theta[y(1 + k) - r_D + s] - \rho k.\]
\[
\frac{\left( \partial D + \frac{\partial D}{\partial r_p} \partial r_p \right)}{\partial r_i} \bigg|_{r_i=r_p} D(r_p, r_p) > \frac{\left( \partial D + \frac{\partial D}{\partial r_i} \partial r_i \right)}{\partial r_i} \bigg|_{r_i=r_D} D(r_D, r_p).
\]

The final inequality follows from (4). Finally, from the incentive compatibility of the initial equilibrium, we have \( V_p(r_p, r_p, k_0, 0) \geq V_G(r_D, r_p, k_0, 0) \), and the proposition is proved. □

The introduction of a subsidy also allows the capital requirement to be lowered while still implementing a prudent-lending equilibrium. The following proposition uses the critical value \( \bar{k}(s) \), defined by (2), and the earlier assumptions that the interbank deposit elasticities \( \epsilon \) (own-rate) and \( \eta \) (cross-rate) are finite and that conditions (3) and (4) both hold.

**Proposition 2:** \( \bar{k}(s) \) is strictly decreasing in \( s \).

**Proof:** Taking the total derivative on each side of (2) with respect to \( s \), we have

\[
\frac{dV_p}{ds} \bigg|_{\bar{k}} + \frac{dV_p}{dk} \frac{d\bar{k}}{ds} = \frac{dV_G}{ds} \bigg|_{\bar{k}} + \frac{dV_G}{dk} \frac{d\bar{k}}{ds},
\]

which implies that

\[
\frac{d\bar{k}}{ds} = \frac{\frac{dV_G}{ds}}{\frac{dV_p}{dk} - \frac{dV_G}{dk}},
\]

where \( (dV/ds)|_{\bar{k}} \) denotes the change in \( V \) with respect to \( s \) when \( k \) is held constant. In proving Proposition 1, condition (4) was used to show that \( dV_p/ds > dV_G/ds \) when \( k \) is held constant. From condition (3), we have \( dV_p/dk > dV_G/dk \), and it follows that \( d\bar{k}(s)/ds < 0 \). □

The mechanism behind Proposition 2 is that the subsidy promotes prudent lending by increasing the bank’s franchise value (the subsidy is not entirely passed on to depositors in the form of a higher deposit interest rate, since \( \epsilon < \infty \)). Since a bank that takes on greater risk of insolvency by choosing the
gambling asset does not fully realize this additional value, the rent the bank could capture by gambling can be allowed to rise without giving the bank incentive to switch its portfolio. In the next section, we will see that this incentive effect does not depend on a net transfer of value from the regulator to the bank. Subsidization promotes prudent lending even if the bank compensates the regulator for the cost of the subsidy with an upfront payment.

4. Compensated Deposit Subsidies

This section analyzes the effect of deposit subsidies when the regulator is compensated for the cost of the subsidy by upfront fees paid by recipient banks. The bank pays $s/(1 - \delta)$ per unit of current deposits upon the introduction of the subsidy and per unit of new deposits thereafter. The regulator makes symmetrical refunds to banks when deposits fall.

The franchise value of the bank, net of prepayment and conditional on prudent lending, is now

$$
(\alpha(1 + k) - r + s - \rho k)D(r_i, r_{-i})/(1 - \delta) - sD(r_i, r_{-i})/(1 - \delta)
$$

$$
= (\alpha(1 + k) - r - \rho k)D(r_i, r_{-i})/(1 - \delta) = V_p(r_i, k, 0).
$$

The net effect of the subsidy on franchise value is nil. Consequently, a bank that intends to make prudent loans will set the same deposit interest rate regardless of the level of subsidy. To see this, consider a bank that has set $r_i = r_p(k, 0)$ and collected deposits $D(r_p, r_p)$ in a symmetric equilibrium. At the time the subsidy is introduced, the bank immediately pays $D(r_p, r_p)s/(1 - \delta)$ and then contemplates resetting $r_i$:

$$
\frac{dV_p}{dr_i} \bigg|_{r_i=r_{-i}=r_p} = \left(\frac{\alpha(1 + k) - r_p + s - \rho k}{1 - \delta}\right) \left(\frac{\partial D}{\partial r_i}\right) - \frac{D(r_p, r_p)}{1 - \delta} - \left(\frac{s}{1 - \delta}\right) \left(\frac{\partial D}{\partial r_i}\right)
$$

$$
= \left(\frac{\alpha(1 + k) - r_p - \rho k}{1 - \delta}\right) \left(\frac{\partial D}{\partial r_i}\right) - \frac{D(r_p, r_p)}{1 - \delta} = 0,
$$

