

TAXATION AND REGULATION OF THE FINANCIAL SECTOR

5.1 Introduction

Since the beginning of the financial crisis numerous proposals have been made for the reform of public policies towards banks and other financial companies. Many individual governments have already taken action, and several official international bodies have also been active in considering reform. Reform proposals have taken two forms. One form is for new, or amended, regulations on banks and financial companies. A second is for new taxes on banks and other financial companies.

This chapter analyses options for the taxation and regulation of banks and other financial companies. It compares and contrasts the two alternative approaches of taxation and regulation as a means to achieving various objectives. And it analyses the interaction between regulations and taxation when both are implemented simultaneously.

The aims and objectives of regulations and tax are not identical. Most financial regulatory proposals fall under two distinct objectives. The first is to reduce the probability of default in individual banks or other financial companies, and in particular in systemically important banks. This has been addressed in a number of ways. For example, the Basel Committee for Banking Supervision (BCBS) has proposed significant reform of its system of capital and liquidity requirements as part of a Basel III package (BCBS 2010a). And the US Dodd-Frank Act has introduced many new provisions, including restricting the trading activities of some financial companies.

The second objective is to put in place a resolution mechanism that can adequately deal with cases where banks or other financial companies reach positions of financial distress despite regulations designed to prevent them from doing so. For example, the European Commission has been active in developing a new res-

olution mechanism within the European Union (European Commission 2010a, b). The aim of the mechanism is “to facilitate the resolution of failing banks in ways which avoid contagion, allow the bank to be wound down in an orderly manner and in a timeframe which avoids the ‘fire sale’ of assets” (European Commission 2010a).

There are also two distinct objectives for tax policy. The first is simply to raise revenue. This could be for at least two reasons: to reimburse governments for the costs of the last financial crisis, and to build up sufficient funds for them to be able to deal with the next one. The explicit aim of the Financial Responsibility Fee proposed in the United States was the former: “My commitment is to recover every single dime the American people are owed” said President Obama, on January 14, 2010, in a White House press release. In addition, the International Monetary Fund (IMF) was asked by the September 2009 G20 meeting “to prepare a report on how the financial sector could make a ‘fair and substantial contribution’ to meeting the costs associated with government interventions to repair it” (IMF 2010b). The latter is closely related to the design of a resolution mechanism, and in particular is associated with building a resolution fund that is financed by a tax on the financial sector.

The second objective of tax policy is more closely linked with regulation: namely, Pigouvian taxes could be introduced with the aim of affecting the behaviour of the financial sector in a similar way to regulations. Proposals here include new taxes on bank liabilities, and on bank bonuses. For example, the IMF has proposed a Financial Securities Contribution (FSC), based broadly on liabilities, which might have similar effects as the Basel capital requirements. The choice and interaction between taxation and regulation is particularly important in this area.

This chapter cannot cover all aspects of the taxation and regulation of the financial sector. It therefore limits itself primarily to a discussion of taxation policies, with a particular focus on where these may overlap or conflict with regulation. The chapter

therefore leaves several important issues of regulation aside: it neither discusses the design of a resolution mechanism nor issues of competition within the financial sector such as whether some large banks should be broken up, or whether their activities should be restricted.

The chapter proceeds in the next section by first setting out a summary of the causes of the financial crisis. This is a necessary first step to analysing and understanding the role of alternative policies designed to affect behaviour in the financial sector: effective policy should be targeted towards the underlying causes of the crisis. The chapter then contains a somewhat broad discussion of the relative merits of taxation and regulation as ways of improving the outcome of behaviour in the financial sector for society as a whole. The section also contains a brief summary of the key relevant taxation and regulatory proposals that have been made in response to the financial crisis.

Sections 5.4 and 5.5 address in turn the two objectives of taxation: to raise revenue and to influence behaviour to prevent a subsequent crisis. We discuss the appropriate design of taxation in each case, and particularly in the second case we contrast the options of taxation and regulation, and highlight issues which arise if both forms of intervention are used simultaneously. Section 5.6 concludes.

5.2 Underlying causes of the crisis

There were clearly many elements that contributed to the onset and scale of the financial crisis. In order to identify policies that may help to reduce the probability of future crises, it is useful first to identify some of the more important factors that created the recent crisis. We will do this briefly, since other contributions have already provided a comprehensive analysis of the causes of the crisis.¹

Two key factors are liquidity and solvency. Banks use short-term debt to provide long-term loans. There are clear benefits from this to society: funds can be pooled to allow investment in long-term illiquid assets, while meeting the expected demands for individuals' short-term liquidity needs. However, as Diamond and Dybvig (1983) demonstrated, in such a situation any cost to the liquidation of long-term assets is likely to

result in banks being inherently fragile, and susceptible to demands from short-term debtholders. The existence of deposit insurance reduces such fragility, as deposit holders are protected and hence less likely to create a bank run. By acting as lender of last resort, central banks can have a similar impact, as demonstrated by Rochet and Vives (2004).

However, as King (2010) argues, although in 2007 "everyone thought that the crisis was one of liquidity ... it quickly became clear that it was in fact a crisis of solvency" (p. 8). The problem of insolvency was created by excessive leverage and risk. According to Sinn (2010), in 2006 the five largest American investment banks had equity to asset ratios of between 3.2 percent and 4.6 percent (based on European accounting rules, these ratios would have been even lower).

The implication of such low equity ratios is clear. Suppose that the ratio is 4 percent. Then if the value of the assets held by the bank falls by more than 4 percent, the bank would be technically bankrupt: equity holders should be wiped out, and creditors should share what is left. It is clear, then, that both the risk of the bank's assets and the proportion of its assets that are financed by debt are crucial for solvency. This is why regulatory requirements for the capital ratio depend on risk-weighted assets: we discuss below whether existing and proposed regulations and taxes are sufficiently strict.

Several factors may have been involved in creating the situation in which banks held excessively risky assets, given their equity capital. One, highlighted by Sinn (2010) in the context of the present crisis and first analyzed theoretically in Sinn (1980), is the misuse of limited liability. We discuss this in the next subsection, before considering other factors, including preferential taxation.

5.2.1 Limited liability

In the presence of risky investment, limited liability implies that the shareholders of a company gain from risk on the upside, but that their losses on the downside are limited. When debtholders do not react to the banks' risk choices, limited liability creates the incentive both for high leverage and high risk: both of these improve the gamble available to shareholders.

The importance of the response of the debtholders to greater risk on the asset side is illustrated by a simple

¹ See, for example, EEAG (2009, Chapter 2) and Sinn (2010).

example in Appendix 5.A. The first part of the example considers three companies, each undertaking an investment of 100, financed by 20 of equity and 80 of debt. The expected return on each of the investments is 10 percent. The three companies differ in the risk of that return: in particular there are two possible outcomes for each company; in the bad outcome, the total return may be less than the outstanding debt, in which case the company defaults: the shareholders receive nothing, and the debtholders also lose.

Suppose debtholders are able to observe the strategy of the company, and to hold the company to a strategy after the lending has taken place. Suppose also that there are no specific costs associated with bankruptcy. In this case, debtholders will demand a rate of interest that compensates them for greater risk. In particular, as the downside risk to creditors increases, the interest rate charged will increase. Since shareholders have to pay the higher interest rate in the good state, it is straightforward to show that in this case there is no incentive for shareholders to take on extra risk.

This is demonstrated in a more complex differentiated duopoly banking model by Matutes and Vives (2000) or in a competitive banking model by Sinn (2003).² In subcases of these models, banks compete for deposits, have limited liability, and choose the risk of their investment, while taking into account that the interest rate charged by the depositors depends on the risk they choose. In these circumstances, for risk-averse investors there is a disincentive to take on extra risk and the choice of risk is optimal from a social perspective.

A similar argument holds with respect to increasing leverage. A second example in the Appendix A compares three companies with the same investment, but with different leverage ratios. As before, if the rate of interest charged by the debtholder accurately reflects her own risk, then there is not a clear case for using additional leverage. In fact, this is simply an example of a fundamental, and possibly the most famous, result of the theory of corporate finance – the theorem of Modigliani-Miller (1958). This states that, given certain conditions, the risk and value of a company does not depend on the way in which it is financed: it depends only on the activities that the firm undertakes. Given the company's activities, a rise in the use of debt and a commensurate decline in the

use of equity will increase the risk and required rate of return of both the debt and the remaining equity. But the overall cost of capital of the company will be unaffected.

So the existence of limited liability in itself does not necessarily induce more risky behaviour, nor does it necessarily induce more leverage. However, limited liability does induce excessive risk taking when debtholders or other market partners on whom the actual liability would fall instead of the decision makers do not react to the bank's risk choices.

This is illustrated in Appendix 5.A. If, for example, debtholders simply charge the risk-free rate of interest irrespective of the risk taken by the company, then shareholders have an incentive both to increase leverage and to increase the risk of the company's investment. The reason is the combination of the fixed rate of interest charged by debtholders and limited liability for shareholders. For a given rate of interest, a more risky strategy allows shareholders to gain more on the upside, but not to lose any more on the downside. And this strategy can be more successful the higher the proportion of the investment funds provided by the creditors.

There are various reasons why this latter case of non-reacting interest rates may be relevant in practice. One is that the government bears the losses exceeding the equity capital. This possibility has been analysed in general risk theoretic models by Sinn (1980, 1982) and in an explicit banking model by Dewatripont and Tirole (1994). A second is that in a one-shot game, bondholders are unable to enforce a particular risk policy on the bank, as the lending contract is made before the decision about the risk. This was analysed by Matutes and Vives (2000) in a general banking model. A third is that due to asymmetric information which makes bank bonds and deposits lemon products whose risk-return characteristics are opaque, debtholders cannot distinguish between safe and risky banks and are therefore unable to charge the risky banks higher interest rates. This possibility has been analysed in general terms in Sinn (1980) and in an explicit banking model by Sinn (2003). The lemon interpretation in the context of the opaqueness of derivatives trading is in the centre of Sinn's interpretation of the crisis (Sinn 2010).

