BRUSSELS ECONOMIC REVIEW-CAHIERS ECONOMIQUES DE BRUXELLES
VOL. 56(3/4) AUTUMN-WINTER 2013

THE INVISIBLE HAND AND THE BANKING TRADE: SEIGNIORAGE, RISK-SHIFTING, AND MORE[*]

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ABSTRACT:
The classic Diamond-Dybvig model of banking assumes perfect competition and abstracts from issues of moral hazard. To reflect conditions prevailing in UK banking, however, we incorporate market power and risk-taking by banks with limited liability, with explicit analytical results for the case where depositors are highly risk averse. We show how the effectiveness of bank franchise value in checking risk-taking may be undermined by the prospect of bailouts; and how bail-in provisions are being designed to correct this.

JEL CODES: E41, E58, G21, G28.

KEYWORDS: Money and banking, Seigniorage, Risk-taking, Bailouts, Regulation.

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[*] Acknowledgments: We are most grateful for comments received from Douglas Diamond as discussant when the paper was presented at the University of Poitiers Conference, June 2013; and to two journal referees for their constructive suggestions. The paper has also benefited from discussions with colleagues Ken Binmore, Herakles Polemarchakis, Thijs van Rens and Michael McMahon; and with Oliver Bush, Chuan Du, Dmitry Kuvshinov, David Miles and Kallol Sen at the Bank of England. Thanks are due to Han Xu and Katie Roberts for research assistance, funded by ESRC Centre for the Competitive Advantage in the Global Economy.
We are grateful to the Bank of England for the opportunity to revise the paper as Houblon-Norman Fellows. We remain responsible for all errors; and the views expressed are those of the authors and do not represent those of the Bank of England or the Monetary Policy Committee.
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'There are few ways a man may be more innocently employed than in getting money.' Samuel Johnson (1775)

INTRODUCTION

The quotation above, from a letter of Samuel Johnson to his printer, was penned shortly before Adam Smith published the metaphor of the Invisible Hand. It seems to express the same sentiment --- that the pursuit of profit may be good for economic welfare. Adam Smith famously cited the butcher, the brewer and the baker to make his point that competitive market forces will benefit the consumer. Should the same logic not apply to the banker?

To judge from the textbooks, it should. In the classic paper by Diamond and Dybvig (1983), for example, it is shown how banks can provide liquidity insurance to depositors while at the same time providing finance for longer term investors; and how the magic of maturity transformation, which raises the expected utility of all depositors, can be achieved under a zero profit constraint[1]. In his memorial lecture at Adam Smith's birthplace in Scotland, Alan Greenspan (2005), then Chairman of the Federal Reserve System, suggested that the Invisible Hand also applied to finance and spoke in favour of financial deregulation. For, during the era known as the Great Moderation, monetary authorities in both the US and the UK had come to practise 'light touch' or self-regulation in banking and finance.

As Stiglitz (2012) argues in *The Price of Inequality*, however, a less benign view of the operations of financial markets and banks is called for in the light of the subsequent 'North Atlantic' financial crisis, involving not only the US and the UK but many other countries, including Iceland and Ireland whose economies were ravaged by losses in banking.

In this spirit, we modify the model of Diamond and Dybvig to include *monopoly* and *excess risk-taking*[2]. To analyse imperfect competition, we treat the two-asset, Diamond-Dybvig model as a representative bank. Introducing pricing power vis-à-vis depositors, with only one bank, allows for a comparison of monopoly with competition, where monopoly profits constitute the 'seigniorage' collected by private banks who have the licence to create money. We then add risky payoffs to the longer term asset, in the form of a mean-preserving spread; and examine the incentives to take on such risk under monopoly and competition, with varying levels of regulatory capital.

Excess risk-taking is used to symbolise the problems of 'moral hazard' in an industry where bankers can act in this way without depositors being aware of what is being done with their money. That there are no bank runs in response to such risk-taking (nor risk premia on deposit rates) is because our model, like that of Cordella and Yeyati (2003), applies to insured deposits. An alternative - and less

[1] Deposit banking is, of course, subject to the risk of coordination failure (in the form of bank runs); but this can be handled by a Lender of Last Resort or by deposit insurance, as the authors point out.

[2] Marini (2003) has extended Diamond and Dybvig (1983) model to allow returns on the long assets to be stochastic. However, such risk is common knowledge to all players and there is no option for the bank to choose a safe technology, so moral hazard is not an issue.

flattering - characterisation of the moral hazard problem is that offered by Gertler et al. (2010) and Gertler and Karadi (2012), where the hidden action taken by bank managers is simply to divert profits for their own private benefit[3].

It has been argued in the literature, in Hellmann et al. (2000) for example, that bank profits may have the beneficial side effect of checking moral hazard: the prospect of losing their banking licences inhibits excess risk-taking by big banks who see themselves as *Too Big To Gamble*. This optimistic line of reasoning is, we believe, seriously flawed insofar as it ignores the leverage that large banks can exert on society to provide bailouts.

If the market power that yields seigniorage also means that the bank is *Too Big to Fail*, then it may exacerbate rather than cure excess risk-taking[4]. Cordella and Yeyati (2003) explore conditions when bailouts can have the opposite effect, namely when they are triggered by exogenous factors such as war or earthquakes. To reduce risk-taking, however, the guarantee of bailouts in such circumstances has to be balanced by banning them for commercial failure. The bailout policy specified below has no such beneficial conditioning. If parameters of the risks being taken can be concealed, moreover, prudential banking may be threatened not only by market power but also by 'gaming' the regulator.

The paper proceeds as follows. Section 1 provides a brief review of the high concentration and profitability characteristic of recent UK banking; then, in Section 2 we use a graphical exposition of the Diamond-Dybvig model - and a focus on a monopoly bank - to show how restricted competition allows banks to raise profits and collect seigniorage by restricting the supply of liquidity.

The incentive for risk-shifting due to limited liability is discussed in Section 3; and the case where depositors are extremely risk-averse (so have a high demand for bank-supplied liquidity) is used to illustrate the notion that banks may be Too Big To Gamble[5] because the incentive to play safe (so as to keep one's licence) checks the temptation to take on excess risk. The role of regulatory capital in checking risk-taking by adding 'skin in the game', is also analysed, both in perfect competition and as a complement to monopoly profit.

In Section 4 we discuss how bailout prospects that effectively insure the banking licence can undermine prudence, so greatly increased regulatory capital will be required as banks become Too Big To Fail; and we use a calibrated example to illustrate. (Noss and Sowerbutts, 2012 have used empirical methods to estimate the option value of bailout prospects for UK banks.) The section ends with an account of how, by arranging for banks to be bailed-in, the special resolution procedures being put in place after the crisis are designed to offset these moral hazard effects.

[3] i.e. there is 'looting', to use the terminology of Akerlof and Romer (1993).
[4] In 2008, for example, a UK High Street bank tried to buy Lehman Brothers New York before bankruptcy (a gamble that was blocked at the last minute by the Chancellor of the Exchequer).
[5] Numerical examples are provided of low and high risk-taking that call for regulatory capital requirements analogous to those proposed by Miles et al. (2012).

In Section 5, we argue heuristically that, when regulatory capital is plotted against market concentration, opposing effects of market power will produce a U-shaped prudential frontier. That this can be 'gamed' by concealing risks – at considerable cost to the taxpayer – is, we believe, a key factor driving current efforts at regulatory reform, whose key elements are briefly discussed.