using the first-order condition for $r_p(k, 0)$, so there is no incentive to adjust the rate.
After the rate is set and deposits are taken, the prepayment is treated as a sunk cost in deciding between the prudent and gambling assets. Therefore the critical interest rate at which gambling becomes profitable, taking the interest rate as given, is unaffected by prepayment. As with uncompensated subsidization, the critical rate increases by the full amount of the subsidy: \( \hat{r}(k, s) = \hat{r}(k, 0) + s \). Since \( r_p(k) \) does not shift, there is no immediate effect on the equilibrium deposit interest rate, but the upward shift in \( \hat{r} \) allows \( k \) to be lowered without jeopardizing the prudent-lending equilibrium (a claim that will be proved below), and lowering the capital requirement raises the equilibrium deposit interest rate.

To see the effect of compensated subsidization on the incentive for market-stealing deviations, consider the no-gambling condition when the prepayment has been sunk, but the expansion of deposits by increasing the deposit interest rate from \( r_p \) to \( r_D \) would require an additional immediate payment of \( s/(1 - \delta) \) times the resultant increase in deposits:

\[
V_p(r_p, r_D, k, s) \geq V_C(r_D, r_p, k, s) - \left( \frac{s}{1 - \delta} \right) \left( D(r_D, r_p) - D(r_p, r_p) \right),
\]

or

\[
\left\{ \frac{\alpha(1 + k) - r_p + s - \rho k}{1 - \delta} \right\} D(r_p, r_p) \geq \left\{ \frac{\theta [\gamma(1 + k) - r_D + s] - \rho k}{1 - \delta \theta} \right\} D(r_D, r_p) - \left( \frac{s}{1 - \delta} \right) \left( D(r_D, r_p) - D(r_p, r_p) \right).
\]

By rearranging, we can see that this condition also describes the decision facing a bank that has not yet taken deposits or paid any upfront fee, a potential entrant for instance, that is deciding whether to enter as a prudent lender or as a gambler:

\[
V_p(r_p, r_D, k, 0) \geq V_C(r_D, r_p, k, s) - \left( \frac{s}{1 - \delta} \right) D(r_D, r_p),
\]

or

\[
\left\{ \frac{\alpha(1 + k) - r_p - \rho k}{1 - \delta} \right\} D(r_p, r_p) \geq \left\{ \frac{\theta [\gamma(1 + k) - r_D] - \rho k - s (\frac{1 - \theta}{1 - \delta})}{1 - \delta \theta} \right\} D(r_D, r_p).
\]
In either situation, the value of an incremental increase in the deposit rate from \( r_p \), either when entering or when contemplating a switch to the gambling asset, conditional on prudent lending by all other institutions, is the same:

\[
\frac{dV_C}{dr_i} \bigg|_{r_i=r_p} = \frac{\{\theta[y(1+k) - r_p + s] - \rho k\} \left( \frac{\partial D}{\partial r_i} \right) - \theta D(r_p, r_p)}{1 - \delta \theta} - \left( \frac{s}{1 - \delta} \right) \left( \frac{\partial D}{\partial r_i} \right)
\]

Since this expression is decreasing in \( s \), the compensated subsidy reduces the incentive for market-stealing deviations, other things being held equal.\(^{11}\)

As we have seen, compensated subsidization leaves both the franchise value and the value of incremental changes in the deposit interest rate unaltered for a prudent lender, and it lowers both the present value of riskier lending behavior and the marginal value of market-stealing deviations to riskier portfolios. Driving these effects is that gambling strategies take on greater insolvency risk, lowering the present value of fixed annuities like the subsidy, so that the upfront fee cannot be fully recouped under a riskier investment strategy. The compensated subsidy thus places a quasi-speed limit on the expansion of deposits that precedes the optimal deviation to riskier lending strategies without interfering with the expansion of deposits by prudent lenders as an explicit speed limit would.

Finally, we can see that the compensated subsidy allows the capital requirement to be lowered without adversely affecting portfolio choice. Again it will be useful to define a critical level of capital, \( \bar{k}(s) \) say, to be the lowest level of capital financing consistent with prudent lending. Under the compensated subsidy, \( \bar{k}(s) \) is defined such that