These three reasons for why limited liability may result in excessive risk-taking in principle apply to all limited liability firms, and not only to banks.

² In Sinn (1980) this borderline case was discussed in term of the Coase theorem, before the discussion moved to asymmetric information and bailout strategies.

However, except for the second reason, they are more relevant for banks than for normal firms.

Unlike normal firms banks have a higher chance of being bailed out by the government because they are considered systemically relevant and “too big to fail”. Ueda and Weder di Mauro (2010) have recently used two approaches to estimate the impact of the “too big to fail” subsidy for banks. Their estimates of the benefits to banks are measured in terms of a funding cost advantage, and range from 20 basis points to 65 basis points.

Moreover, the asymmetric information case may be particularly relevant for banks as the banking business is extremely “opaque” due to the use of derivatives, off-balance sheet operations and mutual CDS insurance, as ex-Fed chairman Alan Greenspan has argued. Normal firms that borrow from banks are usually well observed by the banks’ risk officers, but the banks themselves, which tend to receive their funds from a dispersed group of individual households, do not face a similarly strong controlling power among their creditors.

The problem of asymmetric information was worsened by what the governor of the Bank of England, Mervyn King, called a “lapse into hubris”:

“The real failure was a lapse into hubris – we came to believe that the crises created by massive maturity transformation were problems that no longer applied to modern banking... There was an inability to see through the veil of modern finance to the fact that the balance sheets of too many banks were an accident waiting to happen, with levels of leverage on a scale that could not resist even the slightest tremor to confidence about the uncertain value of bank assets” (King 2010, p. 10).

In this view, the proliferation of financial instruments, together with special investment vehicles, and other factors documented at length elsewhere, simply got out of hand, with buyers of financial instruments having little idea of their underlying risk. Rating agencies – either through deliberate policy determined by their own incentive mechanisms or simply because of miscalculation – were unable to offer appropriate advice.

In this case, the excessive leverage and risk taken by banks was, at least in part, simply a mistake. This would explain the relatively low rates of interest

charged by creditors, referred to above. If creditors simply underestimated the risks that they were facing and hence charged rates of interest that were too low, this would create an incentive for banks to undertake excessive leverage and risky lending.

5.2.2 Other factors

So one possible explanation for the excessive leverage and risk of banks prior to the crisis is limited liability, because limited liability means that the banks’ risk choices involve negative externalities being imposed on taxpayers or on banks’ debtholders. But what about other explanations such as the role of managers that follow their own agenda or the high cost of equity capital, which are often cited in the public debate? The next two sections go into this.

5.2.2.1 Agency problems

The argument that managers disregard the preferences of their shareholders and expose their banks to excessive risks is often made in the public debate. Bank executives, it is said, typically have incentive systems that make them participate asymmetrically in upside and downside risks. In view of this asymmetry they seek excessive risks that jeopardise the future of the bank at the expense of shareholders and society. This would be a problem even if there was no implicit government guarantees to creditors or the inability of debtholders to punish risk-taking with higher interest rates.

While this argument sounds plausible at first glance, the question remains why shareholders would give their executives incentive schemes that imply excessive risk-taking, if this is not in their own interest.

As has been pointed out in Sinn (2010), a plausible answer is simply that the shareholders give their executives asymmetric incentive schemes, because limited liability provides the shareholders with such asymmetric incentives. As the principals (the shareholders) want their banks to gamble, they give their agents (the executives) incentive schemes that turn them into gamblers. Large bonuses in the case of success are then simply an indication of the interests of shareholders and executives being closely aligned. Thus, no principal-agent theory is needed to understand why there was excessive risk-taking and leverage prior to the crisis.

It is nevertheless striking to see how large the bonuses awarded to executives really are. The annual payment of bonuses in the City of London stretches into billions of pounds. As an example, the UK government introduced a one-off tax of 50 percent on bonuses paid by banks in 2009. This raised around 3.5 billion pounds in tax revenue, implying that executives received a further 3.5 billion pounds, the total cost to banks stretching to 7 billion pounds.

These are such enormous rewards to employees that it is hardly conceivable that they reflect the true value to society of their activities. Probably, the remuneration of managers has elements of a remuneration of superstars. The marginal value of a superstar like a singer, a football player or a racing driver can be huge for the company hiring him or her, but this marginal value may largely stem from depriving other participants in the race from their profit and may therefore measure more the advantage from rent-seeking than a true social advantage. Thus, arguably, the executive problem is not that they choose more risks than their shareholders want but that their remuneration is too large, coming to a considerable extent from winning zero sum games at the expense of slightly less sophisticated private investors.

5.2.2.2 Costs of equity finance

Banks typically argue that they leverage their operations so extensively because equity finance is more expensive than debt finance. The implication is that forcing banks to hold more equity would raise their refinancing costs. In turn this would raise the costs of their lending, probably forcing them to cut back on lending to other sectors and hampering economic growth.

There is a substantial economic literature in corporate finance that investigates this issue in a general context, rather than specifically for banks. In considering equity finance, it is necessary to distinguish two sources: retained earnings and new equity issues. It is generally accepted that by far the largest source of finance to the corporate sector in developed economies is internal finance in the shape of retained earnings. Of external finance, debt is used more heavily than new equity.³

There are many issues of agency and asymmetric information involved in external finance. Kashyap et

al. (2010) usefully distinguish stock and flow concepts of the costs of equity finance. Flow costs relate to issuing new equity. Myers and Majluf (1984) suggested that asymmetry of information between management and external investors would lead to an issue of new equity being interpreted as a negative signal by outsiders, since if managers act in the interests of existing shareholders, then they will sell shares when they believe it to be overvalued. There is evidence that share issues tend to be associated with negative share price effects, compatible with this (for survey evidence see, for example, Graham and Harvey 2001). As a result, managers will be reluctant to use new equity finance in the first place.

Another argument leading in the same direction refers to the double taxation of dividends with corporate and personal taxes that characterizes most OECD tax systems. As was shown by King (1977) the double taxation increases the cost of new share issues over retained earnings and induces firms to prefer internal finance.⁴ It is important to note, however, that the relevant shareholders often reside outside the country, in which case domestic personal tax rates are not relevant.⁵

Due to higher costs of equity finance, it is argued that a requirement to raise the capital ratio is more likely to be met in the short-term by shrinking assets than by issuing new equity, even when the assets represent profitable investments. This is perhaps a caution against demanding too rapid a change in capital ratios. On the other hand, a regulation requiring additional equity presents a reason for issuing new equity that is clearly different from the Myers-Majluf argument. Adhering to new regulation by issuing new equity should reasonably not be viewed by the market as a negative signal. However, to the extent that shareholders are liable to personal taxes on dividend payments, the tax argument does suggest that some pressure may be required that forces banks to satisfy additional equity requirements with new issues of shares rather than allow them to wait until enough equity capital has been accumulated by mere profit retentions.

In any case, the long-run costs of using equity finance are much less clear, precisely since companies and

⁴ In fact, an extension of this argument implies that only new and extremely rapidly growing firms would resort to lump-sum issues of new shares, followed by an extended period where firms neither issue new shares nor distribute dividends to grow with their maximum speed until maturity (Sinn 1991).

⁵ For example, Bond, Devereux and Klemm (2006, 2007) show that significant reforms to dividend taxation in the United Kingdom in 1997 had no discernible effects on investment, dividend payments or share prices.

³ See Mayer (1988) and Tirole (2006).

banks can build up the stock of equity finance by retained earnings.

Admati et al. (2010) and Hellwig (2010) consider various arguments that have been made to justify high leverage in banks. These arguments include: increased equity will increase funding costs since equity is more risky; increased equity requirements will lower the rate of return earned by banks; increased equity would be costly since debt is necessary for providing market discipline to managers; and increased equity would force banks to cut back on lending. They argue that there is little reason to fear such implications, because they are not very likely and if they occur, would be welfare enhancing, given that they would result from an internalization of external losses imposed on taxpayers and/or creditors. Haldane (2010) demonstrates how leverage has significantly increased over the last few years: current levels are by no means the historic norm.

5.2.3 Tax distortions

A further incentive for excessive use of debt finance is the tax advantage of doing so. In addition, there is arguably an advantage to the financial sector from being exempt from VAT.

5.2.3.1 Tax incentives for debt financing

It is generally the case that corporation taxes are based on profits including interest receipts but net of interest payments. For personal and institutional shareholders of most companies, this deductibility of interest payments creates an incentive to ask their managers to finance the company's activities through debt rather than equity, because the shareholders' tax on interest income is less than the overall tax burden on retained earnings consisting of the corporation income tax and possibly a personal capital gains tax on share appreciation. The same is true for the shareholders of banks. For a given set of loans, there is therefore an incentive for banks to finance their activities by debt rather than equity.

Such forms of corporation and personal taxation are not new: in most countries they have been in place for decades. If anything, there has been a move towards lower taxes on personal interest income and higher capital gains taxes, although these have been offset also by reductions in corporation tax rates and

increasing restrictions on interest deductibility at the corporate level to combat tax avoidance. Partly because these forms of taxation have been in place in most countries for some time, this factor is not generally considered to have been a decisive factor in the lead-up to the crisis.⁶

Another reason for this judgement is that the definition of what is "debt" and "interest" tends to be different for tax purposes and regulation (see Devereux and Gerritsen 2010). Some financial instruments may be treated as part of equity capital for the purposes of regulation but as debt for the purposes of tax. Hence what is considered to be equity capital for regulatory purposes may receive favourable tax treatment. This implies that the favourable tax treatment of interest may not induce banks to reduce regulatory capital further.