The impact that monopoly profits, augmented by excess risk-taking, can have on income inequality is illustrated using Lorenz curves in Section 5.

1. Some Key Features of UK Banking

Historically, UK bank balance-sheets were, in aggregate, worth about half of one year's national output. But banking has grown much faster than GDP in recent times, to about twice GDP by 1988 and five times by 2008 (Haldane et al. 2010, p. 84). The key players are universal banks which combine Retail & Commercial banking with Wholesale & Investment activities; and the industry is highly concentrated. This is especially true of the retail and commercial sector where the top five banks account for almost 85% of current accounts, 82% of residential mortgages and handle 91% of the customers from Small and Medium Enterprises (ICB 2011, pp.21-22).

The increase in balance sheets described above was accompanied by a dramatic rise in measured value added, especially profits. For 30 years after World War II, financial intermediation accounted for around 1.5% of economy wide profits on average: but by 2008, its share of profits had risen to 15%. Those in the industry argued that this resulted from financial innovation and financial engineering; and, since the doubling of leverage from the late 1990s until just before the crisis was accompanied by a halving of the fraction of risk-weighted assets, it seemed plausible that banks were expanding their business and profits without taking excessive risk. But subsequent developments suggest otherwise[6].

As Vickers (2011, p. 2) remarked: "One of the roles of financial institutions and markets is efficiently to manage risks. Their failure to do so – and indeed to amplify rather than absorb shocks from the economy at large – has been spectacular." Two insolvent UK mortgage banks had to be nationalised; and two universal banks were bailed-out with taxpayers' money. Capital support provided by the Treasury totalled £70 b (5% of GDP) by the end of 2009; and these operations were accompanied by Quantitative Easing (bond purchases) to the tune of £200b (14% of GDP) by the Bank of England. Adding in other measures, such as guarantees and collateral swaps, Alessandri and Haldane (2009, p. 24) calculate that total emergency financial support provided by the Central Bank and the Treasury amounted to almost three quarters of one year's GDP!

[6] The reader is referred to Haldane et al. (2010, p.89) for discussion of how UK banks appear to have 'gamed' the weights intended to measure the risk on assets in their portfolios; and to Allen and Gale (2007), Chapter 9 for the asset price implications of agency problems of this kind.

2. ADDING SEIGNIORAGE AND GAMBLING TO A CLASSIC MODEL OF BANKING

In their classic model of banking, Diamond and Dybvig (1983) focus on the efficiency of banks in providing liquidity insurance to customers; and, in its basic form, banks are assumed to be perfectly competitive and free of moral hazard problems. This is where we start, before looking at the profits that may be collected by a monopoly bank. By analogy with the 'seigniorage' that the state derives from its monopoly in supplying notes and coin, this revenue flow will be referred to as private seigniorage.

For convenience we proceed diagrammatically, using Figure 1 where the axes measure early and late consumption[7]. The indifference curve shows the expected utility of consumers who have to decide how to invest their initial endowment before they discover their 'type' - whether they will be 'early consumers' or 'late consumers'[8] . The investment options for banks that take consumer endowments as deposits are either to invest in a *short-term* asset (cash), which has a payoff of 1 available either in period 1 or in period 2, but not both; or in a *long-term* asset, which has a higher payoff of $R > 1$, but this is only available in period 2. The outside option, upon which banks must improve if they are to attract risk-averse depositors, is the so-called *no-banking equilibrium* at point N, where agents initially hold short and long assets (in proportions that reflect known population parameters) and then trade with each other when they discover their type. (See Allen and Gale, 2007, Chapter 3, for fuller discussion.)

Can banks improve on what is otherwise available? The resource constraint passing through line N indicates the combinations of early and late consumption which banks can provide while satisfying the No-Profit Constraint of perfect competition[9]. Clearly, the more early consumption they offer the less the bank can invest in the long-term asset.

In the *competitive equilibrium* at point C*,* where the Consumers' Offer Curve[10] intersects the No-Profit Constraint, the provision of liquidity insurance by the banks improves on the outside option by offering extra first period consumption, at the cost of less long-term investment[11]. When consumers are sufficiently risk averse, the competitive equilibrium C clearly improves upon the outside option N as the deposit contract provides smoother consumption for the typical depositor.

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7 A more formal treatment is however available in Miller et al. (2013), where varying degrees of risk aversion and of concentration are also examined.

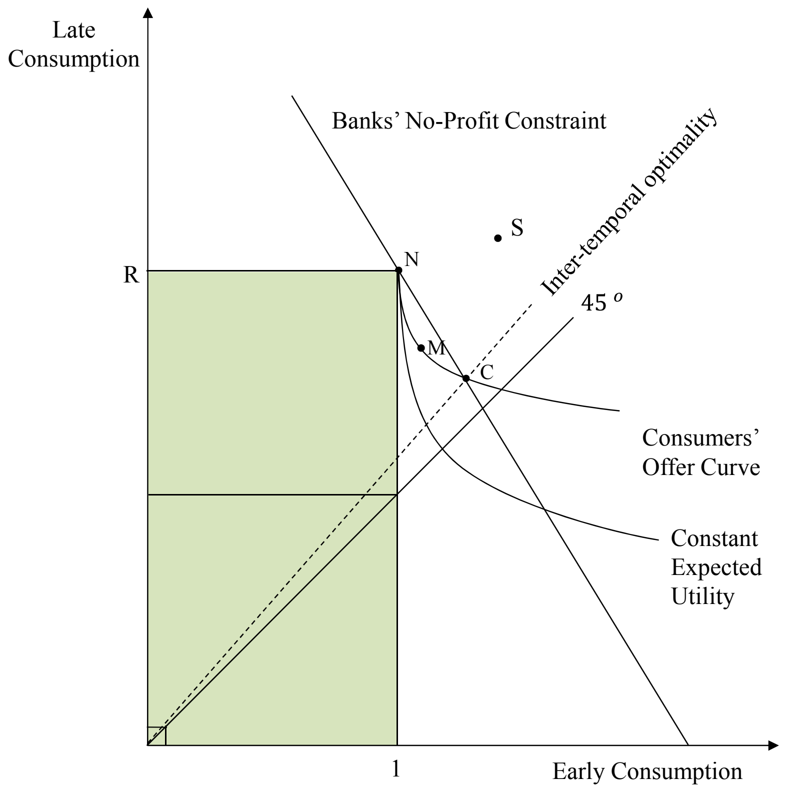
8 They are assumed, however, to know the probability of being one or other type.

9 With competition, late consumers receive all payoffs from the long-term investment of funds not held in cash for early consumers: but this will not be true with imperfect competition.

10 Indicating the ex ante choice between early and late consumption at different interest rates, i.e. points at which lines of different slopes emanating from N are tangent to the indifference curves.

11 As indicated, the competitive equilibrium satisfies the condition for inter-temporal optimality (i.e. the interest rate matches the ratio of marginal utility of consumption at different dates).

FIGURE 1. BANKS AS PROVIDERS OF LIQUIDITY: MONOPOLY VS. PERFECT COMPETITION



By contrast, the point selected by a *monopoly bank* is at point M on the Offer Curve where profits are at a maximum. As the monopolist raises the cost of liquidity insurance, equilibrium at M fails to satisfy the condition for Intertemporal Optimality: so, as can be seen from the Figure, there is less smoothing of consumption than under competition[12]. In addition, with some of the returns on long-term investments retained as monopoly profit, consumption possibilities now lie below the No-Profit Constraint; and the 'transfer' involved will further reduce consumer welfare. Bank shareholders will, however, benefit from the 'seigniorage' profit collected by the bank, as is indicated by their consumption point S lying well above the No-Profit Constraint[13]. Capitalising such profits gives the 'franchise value' of the licence to operate a monopoly bank.