\(^{11}\) The compensated subsidy can reduce but cannot eliminate the incentive for market stealing deviations. As it was in the case of uncompensated subsidization, \( r_p \leq \bar{r} \) is also insufficient to implement a prudent-lending equilibrium under compensated subsidization. Details are provided in the appendix.
\[
\left( \frac{\bar{\mu}_p}{1 - \delta} \right) D(r_p, r_p) \equiv \left( \frac{\bar{\mu}_G}{1 - \delta \theta} \right) D(r_D, r_p), \quad (5)
\]

where \( \bar{\mu}_p = \alpha \left( 1 + \bar{k}(s) \right) - r_p - \rho \bar{k}(s) \), and \( \bar{\mu}_G = \theta \left[ \gamma \left( 1 + \bar{k}(s) \right) - r_D \right] - \rho \bar{k}(s) - s \frac{(1 - \theta)}{1 - \delta} \), and the first-order conditions for \( r_p \) and \( r_D \) imply the following equalities:

\[
\bar{\mu}_p \left( \frac{\partial D}{\partial r_i} \right) = D(r_p, r_p) \quad (6)
\]

\[
\bar{\mu}_G \left( \frac{\partial D}{\partial r_i} \right) = \theta D(r_D, r_p) \quad (7)
\]

We can now present the following proposition:

**Proposition 3**: \( \bar{k}(s) \) is strictly decreasing in \( s \).

**Proof**: Taking the total derivative on each side of (5) with respect to \( s \), and using (6) and (7) to replace \( D(r_p, r_p) \) and \( \theta D(r_D, r_p) \), and since \( \partial r_p / \partial s = 0 \), we have

\[
\left( \frac{\bar{\mu}_p}{1 - \delta} \right) \left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_p}{\partial k} \right) - (\rho - \alpha) \left( \frac{\partial D}{\partial r_i} \right) \left( \frac{d\bar{k}}{ds} \right) \equiv \left( \frac{\bar{\mu}_G}{1 - \delta \theta} \right) \left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_p}{\partial k} \right) - (\rho - \gamma) \left( \frac{\partial D}{\partial r_i} \right) \left( \frac{d\bar{k}}{ds} \right) - \left( \frac{1 - \theta}{\theta} \right) \left( \frac{1}{1 - \delta} \right).
\]

Rearranging, we have

\[
\left( \frac{d\bar{k}}{ds} \right) = -\left( \frac{\bar{\mu}_G}{1 - \delta \theta} \right) \left( \frac{1 - \theta}{\theta} \right) \left( \frac{1}{1 - \delta} \right) \left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_p}{\partial k} \right) - (\rho - \alpha) \left( \frac{\partial D}{\partial r_i} \right) \left( \frac{d\bar{k}}{ds} \right) - \left( \frac{1 - \theta}{\theta} \right) \left( \frac{1}{1 - \delta} \right).
\]

Since the numerator is strictly negative, we have only to show that

\[
\left( \frac{\bar{\mu}_p}{1 - \delta} \right) \left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_p}{\partial k} \right) - (\rho - \alpha) \left( \frac{\partial D}{\partial r_i} \right) > \left( \frac{\bar{\mu}_G}{1 - \delta \theta} \right) \left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_p}{\partial k} \right) - (\rho - \gamma) \left( \frac{\partial D}{\partial r_i} \right).
\]
Given (5), this inequality is equivalent to

\[
\frac{\left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_{k}}{\partial k} \right) - (\rho - \alpha) \left( \frac{\partial D}{\partial r_{i}} \right)}{D(r_{p}, r_{p})} > \frac{\left( \frac{\partial D}{\partial r_{-i}} \right) \left( \frac{\partial r_{p}}{\partial k} \right) - (\rho - \gamma) \left( \frac{\partial D}{\partial r_{i}} \right)}{D(r_{D}, r_{p})}.
\]

This inequality is equivalent to (3), which was assumed to hold. ■

The proposition implies that a fully compensated subsidy sets up for a Pareto improvement: If the bank and the regulator apply the same discount factor, the subsidy alone leaves the bank and the regulator indifferent, but because of its incentive effect the subsidy allows minimum capital requirements to be lowered without destroying the prudent-lending equilibrium. The lower capital requirement reduces costs for banks—the shadow cost of the binding capital requirement. Part but not all of this cost reduction is passed on to depositors in the form of higher deposit interest rates, leaving banks and depositors both strictly better off.

5. Conclusion

The aim of this paper has been to show how deposit subsidies may be usefully incorporated into prudential regulatory schemes. The paper builds upon the substantial foundation of Thomas Hellmann, Kevin Murdock, and Joseph Stiglitz (2000) to show how the introduction of a deposit subsidy can, by increasing banks’ franchise value, lead to more efficient outcomes compared to regulatory schemes that rely on capital requirements.