5.2.3.2 Exemption from VAT

The financial sector is generally exempt from VAT. This means that VAT is not charged on outputs, and VAT paid on inputs cannot be reclaimed. Relative to normal VAT treatment, this implies a higher tax on business-to-business transactions (where VAT at earlier levels of production can be offset against later levels), but a lower tax on business-to-consumer transactions. Broadly, evidence suggests that revenue is lower than would be the case under full VAT treatment.⁷ As pointed out by the IMF (2010), this could have contributed to the financial sector becoming larger than would otherwise have been the case.

Exemption is generally used because of the difficulties in identifying value added on margin-based instruments (e.g. borrowing and lending with a spread, but no explicit charge). There is a small optimal tax literature asking whether financial intermediation, as an intermediate good, should be subject to VAT. Lockwood (2010) suggests that in a simple framework, intermediation services should not be taxed, but that there could be a role for a Pigouvian tax (unrelated to the systemic risk issues discussed here).

⁶ See, for example, Hemmelgarn and Nicodeme (2010), IMF (2010), Shackelford, Shaviro and Slemrod (2010). In Germany, however, the tax reforms of the Schröder government strongly moved in this direction by introducing a personal capital gains tax for the first time and dramatically reducing the personal tax on interest income. These reforms may therefore have contributed to inducing the banks owned by personal German shareholders to exploit more fully the scope for leverage that the Basel system of bank regulation allowed.

⁷ De la Feria and Lockwood (2010).

There is therefore the possibility that the financial sector has been under-taxed, and that it may have gained a larger share of the economy as a result. However, this case should not be overstated.

5.2.4 Why did regulation fail?

Banks and other financial companies have not been free to choose their own leverage and risk positions for many years, but have been subject to regulations especially in the Basel I and II agreements. It is clear that these regulations failed to prevent the crisis. Detailed accounts of why these regulations were insufficient are provided elsewhere.⁸ We will not repeat these at length. However, in assessing the reform of these regulations and the possible role of taxation as a replacement or complement to revised regulations, it is useful to identify briefly why they may have failed. The reader is also referred to the section “The role of the Basel system” in Chapter 2.

Over 100 countries signed on to the Basel I agreement, originally set up in 1988. This provided for a minimum capital ratio. Tier 1 capital consists broadly of paid-in capital, accumulated earnings and preferred stock. Tier 2 includes a broader definition of capital, including subordinated debt. Each of these measures is divided by a measure of risk-weighted assets to create the minimum Tier 1 and Tier 2 capital requirements: 4 percent and 8 percent, respectively.

Under Basel I, assets are assigned to broad risk classes, and given weights for use in these ratios. For example, loans to firms were normally given a weight of 0.5, loans to normal banks a weight of 0.2, and sovereign loans a weight of zero. The Basel II accord, implemented in the European Union, Switzerland and some other countries from 2008, introduced a much more flexible system of assigning weights to specific assets. Broadly, following lobbying from the industry, banks were permitted to use their own models to differentiate – in principle, more precisely – the risks associated with different types of lending. Among other things, this permitted banks to hedge their lending with credit default swaps, and replace the risk weight of the debtor with that of the insurer. Overall, as Sinn (2010) demonstrates, the result was that a Tier 1 ratio could easily be four or five times larger than a simple equity asset ratio of

Tier 1 capital to total assets. For many banks, the simple equity asset ratio was less than 2 percent while they reported a Tier 1 ratio in the range of 8 percent or 10 percent.

The problems of the system were exacerbated further by the accounting treatment of mark-to-market, which created procyclical effects. In an upswing, asset prices rise, high profits are recorded which increase Tier 1 capital, and vice versa. Consequently, there is an incentive to reduce Tier 1 capital in an upswing, making it more difficult to replace this capital in a downswing. This effect is multiplied at lower equity asset ratios.

A further problem of the system was that significant parts of the financial system were not subject to the Basel regulations, in particular, hedge funds and special purpose vehicles. The latter were vehicles typically set up in tax havens, and whose assets did not appear on the balance sheet of the parent bank, even though in practice the parent was obliged to assume the risks of the special purpose vehicle.

This very brief review serves to highlight two factors: the level and the definition of the required capital ratio. Both factors require attention.

5.3 Tax versus regulation

Historically, policies to deal with negative externalities arising in the financial system have taken the form of regulation rather than taxes. However, since the crisis there has been a growing interest in the possibility of introducing new taxes on banks.⁹ The motivation could be to induce less harmful behaviour and so reduce externalities, or to raise additional revenue, or both. In this section we address the basic principles involved in choosing between tax and regulation as a means of reducing externalities. We then briefly summarize recent policies either proposed or already enacted by national and international governments.

5.3.1 Basic principles

There is clearly a case for policymakers to intervene in a market which, left to itself, would generate harmful externalities on the rest of society. The classic exam-

⁸ See, for example, Sinn (2010) and Vives (2010a).

⁹ Recent theoretical contributions include Bianchi and Mendoza (2010), Jeanne and Korinek (2010) and Perotti and Suarez (2010).

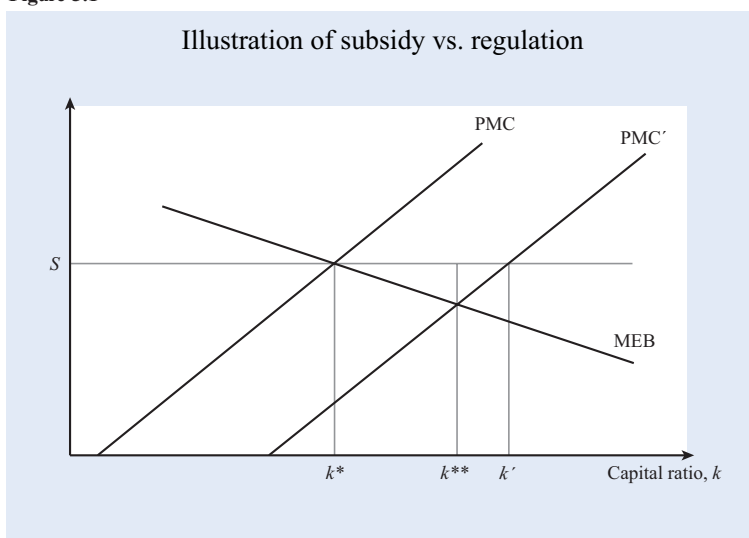
ple of such a market is one that creates pollution. But the need for regulation of banking shows that this is generally also thought to be true in this case as well. In considering intervention in such markets, policymakers have two possible tools, essentially affecting prices or quantities. We can translate this into taxes – affecting prices – or regulation – affecting quantities. Existing regulation of banks through capital requirements is a form of quantity control: banks are given a minimum capital requirement. A tax would follow a different route: by taxing or subsidizing alternative forms of finance, policymakers may induce banks to hold more capital.

The current mainstream view amongst economists about the relative merits of these two approaches stems from a contribution by Weitzman (1974). For example, Stern (2007) and Keen (2010) both apply Weitzman's model to externalities from carbon emissions and from systemic risk in banking, respectively. It is therefore worth briefly presenting this approach before discussing its application in the case of banking.

The approach is illustrated in Figure 5.1, taken from Keen (2010) though also used elsewhere. The upward-sloping lines show the private marginal costs (PMC) facing banks as the proportion of their funding in the form of equity capital, k , rises. The downward-sloping lines represent the marginal net external benefits (MEB) of increasing k . The initial social optimum is at k^* , where the initial PMC line intersects with the MEB line. In the absence of any regulation or taxation the bank would choose the capital ratio for which the private marginal costs are zero.

Keen (2010) discusses the slopes of these lines in terms of a *failure externality* and a *bailout externality*. The failure externality reflects the probability of a bank falling into distress or failure, and the wider social costs if it does so. The greater is the sensitivity of this failure externality to the capital ratio, the steeper is the MEB line. The bailout externality reflects the benefits to banks due to a lower interest rate charged by creditors as a result of creditors expecting to be bailed out in the event of default. A

Figure 5.1



larger bailout externality tends to flatten the PMC line, since it blunts the sensitivity of the cost of raising finance to the capital ratio.

With perfect information, a policymaker could ensure that the social optimum k^* is chosen in the market in two ways. It could subsidise the bank by paying a marginal subsidy of s to offset the banks private marginal costs. Or it could impose k^* as a minimum capital requirement.

However, now suppose that there is a change in the private marginal cost line to PMC'. Alternatively PMC' might also be interpreted as the "true" private marginal cost, known to the bank but not known to the policymaker (who believes that this cost is represented by the original line, PMC).

Under a minimum capital requirement of k^* , there is no change in the capital used by the bank. Even at PMC', the bank would prefer a capital ratio of less than k^* , since at this point private marginal costs are still positive. With a subsidy of s , however, the bank would instead choose a capital ratio of k' , where the combination of marginal cost and subsidy remains zero.

Neither of these outcomes is optimal, since the optimal position is at k^{**} . Conventional analysis compares the total welfare cost under each option. This depends on the relative slopes of the PMC and MEB lines. The position shown in the figure is that the distortion is lower with the subsidy, reflecting the fact that the PMC line is steeper than the MEB line. But this need not generally be true.

However, this analysis makes several implicit assumptions. Notably, as pointed out by Kaplow and Shavell (2002), the analysis assumes a linear subsidy schedule: that is, the marginal rate of subsidy is fixed.¹⁰ Suppose instead that a non-linear schedule were possible. We can expect the bank to take into account its private costs, but not the net social benefits, of a higher capital ratio. Then the optimal position could be achieved if the policymaker could set a marginal subsidy schedule equal to the MEB schedule. In effect, this would simply mean that the bank would fully incorporate the MEB schedule into its decision making.

In this case, the policymaker would not need to know anything about private costs or benefits, but only to estimate the MEB schedule, reflecting the net marginal costs to society. Of course, to the extent to which the MEB schedule is measured with error, then the marginal subsidy would also contain error, and the outcome would not be efficient. But this would be the case with any intervention.