The offer curve in Figure 1 implicitly gives the demand for liquidity supplied by commercial banks. In what follows, we derive the "demand for money" explicitly; and use it to show how seigniorage is collected by private banks.

[12] The distortionary effect of monopoly pricing on the demand for liquidity is also shown in Figure 2.
[13] The effect of monopoly banking on the income distribution is discussed further in Section 6.

Using the notation of Allen and Gale, we start with a monopoly bank that can set the effective price of liquidity $\tilde{R}$ so as to affect depositors demand for liquidity $c_1 - 1$ (where c_1 represents the early consumption in the deposit contract offered by the monopoly bank and 1 is the early consumption available as an outside option). Since the actual interest rate on long term investment is *R,* the profit of the monopoly bank will be

$$\pi = \lambda(\tilde{R} - R)(c_1 - 1) \qquad (1)$$

$$= \lambda\tilde{R}(c_1 - 1) - \lambda R(c_1 - 1)$$

where the first term indicates the revenue to the bank obtained by raising the "price" to $\tilde{R}$, and the second indicates the cost of holding cash reserves to meet the requirements for early consumers. (For detailed derivation, see Annex.)

Assuming CRRA utility with risk aversion $\gamma > 1$, the demand function of depositors can be written as

$$c_1 - 1 = \frac{R - \tilde{R}^{1/\gamma}}{\tilde{R}^{1/\gamma} + \frac{\lambda}{1-\lambda}\tilde{R}} \equiv f(\tilde{R}), R \leq \tilde{R} \leq R^{\gamma}; \qquad (2)$$

And, given $R \leq \tilde{R} \leq R^{\gamma}$, the demand function is downward-sloping in $\tilde{R}$, i.e., $f'(\tilde{R}) < 0$.

Under perfect competition equilibrium is reached when the price of liquidity is equal to the 'marginal cost' so $\tilde{R} = R$, and

$$c_1^c - 1 = \frac{R - R^{1/\gamma}}{R^{1/\gamma} + \frac{\lambda}{1-\lambda}R}. \qquad (3)$$

which corresponds to point C in the Figure.

What if the supply is restricted under conditions of imperfect competition? Consider specifically the case of a monopolist who sets the effective price of liquidity $\tilde{R}$ so as to maximise profits, i.e. maximises (1) subject to (2). This yields the first order condition (FOC)

$$\lambda\left[\left(\tilde{R} - R\right) + \frac{\partial\tilde{R}}{\partial c_1}(c_1 - 1)\right] = 0$$

Hence we may write: $\tilde{R} - R + \frac{c_1 - 1}{\partial c_1/\partial\tilde{R}} = 0$

and so

$$\tilde{R} - R + \frac{c_1 - 1}{f'(\tilde{R})} = 0 \qquad (4)$$

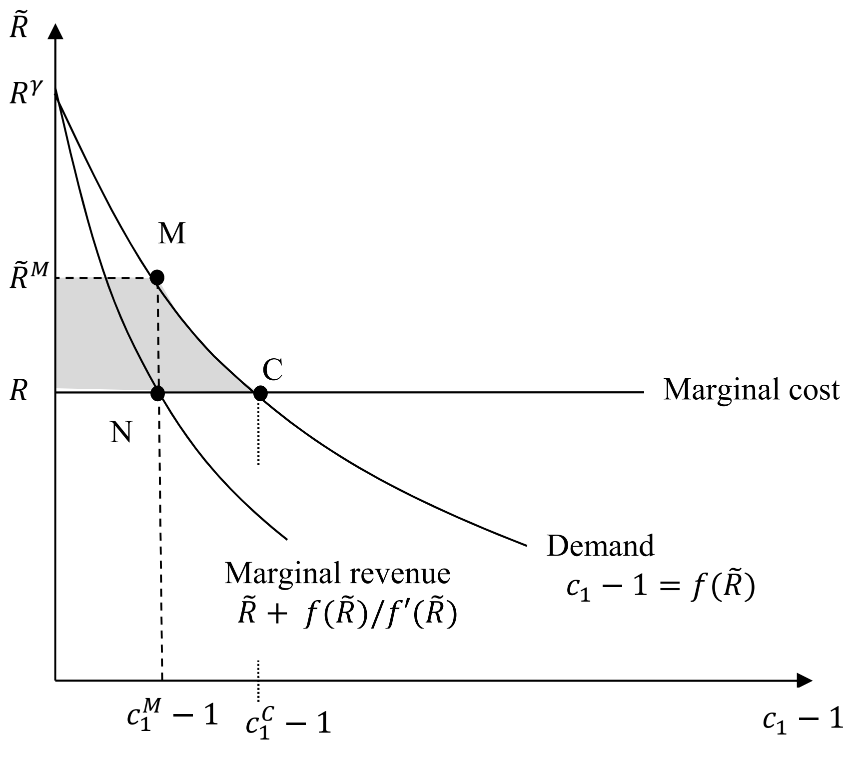
where the last term on the left hand of in (4) reflects the fact that the bank takes into account that price adjustment can affect demand for liquidity.

Replacing $c_1 - 1$ in (4) using (2), one obtains the condition that MR = MC:

$$\tilde{R} + \frac{f(\tilde{R})}{f'(\tilde{R})} = R \quad . \tag{5}$$

Note that for $R \le \tilde{R} \le R^{\gamma}$, $f'(\tilde{R}) < 0$; so clearly the price of liquidity under monopoly $\tilde{R}^M$, the solution to (5), must lie above R. This is illustrated in Figure 2 below which shows how the demand for liquidity, measured by $c_1 - 1$, declines as the effective price of liquidity $\tilde{R}$ rises. So as the price of liquidity rises from R to $\tilde{R}^M$, the demand falls from competitive equilibrium from C to M.

FIGURE 2. THE DEMAND FOR MONEY AND THE FLOW OF PRIVATE SEIGNIORAGE



The shaded area in the Figure shows the consequent loss of consumer surplus due to monopoly: which can be decomposed into the *deadweight loss*, indicated by the 'Harberger triangle' MNC; and the *transfer* from consumer to monopolist, indicated by the quadrilateral R NM $\tilde{R}^M$ in the Figure. The latter, measured as $\lambda(\tilde{R}^M - R)(c_1^M - 1)$ where λ indicates the fraction of the population needing liquidity, is the flow of 'seigniorage' accruing to bank shareholders. In the analytically tractable case of infinite risk aversion, ($\gamma \rightarrow \infty$), discussed further below, seigniorage profits are simply: $(R-1)(1-\lambda)$.

More generally, with oligopoly, equilibrium will lie between M and C in Figure 1; and increasing the number of banks will take equilibrium from monopoly to competition.