Two cases have been considered: In the case of uncompensated subsidization, the deposit insurer bears the cost of the subsidy. Part of the subsidy is passed on to depositors in the form of higher equilibrium deposit interest rates and the balance increases franchise value, which improves prudential incentives for banks. In the case of compensated subsidization, the cost of the subsidy is paid upfront by the recipient banks. This policy has no direct effect on equilibrium deposit interest rates, conditional on
prudent lending, but the value of market-stealing deviations to riskier lending practices is reduced, again improving prudential incentives for banks.

Both compensated and uncompensated subsidization can be implemented through the management of deposit insurance funds. An uncompensated subsidy is identified with a reduction in deposit insurance premiums, which would transfer value from the deposit insurance fund to banks and lead to higher equilibrium deposit interest rates and greater prudential incentive for banks. A compensated subsidy is functionally the same as prepayment of deposit insurance assessments. Using the appropriate discount factor to determine the upfront fee, prepayment would have no immediate effect on interest rates but would improve prudential incentive for banks. In particular, prepayment would reduce the incentive for market-stealing deviations, imposing a quasi-speed-limit on the expansion of deposits that precedes the optimal deviation to riskier lending practices without interfering with the expansion of deposits to finance prudent lending.

The general recommendation for the management of deposit insurance funds is to front-load transfers from banks to the fund, replacing quarterly assessments by upfront payments of equal present value to the greatest practical extent, and to annuitize transfers from the fund to banks rather than paying dividends all at once. If it is desirable (or mandated, as in the provision of Dodd-Frank) to immediately reduce deposit insurance fund balances, perpetual interest-free loans from the fund to banks in amounts tied to the volume of deposits mobilized are preferable to dividends from the standpoint of prudential regulation.

The only major informational burden being the determination of the appropriate discount factor in setting the upfront fee, subsidization arguably meets the standard for robustness set forth by Patrick Honohan and Joseph Stiglitz (2001): The policy places minimal informational and enforcement burdens on the regulator and possesses “both the ability to cope with a variety of failure-inducing circumstances and behavior and a deliberate lack of subtlety in method.”
Appendix

The compensated subsidy can reduce but cannot eliminate the incentive for market stealing deviations. As it was in the case of uncompensated subsidization, \( r_p \leq \hat{r} \) is also insufficient to implement a prudent-lending equilibrium under compensated subsidization. To see that there is still the potential for profitable market-stealing deviations when \( r_p = \hat{r} \), so that still \( r_D > r_p \), we can see by the following steps that \( \left( \frac{dV_G}{dr_i} \right)_{r_i=r_{-i}=r_p} > 0 \) when the bank is indifferent between assets after having set \( r_i = r_p \) and made the upfront payment. First,

\[
\frac{dV_G}{dr_i} \bigg|_{r_i=r_{-i}=r_p} = \left( \frac{\mu_p(r_p, k, s) \frac{\partial D}{\partial r_i} - \theta D(r_p, r_p)}{1 - \delta} \right) - \frac{s}{1 - \delta} \left( \frac{\partial D}{\partial r_i} \right)
\]

can be written as follows after using the first-order condition for \( r_p \) to replace \( D(r_p, r_p) \) by \( \mu_p(r_p, k, 0) (\partial D / \partial r_i) \) and combining terms involving \( s \):

\[
\frac{dV_G}{dr_i} \bigg|_{r_i=r_{-i}=r_p} = \left\{ \theta [\gamma(1 + k) - r_p] - \rho k - s \left( \frac{1 - \theta}{1 - \delta} \right) - \theta [\alpha(1 + k) - r_p - \rho k] \right\} \left( \frac{\partial D}{\partial r_i} \right) / (1 - \delta \theta).
\]

This expression is strictly positive if and only if

\[
\theta [\gamma(1 + k) - r_p] - \rho k - s \left( \frac{1 - \theta}{1 - \delta} \right) > \theta [\alpha(1 + k) - r_p - \rho k]. \quad (I)
\]

But if the bank is indifferent between the prudent and gambling assets after paying the upfront fee, then

\[
\left\{ \frac{\alpha(1 + k) - r_p + s - \rho k}{1 - \delta} \right\} = \left\{ \frac{\theta [\gamma(1 + k) - r_p + s] - \rho k}{1 - \delta \theta} \right\},
\]

which is equivalent to \( \theta [\gamma(1 + k) - r_p] - \rho k - s \left( \frac{1 - \theta}{1 - \delta} \right) = \left( \frac{1 - \delta \theta}{1 - \delta} \right) \mu_p(r_p, k, 0) \).

Feeding this expression into (I) and dividing through by \( \mu_p(r_p, k, 0) \), the inequality is obvious, since \( (1 - \delta \theta) > \theta(1 - \delta) \).
References