Although the analysis has been framed in terms of a subsidy to be paid to banks, it is relatively straightforward to instead consider this in the form of a tax. The MEB schedule has been drawn with positive values, reflecting a reduction in the net social cost of an increase in the capital ratio, k . A tax which falls as k rises would therefore also be consistent with this approach. Note, though, that such a tax would not necessarily yield revenue equal to social costs. This is because the tax would in principle be set to match the marginal social costs, rather than the average social costs. In general, since *marginal* costs are likely to fall with k , then they will be lower than *average* costs. If each bank faced a tax rate based on the marginal cost of its capital ratio, it is therefore likely to be the case that tax revenues would be lower than social costs.

Of course, both regulation and taxes face a problem in translating such macroeconomic analysis into a policy fit for individual banks. This is partly simply a scale problem. For example, if all banks faced the same non-linear schedule, it would be necessary to divide the aggregate marginal external benefit between banks to derive the appropriate schedule for each bank. A similar problem exists for regulation. A more difficult problem is heterogeneity between banks: a bank which creates more systemic risk at the margin should in principle be taxed at a higher rate. But it is very diffi-

cult to implement a tax in which each bank faces a different tax rate. Dealing with differences between banks is perhaps less difficult for regulation: although even with regulation typically the same regulations apply to all banks within a jurisdiction.¹¹

Finally, this theoretical analysis leaves aside the fact that there is already a system of quantity regulation in place, supported by over 100 countries who have adopted the Basel system. By contrast, proposals for addressing banking externalities through taxes have barely been examined. Taking it as given that some form of regulation will continue along the lines of Basel III, as discussed below, a relevant question is whether there is a role for taxation as a correction mechanism *as well as* regulation. We discuss this further below in the context of specific proposals.

5.3.2 Options for tax and regulation

In this section we briefly summarise proposals for tax and related proposals for regulation that have been made, and already enacted, since the financial crisis began.

5.3.2.1 Tax

Taxes that have been proposed by national and international governments are summarized in Box 5.1.

5.3.2.2 Regulation

Several areas of regulation have been addressed in response to the financial crisis. Here we focus only on changes to capital and liquidity requirements, proposed by the Basel Committee on Banking Supervision (BCBS) as part of the Basel III framework. We therefore leave aside issues relating to the split of financial companies between retail and investment banking, reducing the size of financial companies to prevent them from being too big to fail and the design of resolution mechanisms.¹² All of these issues are important. However, we focus on capital and liq-

¹⁰ Weisbach (2010) also points out that this analysis assumes that policymakers are not able to change the rate of subsidy, or required level of k , in response to new information.

¹¹ The Financial Securities Contribution (FSC) proposed by the IMF is a tax on liabilities. Imposed at a single rate on the value of liabilities, this would be a linear tax, and subject to the Weitzman analysis above. The IMF does consider the possibility that the rate could reflect the systemic risk of each bank but does not appear to consider a non-linear schedule.

¹² Important proposals for regulation of these factors are contained in European Commission (2010b) and Dodd-Frank Act (2010).

Box 5.1**Alternative forms of taxation**

We describe four alternative forms of taxation on banks. This discussion draws on the IMF (2010), and also identifies cases where such taxes have been proposed or enacted.

Financial Securities Contribution (FSC)

Various forms of a tax, or levy, on the liabilities of financial companies have been proposed. The version considered by the IMF (2010) would be paid by all financial institutions, and would initially be levied at a flat rate on a broad measure of the institution's liabilities or assets, excluding capital (Tier 1 for banks), and with a credit in respect of insured liabilities, such as deposits.

This is similar to the Financial Responsibility Fee (FRE) proposed by the United States. This was originally envisaged as a charge of 15 basis points on the liabilities, less Tier 1 capital and insured deposits, of large financial institutions. However, more recent proposals have envisaged it being based on risk-weighted assets. Sweden has introduced a similar stability fee on liabilities of banks at a rate that will rise to 3.6 basis points. The United Kingdom will also introduce a levy, based explicitly on the IMF proposals from 2011. It was originally planned to have a rate of 7 basis points on a broad definition of liabilities. However, the United Kingdom has set a target of raising 2.5 billion pounds in revenue, and plans to adjust the rate to meet this target. France and Germany have also announced their intention to introduce a similar levy.

The motivation for the levy differs. The IMF proposed that it be linked to a resolution mechanism, and that the levy would be intended to pay for any future government support for the sector. In Sweden, the fee is intended to accumulate around 2.5 percent of GDP in a resolution fund. The original US proposal was intended to recover costs already incurred in the crisis. Originally, the UK proposal was "designed to encourage less risky funding and complements the wider agenda to improve regulatory standards and enhance financial stability" (Hoban 2010), but the UK government has more recently emphasised its role as raising revenue. Germany intends to set the rate to reflect systemic risk, and earmark the proceeds for a resolution fund.

Financial Activities Tax (FAT)

The IMF also considered various forms of a Financial Activities Tax. One possibility is to base the tax on profits and all remuneration of financial institutions. If all remuneration is included in the tax base, then the base would effectively be value added, and so could be seen as a substitute for VAT, which is not generally applied to financial activities. However, if the profit element is appropriately designed, and if the remuneration element is restricted to higher levels of remuneration, it could approximate a tax on economic rents earned in the financial sector, given that part of the rent is captured by high-earning executives.

Tax on bonuses

The United Kingdom introduced a temporary tax on bonuses in the financial sector from December 2009 to April 2010 at 50 percent of bonuses above 25,000 pounds. France introduced a temporary bonus tax for the accounting year 2009 at 50 percent of bonuses over 27,500 euros. A tax on bonuses is more difficult to implement on a permanent basis since it would be necessary to identify the proportion of total remuneration which is deemed to be a bonus. Nevertheless, Italy introduced a permanent tax of 10 percent on bonuses and stock options exceeding three times manager's fixed remunerations, from 1 January 2010.

Financial Transactions Tax (FTT)

Popular debate has favoured a financial transactions tax (which has also become known as the "Robin Hood" tax). Many countries already have some form of financial transactions tax. Advocates argue that such a tax could raise substantial revenues from taxing speculative flows that have little social value, and may serve to reduce the incentive to create a cascade of structured securities that were at the heart of the financial crisis. However, the tax would be a relatively blunt instrument for correcting socially costly financial behaviour as it would not be able to distinguish between desirable and undesirable trading. It would not target the key sources of systemic risk, such as the size and interconnectedness of banks. And its burden is likely to fall on the consumers of financial products in the form of lower returns to savings and higher borrowing costs. A comprehensive survey of the case for and against an FTT is provided by Matheson (2010).

uidity requirements because it is in these areas that there is a need to analyse the interaction and choice between taxes and regulation.

The Basel III framework, setting new controls on capital and on liquidity, was announced in September 2010. The minimum limits for "capital" as a percent-

age of risk-weighted assets or the size of the balance sheet, which come into effect by 2019, are shown in Table 5.1.

The counter-cyclical buffer range is intended to be left to national authorities. Also, BCBS announced that “systemically important banks” should have loss-absorbing capacity beyond these standards. The minimum capital asset ratio of 3 percent, which corresponds to a maximum leverage ratio of 33, is new. It avoids the problem of risk-weighting the banks’ assets at the cost of not distinguishing between their risk. Its effect is discussed further below. The 3 percent ratio will be tested over a period that begins in 2013.

Note too that countries are able to impose much stricter requirements. For example, Switzerland requires UBS and Credit Suisse to hold total capital equal to 19 percent of their risk-adjusted assets. Nine percentage points is allowed to be held in the form of contingent convertible capital instruments (cocos), which are bonds that convert to equity if a bank’s capital ratio falls below a predetermined level.

The Basel III proposals contain two new minimum liquidity requirements, designed to enhance both the ability of banks to repay their liabilities as they fall due and the maturity matching of banks’ balance sheets. There is a particular emphasis on moving banks away from relying too heavily on short-term wholesale funding:

- Liquidity coverage – banks must hold sufficient high quality liquid assets (cash, government bonds, covered bonds and highly rated corporate bonds) to enable them to withstand for 30 days the loss of a proportion of their retail deposits and an inability to roll over any corporate and wholesale deposits.

- Net stable funding – banks must hold sufficient stable sources of funding to match their lending of over one year maturity.

In the European Union, these proposals are expected to be implemented through the Commission’s Capital Requirements Directive. As with capital, national regulators may set additional standards. For example, the United Kingdom has already implemented new liquidity arrangements which are, in many respects, more restrictive than those proposed by the BCBS and are likely to remain so.

Both the BCBS and national regulators have also emphasised the importance of the boards of banks’ understanding liquidity risk, taking a close interest in setting a risk appetite, and satisfying themselves that these risks are properly monitored and controlled; the need for banks to run a range of stress tests, covering both bank-specific and market-wide vulnerabilities; and for banks to have adequate systems, data, reporting and management information to enable continuous management of liquidity.

Basel III is an improvement over Basel II insofar as it requires substantially more equity. The leverage ratio in particular will change banks’ behaviour insofar as they now for the first time need to hold equity against government bonds, which are not included in the sum of risk-weighted assets to which the Tier 1 ratio refers.

Nevertheless, a minimum of the capital asset ratio of 3 percent is not yet sufficient as a bank’s losses could easily exceed 3 percent of its balance sheet. For example, in the present crisis, the write-off losses of internationally relevant financial institutions such as Wachovia, Washington Mutual, Fannie Mae or Freddie Mac ranged between 13 percent and 16 percent of the respective balance sheets.¹³ The failure of these banks would not have been prevented with the Basel III regulation.