3. Bank Profits: Productivity Miracle or Mirage?

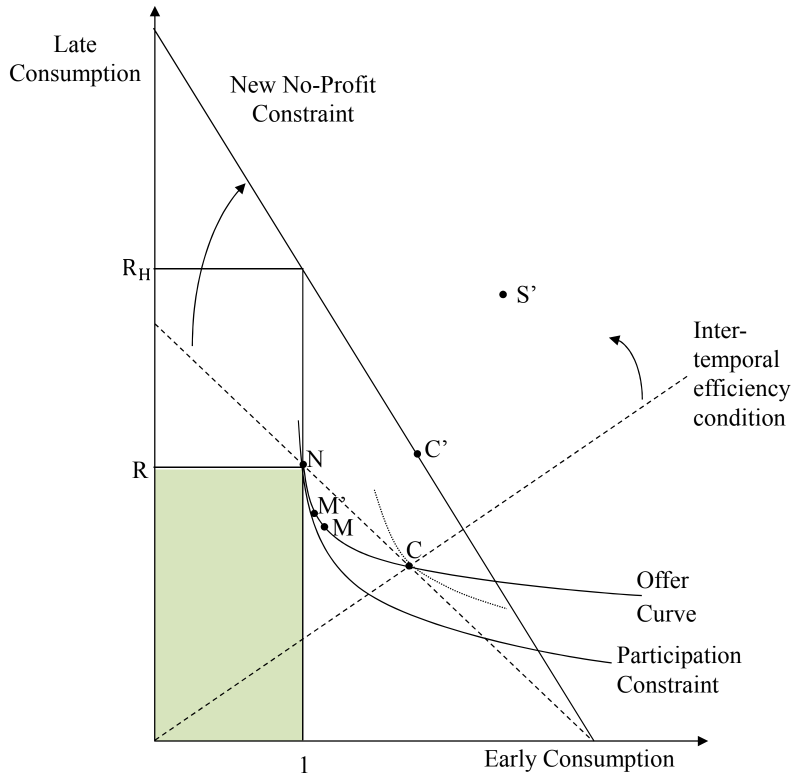
Of the extraordinary expansion of US banking in the lead-up to the financial crisis, Reinhart and Rogoff (2009, p. 210) remarked:

The size of the US financial sector more than doubled, from an average of 4% of GDP in the mid-1970s to almost 8% of GDP by 2007… Leaders in the financial sector argued that in fact their high returns were the result of innovation and genuine value-added products, and they tended to grossly understate the latent risks their firms were undertaking.

This parallels closely what we have reported above for the UK. But, before looking at the profits that might be expected to arise from excessive risk-taking, consider first the case of a genuine improvement in the return to long term investment which is available only to banks – a *productivity miracle* that raises the return available to banks (but not outsiders) from R to R_H.

How this affects profits and liquidity provision is indicated in Figure 3, where the No-Profit Constraint swivels clockwise, but the Intertemporal Optimisation schedule swivels the other way. As a consequence, the competitive equilibrium shifts from C to C', with no increase in profits. With monopoly banking, however, consumers gain much less. Since the productivity gain is, by assumption, not available outside banking, there is no change in the outside option, so equilibrium moves from M to M' along the existing offer curve giving a substantial boost to profits.

FIGURE 3. A PRODUCTIVITY IMPROVEMENT IN BANKING: COMPETITION VS. MONOPOLY



So far so straight-forward: any model where banks have opportunities that households do not should lead to rents for the banks. But what if the so-called productivity increase is an illusion?[14] What if - along the lines suggested by Reinhart and Rogoff - there was little or no increase in expected return; and the apparent increase in bank profitability is the upside of a gamble whose downside is concealed (so no risk-premium is added to debt finance)?

This is what we refer to as a Mirage. If the parameters of risky gambles are known to the regulators, as in Hellmann et al (2000), then regulatory capital requirements may be used to prevent risk-taking as is discussed below.

If, as appears to have been the case in the UK, regulators were not aware of the true risks being taken[15], gambling would not be prevented and banks may fail. As a simple illustration, let the upside of the gamble be treated as completely safe, so the regulator fails to increase the capital requirement. In that case, as long as the gamble pays off, equilibrium will shift to M' just as before, with little increase in

[14] For the terminology used here to distinguish between a rise in profits due to a real productivity increase and that due to increased risk-shifting, see Haldane et al. (2010) "What is the Contribution of the Financial Sector: Miracle or Mirage?".

[15] See Haldane et al. (2010, p. 89).

consumption for the average depositor, but a large increase in profits and shareholder's consumption as in the Figure 3. When the gamble fails, the truth will be out and the bank will fail too.

To see whether and when banks will be tempted to take on excessive risk, we use the analytically tractable case of Leontief preferences where consumers choose the same consumption in both periods. As can be seen from Figure 4, the expected utility curves in this case are L-shaped, with the kink lying on the 45 degree line. Gambling is assumed to take the form of mean-preserving spreads whose attraction lies in the "risk-shifting" that limited liability permits. Until Section 6 below, however, we will, as in Hellman et al. (2000), assume that the regulator is aware of the nature of the risks involved.

3.1. PERFECT COMPETITION

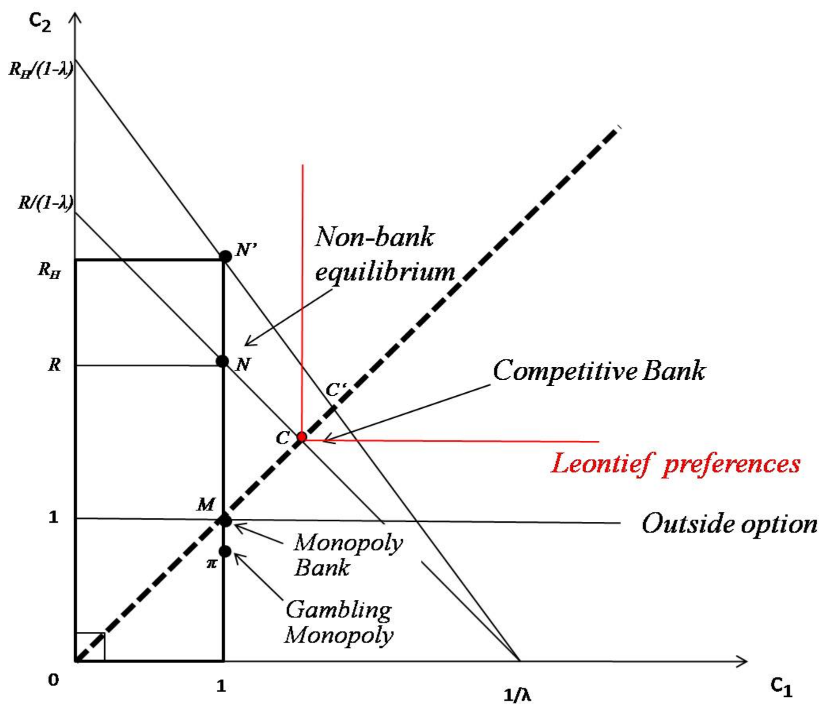
For this case, the competitive equilibrium without gambling will be defined by

$$c_1 = c_2 = c \qquad (6)$$

$$(1-\lambda)c_2 = R(1-\lambda\, c_1) \qquad (7)$$

where equation (6) is FOC for Leontief preferences and (7) is the zero profit condition. Solving (6) and (7) yields the competitive contract of (c,c) where $c = R/(1-\lambda+\lambda R)$, as shown at the point labelled *C* in Figure 4.

FIGURE 4. COMMERCIAL BANKING WITH LEONTIEF PREFERENCES



What would be the deposit contract under perfect competition if banks can gamble? Given Leontief preferences and the capital requirement of k, the deposit contract must satisfy (6) and the modified zero profit condition

$$\pi[(1-\lambda c_1)R_H - (1-\lambda)\, c_2] + (1-\pi)(-k) = 0 \tag{8}$$

where the first term on the left hand side of (8) represents expected payoff to the bank in the high state and the second term reflects limited liability, i.e., in the bad state, the bank loses at most its capital.