There is moreover the problem that even the tightest equity regulation will fail to establish more prudence in the banking business if the government sees itself forced to bail out a bank when its equity falls below the regulatory minimum because the bank would otherwise have to be shut down by the regulator (the

Table 5.1

Basel III capital requirements from year 2019

	Common equity	Tier 1 capital	Total capital
Capital-asset ratio*		3.0	
<i>Percentage of risk-weighted assets</i>			
Minimum	4.5	6.0	8.0
Plus conservation buffer	7.0	8.5	10.5
Counter cyclical buffer range	0–2.5		
<i>Basel II</i>		4.0	8.0
* inverse leverage ratio.			

Source: BCBS (2010a).

¹³ See Sinn (2010), Chapter 8, Table 8.1.

regulation paradox). As we argue in Chapter 2, the problem could be removed by bailing out the endangered banks not with gifts but with fresh equity in exchange for company shares. Providing new equity in exchange for shares makes the regulatory equity of the bank liable without having to shut down the bank; it is a method to save the bank without saving its shareholders. It induces the shareholders to opt for cautious business models that reduce the risk of gambling at the expense of the taxpayers.

To be able to recapitalise banks, a fund could be set up that holds enough capital for this purpose. The government could force banks to set up this fund with an appropriate levy, or it could impose a tax on the banking business such as will be discussed in the next section.

5.4 Taxation to raise revenue

The rationale for raising additional tax revenue from banks and other financial companies can be backward-looking or forward-looking.

As noted in the Introduction, the original US proposals for a “Financial Crisis Responsibility Fee” were explicitly related to paying for the bailout costs of the crisis through the Troubled Asset Relief Program (TARP). Laeven and Valencia (2010) provide some evidence on the costs of bailouts to date. As might be expected, these vary considerably between crises and between countries. They also vary depending on what is included in the costs. For example, with respect to the financial crisis of 2007–8, Laeven and Valencia estimate that the direct fiscal costs were on average around 5 percent of GDP. In advanced economies, by the end of 2009, the IMF (2010) suggests that the cost of direct support had amounted to only 2.8 percent of GDP. But Laeven and Valencia point out that the crises led to output losses of 25 percent of GDP, and a consequent increase in public debt of around 24 percent of GDP. How large a tax is needed to cover costs therefore depends critically on exactly what costs are to be covered.

The aim of reimbursing past costs deserves some comments. First, the effective incidence of taxes levied on banks now may not match the effective incidence of prior bailout payments. The implication of President Obama’s remarks, cited above, is that individuals that benefited from the US bailouts should be those who repay that money in the form of higher

taxes. But it is not enough to say, for example, that bank A received bailout funds, and therefore that bank A should face a tax payment now. First, this is because the benefits of the bailout were shared widely across the economy. Indeed, the point of the bailout was not to protect individual banks but to protect the entire financial system, and beyond that, the entire economy. To that extent, virtually everyone in the economy must have benefited from bailouts.

Second, even from a narrower perspective, it cannot be the bank that ultimately bears the tax burden, but individuals associated with the bank – its shareholders, employees, suppliers and customers. Which of these individuals ultimately bears the tax burden depends on the type of tax levied, and the conditions in the various markets in which the bank operates. What is far from clear, however, is whether any tax levied post-crisis will be borne by the individuals who profited from the bailouts, or from the behaviour of the bank before the bailout.

The instructions from the G20 to the IMF for considering taxes on banks were also based on raising revenue, rather than influencing behaviour: the IMF was charged to consider how the financial sector could make a “fair and substantial contribution” to meeting the costs associated with government interventions. However, this was also interpreted by the IMF as a forward-looking question: how could a tax or levy help meet the costs of future crises? The IMF rightly argues that the financial sector should pay for fiscal support that it may receive in the future. It also points to the need for an effective resolution mechanism in the event that financial support is needed, and believes that taxes could support regulation in addressing externalities arising in the financial sector. We discuss the last point in the next section. Here we consider only the scope of a tax on the financial sector that would be necessary to support an effective resolution mechanism. The size of the revenue necessary is open to question, and is not directly addressed by the IMF. We also leave that aside, though it seems reasonable that revenues should build up over time to a fund that amounts to at least several percent of GDP.

In designing a tax to raise revenue there are two possible routes to consider, even leaving aside (as we do here) the possibility of attempting to modify behaviour to reduce externalities. The first route would be to attempt to design a tax or levy that is like an insurance premium. The second route would be to attempt to design a tax that is as non-distorting as possible.

Following the insurance premium route, the tax should fall more heavily on banks and financial companies that are more likely to require help from a resolution fund, and from those that are likely to require more substantial funds if that event occurs. That is, the tax should fall more heavily on companies that are larger, more fragile, and more systemically connected to the rest of the financial sector.

A tax designed on this basis would go well beyond the simple objective of raising revenue. By targeting companies that are more likely to require financial support, the tax would in turn be likely to have significant behavioural consequences. For example, Matutes and Vives (2000) show how fair, risk-based, deposit insurance induces banks to behave less aggressively when the regulator observes the risk position of the bank. This may have beneficial consequences but raises the issue of the relationship with existing regulations. The proposed tax that comes closest to this is the Financial Securities Contribution (FSC); we discuss this proposal in more detail in the next section.

The alternative approach would be to design a tax that would raise revenue from the financial sector as a whole but would not seek to base the tax liability on actuarially fair insurance premia. Other things being equal, such a tax would not distort the behaviour of the financial sector beyond what is required by regulation. The most obvious way to achieve this would be a tax on economic rent.

This could be implemented in several ways, but perhaps the most straightforward would be something comparable to existing corporation taxes but which also gives relief for the opportunity cost of equity finance, known as an “allowance for corporate equity”, or ACE (IFS 1991). This has been proposed in the literature as a replacement for existing tax systems on the grounds that it is neutral with respect to the financing decision (since debt and equity receive equivalent treatment) and the scale of investment (the effective marginal tax rate is zero, since it is a tax only on economic rent).

Note that such a tax could be implemented in addition to conventional, existing corporation taxes. The effect would be that the total marginal tax rate on economic rent would be equal to the sum of the rates of the two taxes, while a lower rate (from existing taxes) would be applied to other capital income. This would not remove the tax advantage to debt finance, but the new tax would not exacerbate that problem. An alter-

native would be to use such a tax to replace existing corporation taxes. However, in this case raising revenue in excess of what is already raised would require a very high rate, since it would be applied to a narrower tax base.

The IMF instead has proposed a series of taxes that they call a “Financial Activities Tax” (FAT) (see Keen, Krellove and Norregard 2010, for a discussion). At one extreme, this would be approximately the same as a corporation tax with an ACE allowance, plus a tax on very high remuneration. This could also be considered as a tax on economic rent, to the extent that part of the economic rent of the company is captured by the management in the form of high remuneration.

At the other extreme, the IMF proposes a tax on economic rent plus all remuneration, rather than just high remuneration. They point out that this tax base is equivalent to value added, and consider whether it would be appropriate as a tax on the financial sector in place of VAT (which is not generally applied to the output of financial services). There is a reasonable case to be made for raising additional revenue in the form of a tax on value added. However, there are important technical details about how it could be implemented that remain as yet unresolved. The key issue is one of cascading: in the VAT system, VAT paid on inputs can be offset against VAT charged on outputs, which has the net effect that VAT ends up as a tax on sales to the final consumer. But there is no mechanism as yet for introducing something similar for the FAT, which may mean that there are several levels of tax.

Nevertheless, some form of the FAT is a promising way of raising additional tax revenue from the financial sector in a way which should generate relatively small distortions. The choice between a narrower tax base focussed on economic rent, and a broader tax base equivalent to value added, depends to some extent on the need for revenue and the consequent rate at which the tax would be levied. For relatively small tax revenues, the narrower tax base is attractive. However, if larger revenues are needed, then the implied tax rate required could be very high, and the broader tax base would become more attractive.

5.5 Crisis prevention

In the previous section we have discussed the appropriate structure of taxes on the financial sector when

the aim is to raise revenue either as a form of insurance premium, or in a relatively non-distorting way. We now turn to discuss the possibility that taxes may be used as a way of deliberately influencing the behaviour of banks and other financial institutions, in particular to reduce the risk of a future financial crisis. A key issue in considering any form of tax designed for this purpose is its interaction with regulatory requirements. Starting with a blank sheet of paper, it might be possible to design a tax that would make regulation unnecessary; and we discuss this possibility briefly. More realistically though, any new tax would sit alongside existing and new regulations. It is therefore important to consider the impact of such a tax conditional on such regulations being in place.

The main focus of this section is how taxes and regulation can be used to address the solvency of financial companies through capital requirements or taxes on liabilities. However, this cannot be divorced from other aspects of their behaviour. In particular, capital and liquidity regulations and taxes need to be coordinated, together with competition policy.¹⁴

In the space available we do not aim to be comprehensive in discussing options for regulation and taxation. We therefore do not consider issues of competition; we do not discuss whether investment banking should be split from retail banking, or whether banks should simply be reduced in size. While these are important regulatory issues, they are less relevant for taxation, and we therefore leave them to one side.¹⁵

5.5.1 Capital adequacy

As described above, there have been considerable recent developments in regulations for capital adequacy through the Basel III proposals. At the same time, some of the taxes proposed in response to the financial crisis have also been designed to target the amount of capital held by banks. In this section we address two main issues. First, we consider the likely effects of a tax on financial liabilities, along the lines of the Financial Services Contribution (FSC) proposed by the IMF, on the financing and lending activities of banks. Second, we summarise evidence on the case for more stringent capital requirements or taxes.

¹⁴ Vives (2010b) shows how liquidity and solvency requirements are substitutable and how they may depend also on the strength of competition.

¹⁵ Vives (2010a) discusses at length the relationship between competition and stability in banking in the aftermath of the crisis.

5.5.1.1 Taxes in the presence of regulation

If taxation is to be used as an element of crisis prevention, then its precise design is important. To illustrate this, consider the FSC, as proposed by the IMF, a form of which has been enacted in Sweden and the United Kingdom. The IMF proposes a levy based on “a broad balance sheet base on the liabilities side, excluding capital ... and possibly including off-balance sheet items, and with a credit for payments in respect of insured liabilities” (IMF 2010a, p. 13).

The IMF proposes this base after considering a levy based on risk-weighted assets. It rejects the former on the grounds that such a levy could duplicate the effects of Basel regulations also targeted at risk on the asset side. This illustrates the problem of attempting to use two instruments. If the tax and the regulation are perfectly in alignment, then it seems likely that the tax would have no effect on behaviour beyond what is required by regulation. But if they are not in perfect alignment, then the form of their interaction could be important.

To prepare for this discussion let us first study the interaction between a regulation based on the Tier 1 capital ratio and one which is in addition based on the capital asset ratio as in the Basel III system. Consider Figure 5.2. The vertical axis shows a bank's sum of risk weighted assets relative to total assets, R , and the horizontal axis the capital ratio, i.e. the ratio of Tier 1 capital to total assets (the inverse leverage ratio), k . The upward sloping line marked Basel II reflects the trade-off permitted in the Basel II regulations between capital and risk-weighted assets. The inverse of the slope of this line is the Tier 1 ratio, i.e. the ratio of capital and risk-weighted assets. That is, a bank that increased the risk of its assets as measured in the Basel system would be required also to hold more capital. The line therefore represents a locus of points that are just acceptable to the regulator. We assume, based on experience and the theoretical explanations for the incentive to gamble under limited liability, that banks would prefer a combination of lower capital and more risk: that is, they would prefer to be located towards the top left part of the diagram. However, given regulation, the bank is forced to choose a desired position either on the Basel II locus, or to the right of the locus.

Let us assume that the bank chooses the point (R_1, k_1) . In practice, banks may choose to hold a buffer of additional capital to ensure that they do not easily

cross the threshold due to small movements in asset values; however, we neglect that possibility here.

The increase of the minimum Tier 1 ratio according to Basel III pivots the locus to the right in a clockwise fashion, keeping the origin fixed, because more Tier 1 capital is needed relative to total assets for any given share of risk-weighted assets in total assets. In the absence of further effects, let us suppose that given the new regulations, the bank moves to the point (R_2, k_2) .

However, as noted above, the Basel III regulations also introduce a minimum constraint to the capital asset ratio. In the Figure, let us assume that this constraint is binding, at k_3 with $k_3 > k_2$. In effect, at the minimum capital asset ratio the maximum share of risk-weighted assets is R_3 ; above this level, the Tier 1 ratio, as given by the Basel III line, becomes binding. As shown in the figure, as long as the bank continues to prefer to hold less capital and engage in more risky lending, then the effect of the leverage ratio will be likely to shift the bank from (R_2, k_2) not to (R_2, k_3) but to (R_3, k_3) . This is still on the locus of acceptable points under the Basel III line. But it does not represent a safer combination of capital and risk as measured by the Tier 1 ratio: rather, since it lies on the Basel III line, these two points represent an equally acceptable trade-off between risk, as ordinarily measured, and capital.

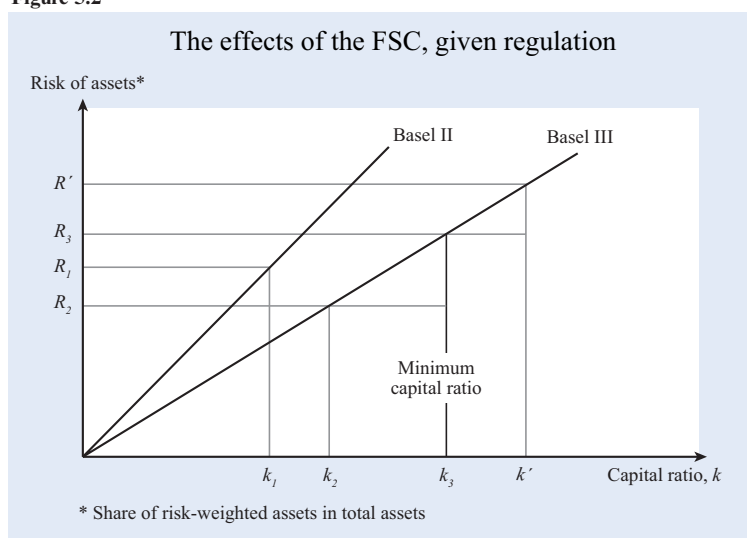
This may seem to imply that the minimum capital ratio does not serve any useful purpose. However, the rationale for the minimum capital asset ratio in Basel III is that there are important deficiencies in the Basel system of risk measurement. As noted above, loans to companies normally have a weight of 0.5, loans to banks have a weight of 0.2, and loans to governments are not counted at all. The financial crisis in general and the sovereign debt crisis in particular have shown how distorted the idea of measuring risk by looking at risk-weighted assets actually is. What seemed as a reasonable concept, in practice has turned out to be a recipe for disaster (see Chapter 2).

The leverage constraint in terms of the minimum capital asset ratio, k_3 in Figure 5.2, was intro-

duced to constrain the assets not included in the concept of risk-weighted assets. If the availability of equity capital is fixed, then a bank has to scale down its balance sheet to meet the higher required capital asset ratio. Doing so by reducing assets not included in the sum of risk-weighted assets, such as the lending to governments, would also raise the average risk of the remaining assets, and help the bank move towards (R_3, k_3) . But it would reduce the overall risk, as the volume of assets such as government bonds, which are risky but not included in the sum of risk-weighted assets, is smaller at k_3 than at k_2 . Thus, even though the minimum capital requirement does not change the measured risk relative to capital, it does reduce the non-measured risk relative to capital, which could mean lower externalities being imposed on the bank's creditors and on taxpayers.

In addition to the leverage constraint, improvements in the calculation of the sum of risk-weighted assets seem advisable, given that the risk weights have been chosen arbitrarily, reflecting lobbying power more than basic economic rationale. A re-adjustment of these weights seems highly advisable. Such a reform should ensure that the sum of risk-weighted assets across all banks of a country equals or approximates the sum of all assets; this would avoid the Tier 1 ratio being four to six times as large as the capital asset ratio (Sinn 2010, Chapters 7 and 8). Some economists, such as Hellwig, find such endeavours futile as lobbyists will always undermine the effort of re-adjusting risk weights so as to truly reflect risky lending operations (Hellwig 2010). They therefore suggest giving up the idea of risk-weighting assets entirely and basing the regulation only on the leverage ratio.

Figure 5.2



Consider now the role of the FSC suggested by the IMF, i.e. basically a tax on a bank's balance sheet, net of its capital and augmented by off-shore operations. Suppose we begin at point (R_3, k_3) and introduce the FSC. One possibility is that the new levy would have no effect: the bank would simply accept the additional cost, but that cost would not be sufficient to induce it to increase k .

The other possibility is that the levy is sufficiently high so that the bank chooses to hold more capital than is required by the Basel regulations. As shown in the figure, this could move the bank to (R_3, k') . However, once again, if the bank prefers more risk in the sense of risk-weighted assets, then it can move back onto the Tier 1 Basel III locus by investing in riskier assets, to reach (R', k') .

This change therefore has exactly the same effects as that induced by the introduction of the minimum capital ratio. Given equity capital, assets not included in the sum of risk-weighted assets are reduced, raising measured risk to total assets, but to the extent that the released assets have some risk, the ratio of risk to equity is lower.

The beneficiaries of such a tax would be firms of the real economy because their credits have the highest weights in the sum of risk-weighted assets, and governments will suffer, because their credit is part of the non-measured risk that is reduced by the tax. Lower lending rates for firms and higher ones for governments will result. Given the distortions that the financial crisis and the sovereign debt crisis have demonstrated, this would likely contribute to a more solid growth process of the Western world in the future.

5.5.1.2 Empirical evidence to guide regulation or taxation

Irrespective of the choice of policy instrument, to implement appropriate policy it is necessary to estimate the marginal costs and benefits of banks having higher capital. Not surprisingly, social benefits and costs are hard to measure, and estimates differ considerably, at least in part because of the assumptions made in the analysis. In this section we briefly review existing estimates, attempting to make them comparable with each other. In particular, we compare estimates made by the BCBS (2010b), the Bank of England (2010), Kashyap et al. (2010) and Miles (2010).

First, consider the benefits of raising the capital ratio. Table 5.2 presents estimates derived from the BCBS (2010b). The BCBS (2010b) estimates the benefits of raising the capital ratio for one year as the reduction in the probability of a crisis during that year multiplied by the costs of a crisis if it occurs. They specify estimates of the probability of a crisis relative to the ratio of total capital employed to risk-weighted assets.

The BCBS (2010b) estimates the probability of a crisis at 7.2 percent at a capital ratio of 6, falling to 4.6 percent at a ratio of 7 percent, and continuing to fall to 1 percent at a ratio of 11 percent, with further, though smaller falls after that. The estimates shown in the second column of the Table represent the marginal effects of increasing the capital to risk-weighted assets ratio by 1 percentage point. Thus, for example, increasing the ratio from 6 percent to 7 percent reduces the probability of a crisis by 2.6 percentage points. This gain rapidly diminishes as the ratio rises.

The costs of a crisis are particularly difficult to measure. Estimates depend in part on assumptions made about the effects on the long-run steady-state: that is, whether the output of the economy ever catches up to the level it would have achieved in the absence of the crisis. We do not present new estimates here but simply summarise those of the BCBS (2010b). Across all estimates that it analysed, it found that the mean estimate of the cost of a crisis was 106 percent of pre-crisis GDP, with a median of 63 percent. In columns 3 and 4 of Table 5.2 we show the implied marginal benefits of increasing the capital ratio as reduction in the probability of a crisis multiplied by each of these estimates of the cost of a crisis. The results are broadly in line with those of the Bank of England (2010), although their estimates are presented in a rather different way. The marginal benefit from increasing the capital ratio by one percentage point can be as high as 2.76 percent of GDP, although much smaller gains are likely at relatively high capital ratios. Note though, that these estimates are subject to considerable uncertainty.