Solving for the deposit contract using (6) and (8) yields

$$c_G = [R_H - (1-\pi)k/\pi]/(1-\lambda+\lambda R_H) \tag{9}$$

To avoid gambling under perfect competition, k can be chosen so that $c \geq c_G$, i.e. so that depositors will prefer putting their money with prudent banks. This implies a critical minimum capital requirement of

$$k_C = \frac{\pi}{1-\pi}\left(R_H - \frac{1-\lambda+\lambda R_H}{1-\lambda+\lambda R} R\right) \tag{10}$$

3.2. MONOPOLY

As indicated above, a monopoly bank is assumed to maximise profits by increasing the cost of liquidity supplied to its customers. In the case of extreme risk aversion, where long returns are R, profits will be at a maximum at the point shown as *M*, where the second period consumption is reduced to 1 and the consumer is no better off than in the non-bank equilibrium, shown at point *N*.

How much seigniorage will the monopoly bank collect? Monopoly profits measured at date 2 are defined as: $\Pi_M \equiv R(1-\lambda c_1) - (1-\lambda)\, c_2$. So given the contract (c_m, c_m) where $c_m = 1$, we can write the flow of 'seigniorage' accruing to the bank as

$$\Pi_M = (1-\lambda)(R-1) \tag{11}$$

When capitalised using a discount rate factor $\delta < 1$, this provides the franchise value of the monopoly bank, namely

$$V \equiv \frac{\Pi_M}{1-\delta} = \frac{(1-\lambda)(R-1)}{1-\delta} \tag{12}$$

What if the monopolist can increase profits by risk taking? Assume that there is a gamble available with high and low payoffs, $R_H > R > R_L$, with probabilities $\pi, 1-\pi$ respectively, and that it is a mean–preserving spread relative to the return of *R*, so $\pi R_H + (1-\pi)R_H = \text{R}$. Then, with the monopoly contract of (1,1) as before, the expected monopoly profit (measured at date 2) will be:

$$\Pi_G \equiv \pi[(1-\lambda c_1)R_H - (1-\lambda)\, c_2] + (1-\pi) \text{ x } 0$$

where the last term reflects limited liability; so

$$\Pi_G = \pi(1-\lambda)(R_H - 1) \tag{13}$$

To see graphically how this increases expected profits, note that - with a mean preserving spread - the expected second period value of the bank's portfolio will be measured by the same line as that showing the return on the safe investment *R* (the line passing through points N and C in Figure 4). But owing to limited liability the expected cost of payments to depositors will fall, so the unit cost of the monopoly contract in period 2 falls from 1 to π , as indicated by the point so labelled in the Figure. Compared to *M*, this implies an increase in the flow of expected profits.

As noted by Sudipto Bhattacharya (1982), however, there is a 'self-regulatory' mechanism at work here: for the risk of losing the bank franchise may check gambling. For the **franchise value** V alone to prevent gambling, it is necessary that:

$$\Pi_G - \Pi_M \leq (1-\pi)\delta V \ . \tag{14}$$

a 'No Gambling Condition' (NGC) much like that in Hellmann et al. (2000). (Alternatively, where regulators have the same information as uninsured depositors, the regulator could charge a risk-based premium on the banks for the supply of deposit insurance.)

To supplement such market mechanisms, the regulator can take action to increase the exposure of the bank by imposing an explicit *regulatory capital requirement* defined as funding provided personally by the bank's owner-manager (implicitly assumed not to value liquidity nor to be averse to risk)[16]. In the context of the model being used here, this could for example be achieved by retaining some profits inside the business, so that not all lending is funded from deposits so the owner-manager is more exposed to the risks being taken.

Adding the risk of losing regulatory capital at end of period, expected profits then become:

$$\Pi_G(k) \equiv \pi[(1-\lambda c_1) - (1-\lambda)\, c_2] + (1-\pi)(-k) = \pi(1-\lambda)(R_H - 1) - (1-\pi)k$$

So the NGC is

$$\Pi_G(k) - \Pi_M \leq (1-\pi)\delta V. \tag{15}$$

Since this can be rewritten as

$$\Pi_G - \Pi_M \leq (1-\pi)(\delta V + k) \tag{15'}$$

it indicates that, in this model, k is a perfect substitute for δV.

[16] Alternatively, bank managers maximise the value of equity, which they do not own directly.

Using the franchise value as defined in (12), the critical value of k can be found where the NGC is satisfied with equality, yielding

$$k^* = \frac{1-\lambda}{1-\pi}\left[\pi(R_H - 1) - \frac{(1-\pi\delta)(R-1)}{1-\delta}\right] \quad (16)$$

But note that, if bailouts are available for large banks, much higher capital requirements will be needed to avoid risk-taking.

The distinction being made here between the franchise value (the discounted value of future profits coming from the licence to run a bank) and regulatory capital (built up from retained earnings or rights issues) is, broadly speaking, characteristic of the Basel rules for capital requirements, where regulatory capital does not include franchise value. If banks are, in this way, better capitalised than mandated by the Basel requirements, does this mean they are less likely to take risks? Not if bailouts are essentially guaranteed for large, profitable banks, as discussed in the next section.

4. BAILOUTS AND BAIL-INS

The problem of Too Big To Fail arises when a large bank counts on a bailout by the authorities, where it is able to transfer some losses to other parties (the deposit insurance fund, for example, or the tax--payer). The bailouts discussed by Cordella and Yeyati (2003) are triggered by exogenous 'states of nature' such as wars or earthquakes, where fiscal transfers may be appropriate. What we consider here are transfers to cover losses from gambling – unconditional bailouts which "can only stimulate risk-taking behaviour" (Cordella and Yeyati, 2003, p. 309, footnote 19). After the recapitalisation of UK banks that took place in 2008 Q4, however, the government instigated, as a matter of urgency, bail-in procedures for 'resolving' the affairs of a bank threatened with insolvency; and we review this briefly at the end of this section.

4.1. BAILOUTS THAT PROTECT FRANCHISE VALUES

To emphasize the moral hazard issues involved, consider first consider the hypothetical case of a bailout prospect where the monopoly bank expects to lose its regulatory capital but to retain its franchise without dilution. (More general forms of bailout are discussed later.)

Let the probability of such a bailout be denoted as β, where β can range from 0 to 1. With such a bailout in prospect, the condition for the discounted franchise value δV to prevent gambling now becomes:

$$\Pi_G(k) - \Pi_M \leq (1-\pi)(1-\beta)\delta V\ , \quad (17)$$

so a greater prospect of bailout calls for higher regulatory capital, k. When $\beta = 0$, the above NGC reverts to that without bailout; but when $\beta = 1$, the critical level of regulatory capital required becomes

$$k_B^* = \frac{\pi(1-\lambda)(R_H-1)-(1-\lambda)(R-1)}{1-\pi} \quad (18)$$

To illustrate the issues involved, we proceed with a numerical example, starting in Table 1 with contracts and franchise values computed numerically for prudent banks serving extremely risk-averse depositors (scaled relative to the initial endowments in each period).

TABLE 1. COMPETITION AND MONOPOLY OUTCOMES WITH PRUDENT INVESTMENT

No Gambling	Formula for $\lambda = 0.5$	R = 1.04
Competitive contract	$2R/(1+R)$	(1.02, 1.02)
Monopoly contract	(1,1)	(1,1)
Monopoly Profit	$(R-1)/2$	0.02
Franchise Value (Seigniorage)	$V = (R-1)/[2(1-\delta)$	0.2

Notes: $R = 1.04, \pi = 0.9$; $\delta = 0.9$; $\lambda = 0.5$; $\pi\delta$=*0.81*, $R_L > 0$.

Since investment offers a return of 4%, but half the population want liquid assets before the investment matures, the *competitive* contract offers a 2% increase in consumption to all customers. The *monopoly* contract offers zero increase, however, as the potential gains to depositors are taken as profit. When these profits are capitalised at a discount rate of 10%, this gives the franchise value of 20% shown as the last line of the table.

By contrast, in Table 2, expected profits, critical capital requirements, etc. are computed for banks with limited liability which can invest in assets with "tail risk". Following Foster and Young (2010) this is captured by two--point processes with returns of R_H and R_L, where π=*0.9* is the probability of the upside prospect, R_H. We look at two gambles, one with an upside of *1.06*, the other of *1.10*, both with an expected return equal to the safe rate, which is set at *1.04*, as in Foster and Young. We depart from their assumption that the downside is zero, however. As the upside in the first case is *1.06*, so, for a probability π=*0.9*, the downside return must be *0.86*; in the second case, an upside of *1.10* implies a tail-risk downside of *0.50*. For convenience the formulae being used are shown in column 2, where we assume that λ= *0.5*.

While there may be some 'alpha' portfolio managers who can achieve the upside prospect R_H for sure, the safe rate for the banks being considered here is R, implying that high returns can only be achieved by risk-shifting. In computing expected profits, the banks themselves will take into account the probabilistic nature of high returns and the tail risk of rare but disastrous low returns: but the risk-shifting permitted by limited liability raises expected returns to 3% or more, depending on the variance of returns (as indicated in the first line of the table).

TABLE 2. REGULATORY CAPITAL WITH GAMBLING AND BAILOUTS

Gambles available			$R_H = 1.06$ $R_L = 0.86$ **σ =0.06**	$R_H = 1.1$ $R_L = 0.50$ **σ =0.18**
1	Expected Profit	$\pi(R_H - 1)/2$	0.027	0.045
2	NGC (monopoly) See equation (15)	$\pi(R_H - 1) \leq \frac{(R-1)(1-\pi\delta)}{1-\delta}$	Satisfied	**Not satisfied**
3	k* (monopoly) See (16)	$k^* = \frac{1-\lambda}{R-\pi R_H}\left[\pi(R_H-1) - \frac{(1-\pi\delta)(R-1)}{1-\delta}\right]$	**No need for capital buffer**	0.17 **≈22% RWA**
4	Capital requirement in special case of β=1 See (18)	$k_B^* = \frac{1-\lambda}{R-\pi R_H}[\pi(R_H-1)-(R-1)] > k^*$	0.08 **≈14% RWA**	0.50 **≈ 50% RWA**
5	k*c(competition) See (10)	$k_C = \frac{\pi(1-\lambda)(R_H - R)}{(R-\pi R_{H)}(1-\lambda+\lambda R)}$	0.10 **≈17% RWA**	0.53 **≈ 52% RWA**

Notes: $R = 1.04$, $\pi = 0.9$; $\delta = 0.9$; $\lambda = 0.5$; $\pi\delta=0.81$, $R_L > 0$.

Assuming that the regulatory authorities are aware of the gambles available, one can compute the regulatory requirements needed to prevent them. Before considering a monopoly bank, consider the incentives for gambling in the competitive case – and the capital requirements needed to check them[17]. With competitive banking and limited liability, there will be a temptation to offer contracts that compete with those issued by alpha investors who can obtain R_H for sure and offer $2R_H/(R_H+1)$ – with consequent downside losses for those insuring their deposits.

To check this, the attractive offers that gambling permits need to be brought down to what prudent investment allows. As indicated earlier in equation (10), this can be achieved by capital requirements set at

$$k_C = \frac{\pi(1-\lambda)(R_H - R)}{(R-\pi R_{H)}(1-\lambda+\lambda R)}$$

The numerical results for competitive banks, facing the low and higher variance gambles specified are shown in the bottom line of the Table 2. Prudential regulatory capital ratios of 10% or 53% of deposits respectively are required; which, with λ=0.5 correspond to ratios of 17% and 52% of Risk Weighted Assets (RWA) respectively.

In the absence of bailouts, franchise values for monopoly banking should act as a substitute for regulatory capital. Indeed, as indicated in line 2, the relevant No Gambling Condition, (15) above, is satisfied for the low variance case with no need

[17] Kuvshinov (2011) provides analogous calculations in respect of the model of Hellman et al. (2000).

for regulatory capital. But for the high variance gamble, the franchise value will need to be supplemented by regulatory requirements, as computed using equation (16). With these parameters, as shown in line 3, it turns out that the prudential capital ratio of 17% of deposits is needed which, with λ=0.5, is 22% of Risk Weighted Assets.

When bailouts are available, however, prudential capital requirements can rise alarmingly as shown in line 4 of the table. Thus for the low variance gamble, the capital requirement needed to ensure prudent investment by a monopolist is 8% of deposits which, with λ=0.5, is 14% of Risk Weighted Assets; while in the last column, where the gamble has higher variance so risk-shifting is more profitable, the critical capital requirement increases to half the level of deposits and half of RWA[18].

As reported in the Financial Times, Jenkins (2013), however,

Bank supervisors in the US, UK and Switzerland have recently shifted their focus from core tier one ratios – which relate equity capital to assets weighted for risk – towards a broader catch-all leverage metric, which relates equity to total assets. By that less manipulable measure, supervisors argue, some banks are still undercapitalised.

The incoming Basel III global rulebook demands a 3 per cent leverage ratio, sometimes expressed as a leverage multiple of 33 times, though some countries have recently gone further, with the US planning a ratio requirement of up to 6 per cent.

“It is not very sensible to run a market economy on the basis of a banking system that is 33 times leveraged, let alone 40 or 50 times leveraged,” Sir John Vickers told the Financial Times. He believes the right number is closer to 10 times, equivalent to a 10 per cent ratio.

When we compute the equity ratios for the examples in Table 1 we find that, expressed as a percentage of banks’ total assets sheets, prudential equity financing required for a monopoly bank turns out to run from 7% to33%, depending on the variance - far higher than the 3% equity ratio recommended by the Basel Committee on bank supervision. The figures in this example are more in line with the recommendations of Admati and Hellwig (2013): they want to cut bank leverage down to single figures, with an equity ratio of 20-30%.

4.2. BAIL-IN PROPOSALS

To tackle the Too-Big-To-Fail problem and avoid state-sponsored bailouts of big international banks, the Financial Stability Board has recommended the introduction of special resolution tools (endorsed by leaders of G-20 in November

[18] Such prudential ratios are broadly comparable to those obtained by Miles et al. (2012): using a different methodology they suggest the appropriate levels of regulatory capital needed to absorb risks are 16-20% of RWA for moderate shocks, rising to 45% of RWA for large shocks.