There is a wide dispersion in estimates of the cost of raising the capital ratio. Columns 5 and 6 present estimates of the marginal costs as estimated by the BCBS (2010b) and the Bank of England (2010). Although these estimates are very similar, there are significant differences in how they are computed. In each case, the estimate is based on the assumption that any rise

in the cost of finance to banks from a higher capital ratio would be passed on to borrowers, leaving the return earned by the bank unchanged. The BCBS (2010b) estimates that an additional 1 percentage point in the capital ratio would raise the bank's lending rate by around 13 basis points, and on their central estimate, this translates into a consequent reduction in output of 0.09 percent. The Bank of England (2010) estimates that the change would raise the lending rate by only 7 basis points, but that this would reduce output by 0.1 percent.

Crucially, both of these estimates assume that the rates of return to the bank's capital owners and creditors are unchanged by changing the capital ratio. As discussed above, however, it seems implausible that there should be no change in these rates of return. These estimates should therefore be interpreted as an upper bound.

Further, both estimates take into account the higher tax that will be due because of a reduction in interest payments as the bank replaces debt with equity capital. We have argued above that the deductibility of interest in combination with different effective tax burdens on retained earnings and interest income of shareholders represents a tax-induced distortion to capital markets, generating an incentive to lower the capital ratio. It does not therefore seem reasonable to treat a reduction in this tax advantage as part of the social cost of reducing bank borrowing.

Two other studies attempt to correct for both of these factors. Kashyap et al. (2010) first examine whether there is evidence that the required return on equity falls as the capital ratio rises, as predicted by theory. They claim that their results "give us some empirical support for using the Modigliani-Miller framework as a basis of our calibrations, particularly for the purposes of a long-run steady-state analysis". Based on the Modigliani-Miller approach, Kashyap et al. (2010) consider two costs arising from raising the capital ratio. One is the tax cost, discussed above. They estimate that a 2 percentage point rise in the capital ratio would increase the lending rate by 5 basis points due to taxation. However, we neglect this in the table, on the grounds that this does not represent a social cost.

Kashyap et al. (2010) also consider other potential costs. One is that additional equity capital might replace short-term debt, which might be more likely in the presence of additional liquidity requirements as

well as additional capital requirements. To the extent to which short-term debt has a "money-like" convenience factor, Kashyap et al. (2010) suggest an upper bound on the premium would be 2 basis points for a 2 percentage point difference in the capital ratio. In Table 5.2 we estimate the effect on output of this change. To do so, we use an average of the estimates from the BCBS (2010b) and the Bank of England (2010) of the effect of a 1 basis point change in the lending rate on output. This translates into a marginal reduction in GDP of 0.01 percent.

Finally, Miles (2010) undertakes a similar exercise, using the Bank of England study as a starting point. He too abstracts from the tax effect, and makes a partial adjustment for the required rate of return on equity. He also makes two other adjustments. The result is that he finds the estimated cost is less than 10 percent of that shown in Bank of England (2010). Translating his approach into a comparable cost in our table, we estimate the implied marginal cost to be well under 0.01 percent of GDP. This is shown in the last column of Table 5.2.

While all of the estimates in the table are subject to very large uncertainty, they can form the basis of a rough guide to policy. In terms of a regulatory requirement, the minimum capital ratio should be set where marginal benefits are equal to marginal costs. At the upper bound of estimates of costs, this would imply a minimum capital ratio of around 13 percent to 15 percent, depending on which estimate of the marginal benefit is used. The Basel III requirements currently peak at 13 percent if the ratio for total capital is used, plus the full extent of the counter-cyclical buffer. The estimates in Table 5.2 suggest that this should be considered to be a lower bound for the minimum capital requirement.

Allowing for some reduction in the required return on equity capital, and abstracting from tax advantages, the estimates indicate that marginal benefits clearly exceed marginal costs even at a ratio of 15 percent. This suggests that the optimal ratio could be significantly in excess of 15 percent. Marginal benefits above this are likely to be relatively small, but could easily be as high as 0.1 percent of GDP for each additional percentage point of the capital ratio, though they would decline as the ratio increased.

In principle, the estimates in Table 5.2 could be used as the basis of a Pigouvian tax designed to induce banks to choose the socially optimal capital ratio. To

Table 5.2

Comparison of benefits and costs of raising capital ratios

Capital as % of risk-weighted assets	Marginal reduction in probability of crisis	Implied marginal benefit of increasing capital ratio, % of GDP		Estimated marginal cost of increasing capital ratio, % of GDP			
		Based on mean cost of 106% of GDP	Based on median cost of 63% of GDP	BCBS (2010b), based on median effect	Bank of England (2010)	Kashyap (2010), excluding tax	Miles (2010)
7	2.6	2.76	1.64	0.09	0.1	0.011	0.006
8	1.6	1.70	1.01	0.09	0.1	0.011	0.006
9	1.1	1.17	0.69	0.09	0.1	0.011	0.006
10	0.5	0.53	0.32	0.09	0.1	0.011	0.006
11	0.4	0.42	0.25	0.09	0.1	0.011	0.006
12	0.3	0.32	0.19	0.09	0.1	0.011	0.006
13	0.2	0.21	0.13	0.09	0.1	0.011	0.006
14	0.1	0.11	0.06	0.09	0.1	0.011	0.006
15	0.1	0.11	0.06	0.09	0.1	0.011	0.006

Sources: Columns 2–5, BCBS (2010b); Column 6, Bank of England (2010); Column 7, Kashyap et al. (2010); Column 8, Miles (2010).

begin with, use the BCBS (2010b) estimate of the probability of a crisis at a capital ratio of 7 percent to be 4.6 percent. Evaluating the total expected net cost at this probability based on the mean expected cost of a crisis of 106 percent of GDP, and adjusting for the effects on banks' lending rates, yields a total expected net social cost of just under 5 percent of GDP. This is an indication of the size of the Pigouvian tax that could in principle be levied on the financial sector at this capital ratio. Based on the same approach, the tax would fall to around 3 percent of GDP at a capital ratio of 8 percent, then continue falling to be just under 1 percent of GDP at a capital ratio of 11 percent. In sum, there is a case for a very high Pigouvian tax at low capital ratios. But as capital ratios fall, the optimal Pigouvian tax would fall rapidly.

5.5.2 Other issues

There are of course a number of actual and potential regulations that could be applied to the financial sector. Given the aim of this chapter, we focus briefly on just two related to taxation: liquidity and bonuses. Section 5.2 of this chapter set out arguments in some detail as to whether the financial crisis was caused by either illiquidity of financial companies or by agency problems in that bank executives were not necessarily acting in the interests of shareholders.

It is likely that the real problems causing the crisis were of solvency rather than simply illiquidity. However, even if this is true, then lack of liquidity in the banking system could be an important factor in driving another crisis. Perotti and Suarez (2009a, b) argue that an excessive use of short-term financing imposes an externality on the rest of the financial sector by increasing the risk of fire sales, panics and thus leading to strong crisis propagation mechanisms. As set out above, the Basel III regime will tighten liquidity requirements on banks. But reducing externalities associated with liquidity could in principle also be achieved by a Pigouvian tax. Such a tax has been proposed by Perotti and Suarez (2009a, b), who suggest the introduction of a tax on non-insured liabilities that increase the more liquid the liability is. Very short-term debt financing, being most prone to induce bank-runs, should be taxed the most. Funding from capital and insured retail deposits would, on the other hand, be exempt from the tax.

In principle, liquidity problems could be dealt with *ex post*, by liquidity support from governments or central banks. However, as clearly demonstrated during the latest financial crises, it is very difficult to distinguish liquidity problems from insolvency. In such a case, liquidity support is costly and creates substantial moral hazard problems. Although, the idea to tax short-term financing has a clear merit, it would be necessary to analyse any detailed proposals for such a

tax in the light of detailed proposals for liquidity regulation before judging it.

The extent to which the financial crisis was caused by agency problems, leading bank executives to act in their own interests, is open to question, since the incentives of executives are reasonably closely aligned with those of shareholders, and shareholders may clearly benefit from excessive risk-taking due to the miniscule liability the required capital ratios mean for them. Nevertheless, as noted above, several countries have implemented temporary or permanent taxes on high bonuses paid to bank employees.

We do not favour such taxes. The key reason is that the proportion of an executive's remuneration paid in the form of a bonus can easily be changed. Indeed, there are clear signs in the United Kingdom that the basic remuneration of bank directors is increasing rapidly, as bonuses are expected to decline. A tax on bonuses is therefore likely to distort the incentive package offered to executives. Arguably, this distortion could be in a socially beneficial direction: if executives do not share in the upside gains, then their incentive to undertake risky investment would be diminished. But this could also have a wider effect on the incentives to maximise profit. More generally, high bonuses, and high profits, might reflect a lack of competition in the financial sector. Rather than introducing new taxes on some of the symptoms of this lack of competition, policymakers should consider targeting the fundamental features of the sector that reduce competitive pressures. Extremely high-powered bonuses may reflect shareholders' incentives to take excessive risk rather than an agency problem within banks. Most likely, shareholders will find other ways to induce their executives to gamble if bonuses are taxed.

5.6 Conclusions

This chapter analyses the case for introducing new taxes in the financial sector. Any such taxes would interact with, and possibly conflict with, existing regulations. The chapter therefore deals with both taxes and regulations; it focuses primarily on those regulations which are most closely related to taxation.