2011). As indicated by the Director of the Special Resolution Unit at the Bank of England:

These resolution strategies are designed to ensure that the failure of a G-SIFI (Globally Systemically Important Financial Institution) should be orderly and should avoid exposing public funds to loss. Rather, the creditors of the failing banks should bear losses, as they would do in insolvency, but without the financial instability and disruption to critical functions that the sudden insolvency of a GSIFI would otherwise cause. (Gracie 2012, p. 2)

As is also indicated, such bail-in provisions will need to be accompanied by appropriate regulatory steps beforehand: in particular, G-SIFIs must have sufficient loss-absorbency to bear the losses within the resolution process[19].

To appreciate how such new provisions might check moral hazard, consider the situation where, to preserve the critical functions of banks, a bail-out is available from the state in the form of a capital injection *provided in exchange for some fraction of the equity value* of the bank, $k + \delta V$. In this case, the no-gambling-condition becomes:

$$\Pi_G - \Pi_M \leq (1-\pi)[(1-\beta)(\delta V + k) + \beta c(\delta V + k)], 0 \leq c \leq 1 \quad (19)$$

where c reflects the fraction of bank's equity taken by the state. The impact of state provision will depend crucially on how generous is the bailout (how low is c).

What if, as discussed in the previous section, banks are expecting to retain their franchise value without dilution, so $c = 0$? Then moral hazard will be severe as equation (19) reverts to equation (17), where franchise values are fully protected. If, however, as in the new special resolution regime (including the ex ante provisions), banks can expect to lose their franchise value as well as their regulatory capital as a result of gambling, moral hazard should be checked. For in this case $c = 1$, and (19) reverts to (15'), with shareholders fully exposed to losses. Bail-in provisions introduced in this way should in principle cancel the moral hazard problem associated with 'bailouts' made to protect critical functions.

5. The U-Shaped Prudential Frontier; and Innovation That Outwits Regulation

Although Hellman et al. (2000) discuss how the loss of franchise – like the loss of regulatory capital – can inhibit incentives to gamble, in their case franchise values were generated by the regulator fixing a ceiling on deposit rates (as with Regulation Q), not by the level of concentration in the banking industry, the focus of this paper. How this concentration (and the seigniorage profits it generates) may at first mitigate moral hazard, for banks Too Big To Gamble (TBTG), and then promote is illustrated in Figure 5, with the level of regulatory capital plotted on the vertical

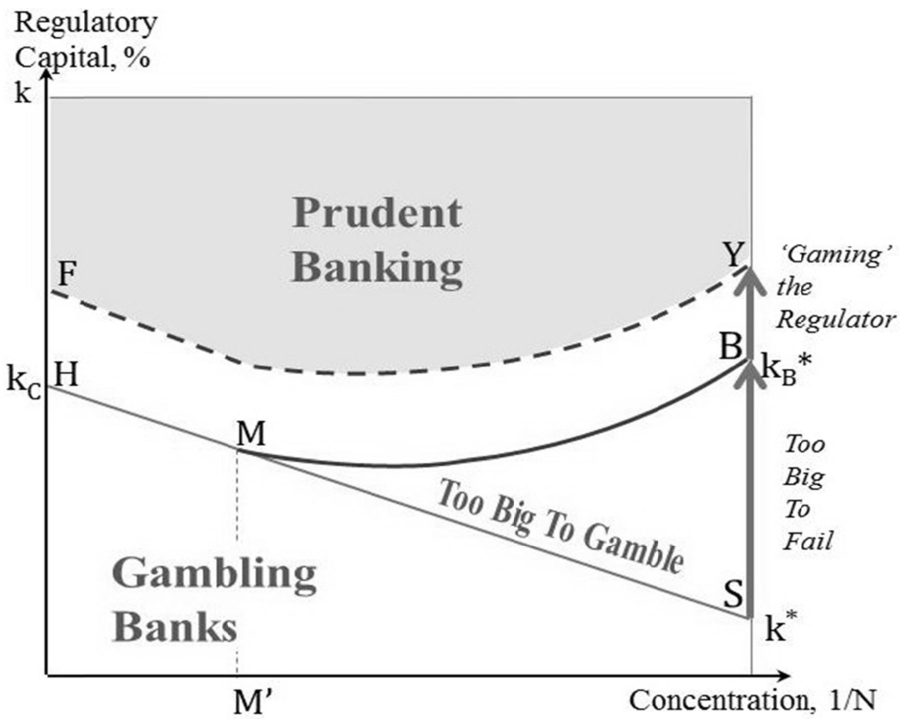
[19] The provisions of the Recovery and Resolution Directive for Europe apparently suggest that '10% of total liabilities might be an appropriate amount' for bail-in, Gracie (2012, p3).

axis, and industry concentration on the horizontal (measured by the reciprocal of the number of banks).

A heuristic impression of the trade-off between regulatory capital and franchise value discussed by Hellman, Murdock and Stiglitz is indicated by the downward sloping line labelled HMS, where k_c on the left is the capital needed for competitive banks, while k^* is that needed for a monopoly bank. Below this line, as indicated, risk-taking behaviour is to be expected, while, above it, prudence should prevail, were it not for two factors that pose a threat to safe banking, TBTF and 'gaming the regulator'.

If one assumes that the willingness of the authorities to bailout banks only kicks in above a certain level of concentration (shown as *M'*), and that the bailout policy involves no loss of seigniorage, then the effect of this bailout policy can be seen from the progressive rise of HMB above HMS to the right of point *M*. The regulatory capital requirement for a monopolist who is TBTF is shown as k_B^* on the right hand side of the Figure; and as shown in the last two rows of Table 2, this could match that required under competition, k_c. In the absence of appropriate bail-in provisions, the effect of TBTF is to reshape the trade-off predicted by Hellman et al into a U-shaped curve. The bail-in provisions discussed above are designed to correct this regulatory distortion.

FIGURE 5. TWIN THREATS TO PRUDENT BANKING: TBTF AND 'GAMING' THE REGULATOR



In discussing these trade-offs, we have so far assumed that the parameters of the risk-taking opportunities available to the banks are *common knowledge*, so the regulatory regime can be designed so that gambling is not incentive-compatible in a rational expectations equilibrium. But what if the parameters are not known by regulators and/or uninsured depositors? As Foster and Young (2010) emphasise, derivatives may be used to shift returns over time so as to fool investors and regulators[20]; and, as Haldane et al. (2010) indicate, UK banks were able to fool the regulators as to risks they were taking before the financial crisis of 2008. In that case, the U-shaped NGC will be shifted upwards, as indicated by the dotted schedule (labelled FY in the figure), shrinking the area associated with prudent banking.

Steps to correct such distorted incentives include: greater transparency, including effective real time monitoring (as under the FIDICIA regulations in the USA); restrictions on bonuses, including deferred payment and 'claw-back' provisions (as being considered in the EU); and restructuring the banking sector, so as to separate commercial from investment banking (as outlined by the Independent Commission on Banking in the UK).

6. GAMBLING AND GINI COEFFICIENT

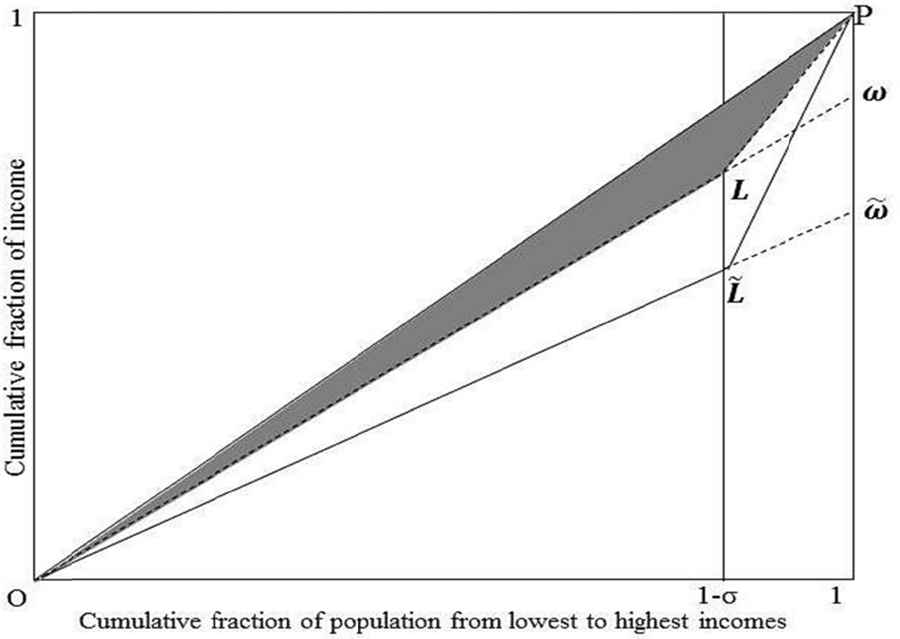
In the *Price of Inequality*, Stiglitz emphasises how rent-seeking in the financial sector has skewed the income distribution to the benefit of high earners. In the model being used here, it is evident that bank concentration will lead to an increase in the Gini coefficient compared with competitive banking: and this effect will become much more pronounced with gambling.

This is illustrated by the stylised Lorenz curves in Figure 6, where σ represents the fraction of the population owning shares in the all-deposit bank. Where ω represents the consumption bundle available to depositors under monopoly banking, and $\omega(1+\mu)$ is the consumption available to the depositors who are also shareholders enjoying the monopoly premium, μ, in this case $\omega = 1/(1+\sigma\omega)$ and the Gini coefficient[21] turns out to be $(1-\sigma)\sigma\mu/(1+\sigma\mu)$. When the bank gambles, the premium paid to owner-managers will of course rise, say to $\tilde{\mu}$, shifting the Lorenz curve to $O\tilde{L}P$ in the figure.

[20] Take for example, undated out-of-money-puts where – unlike the Ponzi scheme where the premium are only financed by attracting new depositors -- the returns on the balance sheet will be the annual insurance premium paid by those holding the puts (with downside risk left off the balance sheet, see Rajan, 2010).

[21] i.e. the area *OLP* in the diagram divided by 1/2.

FIGURE 6. RISING INCOMES IN FINANCIAL SERVICES AND INCOME INEQUALITY



In discussing whether the contribution of financial sector is 'Miracle or Mirage', Haldane et al. (2010, pp. 79, 80) report that the share of financial intermediation in employment in the UK is around 4%, and that: the measured 'productivity miracle' in finance …has been reflected in the returns to both labour and capital, if not in the quantity of these factors employed. For labour, financial intermediation is at the top of the table, with the weekly earnings roughly double the whole economy median. This differential widened during this century, roughly mirroring the accumulation of leverage within the financial sector.

Using the above formula, a doubling of consumption opportunities for those in finance would add about 4% to the Gini coefficient, i.e. about half the rise in Gini coefficient for the UK from 1986 when the Big Bang took place, to just before the crisis in 2007. (Focusing more narrowly on Investment Banking, however, the Financial Times reports compensation running at 6 times the median income in both US and UK[22]).

[22] FT 17th Feb, 2011, ''Banker's pay: time for deep cuts.'

CONCLUSION: BACK TO BANKING BASICS

The results obtained in this paper can be summarized as follows. Monopoly power in banking, while it raises profits and generates positive franchise value, reduces depositors' welfare. Regulatory capital reduces risk-taking incentives for the monopolist. So too can franchise values, for banks that are, so to say, Too Large To Gamble. But not for banks that are Too Big To Fail, if their franchise values are protected by bailout.

Adam Smith was famously critical of monopoly pricing by those with market power. As for risk-taking, he warned in the *Wealth of Nations* that:

To depart on any occasion from [the principles of the banking trade], in consequence of some flattering speculation of extraordinary gain, is almost always extremely dangerous and frequently fatal to the banking company which attempts it. (Book V, Ch 1, Article 1.)

In our view, banking in Britain before the crisis was no example of the benign operation of the invisible hand at work: quite the contrary. The reforms advocated by the ICB and the provisions for special resolution of banks are, however, designed to offset these distorted incentives and to get the taxpayer 'off the hook'. While we have focused on two challenges to the operation of the Invisible Hand – market power and risk-taking – there are others that should be registered before concluding – such as the principal-agent problem that arises when bank executives put their interest (and bonuses) before that of shareholders[23]; and the presence of powerful 'pecuniary externalities' calling for macro-prudential regulation[24].

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[23] As discussed by Akerlof and Romer (1993) for example.

[24] This perspective – what might be called the LSE Critique of Basel II – is most eloquently developed by Adrian and Shin (2008) and Shin (2010).

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ANNEX. DERIVATION OF BANK'S PROFIT FUNCTION

In what follows we derive monopoly bank's profit function, equation (1) in the text. The notation used here is that of in Allen and Gale (2007, Chapter 3) or Miller et al. (2013). The bank offers a deposit contract (c_1, c_2), representing early and late consumption of a consumer, in exchange for an initial endowment of 1. The fraction of early consumers in the whole population is λ. The utility function of a typical consumer is $u(c) = c^{1-\gamma}/(1-\gamma)$, where $\gamma > 1$. As in the text, the (gross) return on the short asset is 1 and that on the long asset is $R > 1$.

The profit of a risk-neutral monopoly bank is given by

$$\pi = (1 - \lambda c_1)R - (1 - \lambda)c_2 \qquad \text{(A1)}$$

where λc_1 represents the fraction of total initial resources (equal to 1) invested in the short asset and $1 - \lambda c_1$ the fraction in the long asset. The first term in (A1) represents returns on the long asset and $(1 - \lambda)c_2$ represents the liability arising due to late consumers. Note that as return on the long asset dominates that on the short asset, the bank will economize on its holding of the short asset. This implies that the amount held in the short asset matches the liability arising from early consumers, λc_1.

The monopoly bank faces the same investment opportunities (short and long) as consumers, so its actual cost of liquidity is R (or $R - 1$, in terms of the opportunity cost of holding the short asset). As the bank has monopoly power in the provision of liquidity, it can manipulate the contract offered to raise the effective cost of liquidity faced by consumers to $\tilde{R} > 1$.

For any given effective cost of liquidity, $\tilde{R}$, consumers will accept the deposit contract (c_1, c_2) if it maximizes the expected utility of a typical consumer subject to the "perceived" budget constraint:

$$(c_1, c_2) = argmax_{(c_1,c_2)}[\lambda u(c_1) + (1 - \lambda)u(c_2)]$$

subject to $(1 - \lambda c_1)\tilde{R} \leq (1 - \lambda)c_2$

The first order condition for the above problem is: $U'(c_1) = \tilde{R}U'(c_2)$.

Using CRRA utility function this implies: $c_2 = \tilde{R}^{1/\gamma} c_1$ (A2)

Substitution of (A2) into (A1) this yields: $\pi = (1 - \lambda c_1)R - (1 - \lambda)\tilde{R}^{1/\gamma} c_1$ (A3)

After simplification one obtains: $\pi = \lambda(\tilde{R} - R)(c_1 - 1)$. (A4)