There are two broad objectives for introducing a tax in the financial sector. The first is straightforward: to raise revenue. This could be backward-looking – to

reimburse governments and society for the cost of the last financial crisis – or forward-looking – to build a resolution fund ready for the next crisis. Indeed we have argued here and in Chapter 2 that such a fund, which provides endangered banks with fresh equity capital in exchange for shares, would be highly useful to overcome the regulation paradox – that no required equity level would prevent a crisis if the regulator shuts down the bank once its equity falls under this level.

From a forward-looking, revenue-raising, perspective, there are various options for the tax base. One is to levy a form of insurance premium, where the tax reflects the risk that an individual company will require support from the resolution fund, and the amount of support it would require. Such a tax would be complex, however, and would almost certainly have repercussions for the efficacy of regulation.

Another option is a FAT, as recently proposed by the IMF, which has two possible forms. In principle, we would favour a narrow base, including economic rents and remuneration of very highly paid employees (which are also akin to economic rents). This would in principle be non-distorting, but may require a relatively high rate depending on the revenue requirements. This tax could be introduced alongside a conventional corporation tax on profits net of interest payments. If so, it would not correct the existing distortion in favour of debt finance, but it would also not worsen it. In principle, the tax could also replace existing corporation taxes. This would be beneficial in that the tax distortion in favour of debt finance would be removed. However, the tax base would be relatively narrow, and to raise the required revenue the implied tax rate may need to be very high.

At the other extreme, another version of the FAT would include all remuneration in the tax base. This would be similar to a tax on value added, and could be seen as a substitute for the lack of VAT in the financial sector. It too could be introduced alongside existing taxes. In this case there are a number of technical details about how the tax could be implemented that remain to be resolved.

A second objective of a new tax in the financial sector could be to help make a future crisis less likely, by inducing banks and other financial companies to reduce leverage or to invest in less risky assets. One option for this objective is the FSC proposed by the IMF. Basically this is a tax on the bank's balance sheet

that exempts the equity capital and insured assets but includes off-balance sheet operations. Several countries have either introduced, or announced that they plan to introduce, such tax. While this tax is partly designed to raise revenue, it is also clearly intended to reduce leverage.

In principle, such a tax could be a meaningful addition to a Tier 1 capital regulation. It could induce a higher ratio of capital relative to all assets including government bonds, which are currently not included in the sum of risk-weighted assets in the Basel system, although the European debt crisis has demonstrated how large the risks associated with such assets really were. However, the FSC, like a minimum capital requirement such as included in Basel III, is independent of the risk of the bank's assets. It is likely that a bank would respond to a higher capital ratio – induced either by the FSC or by the minimum capital ratio – by increasing the risk of its assets, commensurate with Tier 1 capital regulation. The benefit of higher capital would therefore be undermined, at least to some extent, by greater asset risk. After reacting to the tax, the measured risk relative to the capital may be as large as before. Nevertheless, an advantage will remain to the extent that the non-measured risk, including the risk associated with government bonds, is reduced.

In practice, such a tax would be implemented alongside existing regulations. We review evidence on the minimum capital requirements that are necessary to equate marginal social costs and benefits. Based on this evidence, the highest requirement under Basel III, of 13 percent of risk-weighted assets should be seen as a lower bound of what is socially optimal. It is likely that additional social benefits would be achieved by a higher ratio, though these benefits would probably be small, relative to those achieved by raising the ratio to 13 percent.

We propose that these requirements could also continue to be set by regulation, while we are more insecure about the role of a tax. A minimum capital asset ratio is a possibility, but the required ratio should be substantially higher than 3 percent, given that in the financial crisis the write-off losses of the entire US banking system were 4.7 percent of the aggregate balance sheet and quite a number of prominent banks had losses in the range of 14 to 16 percent of their balance sheets.¹⁶

¹⁶ Sinn (2010, p. 175, Table 8.1).

In sum, additional tax revenue would be useful in establishing a crisis resolution fund. Options for taxation include taxes, such as the FAT, that are intended to raise revenue in a relatively non-distorting way. They also include taxes, such as the FSC, which are intended to supplement regulation. The main case in favour of the latter stems from an attempt to overcome the deficiencies of existing regulation: its value may therefore depend on whether it is instead possible to reform the regulation directly.

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Appendix 5.A

Some simple corporate finance

(a) How does limited liability affect the incentive to undertake risky projects?

Consider the following three companies, A, B and C (see Table 5.A.1). Each company undertakes an investment of 100, financed 80 by debt and 20 by equity. In each case there are two equally probable outcomes, good and bad. The expected return is the same in all cases: 110. However, the risk differs. Firm A has possible outcomes of 90 and 130; B of 70 and 150; and C of 50 and 170. The risk free rate of interest is 5 percent.

(i) Risk neutrality

Suppose, to begin with, that both the creditors and shareholders are risk neutral. This implies that the creditor seeks a total expected return of 84.

For firm A, even the bad outcome yields more than 84, and so the creditor can charge the risk-free interest rate of 5 percent, and receive 84 for certain. The shareholder is left with 6 or 46, an expected return of 26. For firm B, in the bad state the firm goes bankrupt, and the creditor receives 70. To achieve an expected return of 84, he must therefore charge an interest rate, b , which earns 98 in the good outcome. This is $b = 22.5$ percent. The shareholder receives zero in the bad outcome, and 52 in the good outcome, again an expected return of 26. The same happens for firm C. In this case the creditor earns 50 in the bad outcome, and must therefore earn 118 in the good outcome, implying an interest rate of $c = 47.5$ percent. The shareholder again receives zero in the bad outcome, and 52 in the good outcome, with an expected return of 26.

Table 5.A.1

Returns – constant capital ratios

	Company	Investment cost	Bad outcome	Good outcome
Company	A	100	90	130
Shareholder	A	20	6	46
Creditor	A	80	84	84
Company	B	100	70	150
Shareholder	B	20	0	$150-80(1+b)$
Creditor	B	80	70	$80(1+b)$
Company	C	100	50	170
Shareholder	C	20	0	$170-80(1+c)$
Creditor	C	80	50	$80(1+c)$

In this case, then, both creditors and shareholders are indifferent between the three companies. This is not surprising: both investors are risk neutral, and only difference between the three companies is risk.

(ii) Risk aversion

Now suppose that the creditor is risk averse. Given that the payoff to the creditor falls in the bad state moving from firm A to B to C, the creditor will require a higher expected rate of return. This implies that the interest rate b will exceed 22.5 percent and the interest rate c will exceed 47.5 percent.

In turn, this implies that the shareholder faces a lower expected return moving from A to B to C. That is, if the creditor is risk-averse but receives a risk premium such that she is indifferent between A, B and C, the shareholder will prefer the firm with the less risky projects, even if she is risk neutral. She would have an even stronger preference for the less risky projects if she is also risk averse herself.

(iii) Credit guarantee

Now suppose that the government guarantees a bailout of the creditors, implying that they are guaranteed a return of 84 in the bad state in all firms. Then the interest rate charged will be 5 percent in all three cases.

In this case, the shareholder will receive 6 or 46 in case A, 0 or 66 in case B, and 0 or 86 in case C. The expected return for the shareholder is thus higher the more risky is the project the firm undertakes.

The same incentives hold for shareholders conditional on having negotiated borrowing at a given rate of interest. For example, there is an incentive for the shareholder to borrow at 5 percent to undertake A, but in fact to use the funds to undertake B, or even better, C. That is, for a given borrowing and a fixed interest rate, the shareholder has an incentive to take on more risky projects.

(b) How does the required return on debt and equity vary with the proportion of the firm financed by debt?

(i) Risk neutrality

Now consider the firm undertaking project B, but allow the proportion of debt to vary from 60 to 80 to 100 under the assumption of risk-neutrality (see Table 5.A.2).

We have already analysed the second case: a risk-neutral debtholder would charge an interest rate of 22.5 percent. Where the company is completely debt financed, a risk-neutral debtholder would charge an interest rate of $k = 40$ percent. This would yield 140 in the good state, with an expected return of 105. When the debtholder invests only 60, then the project is safe from the debtholder's perspective, and the interest rate charged is 5 percent.

The returns to the shareholder are shown in Table 5.A.3.

In this example, there is no clear incentive for the shareholder to use more or less debt. In the case of 100 percent debt financing, the shareholder receives a return of 10 in the good state and nothing otherwise.

Suppose the firm only borrows 80, requiring the shareholder to pay 20. Under the key assumption that the shareholder can borrow under the same conditions as the firm, she could simply borrow the 20 and promise to pay back 0 if the bad state happens and 42 otherwise, giving the required expected return of 5 percent to lenders. Clearly, the shareholder then gets exactly the same cash flows as with full debt financing. The same is true for any other level of debt financing.

More generally, the Modigliani-Miller theorem states that in a world of full information, with no bankruptcy costs, other agency costs or taxes and where shareholders have access to the same borrowing opportunities as the firms, then the value of the company is independent of leverage, while the required rates of return on debt and equity adjust to compensate for different risk associated with different capital structures (Modigliani and Miller 1958).

Table 5.A.2

Returns – different capital ratios

	Project	Investment cost	Bad outcome	Good outcome
Company	B	100	70	150
Shareholder	B	0	0	$150-100(1+k)$
Creditor	B	100	70	$100(1+k)$
Company	B	100	70	150
Shareholder	B	20	0	$150-80(1+b)$
Creditor	B	80	70	$80(1+b)$
Company	B	100	70	150
Shareholder	B	40	7	87
Creditor	B	60	63	63

Table 5.A.3

Shareholder returns – different capital ratios

Equity investment	Bad outcome	Good outcome
0	0	10
20	0	52
40	7	87

Table 5.A.4

Shareholder returns – credit guarantee

Equity investment	Bad outcome	Good outcome
0	0	45
20	0	66
40	7	87

(ii) Credit guarantee

However, now consider again the case in which the government guarantees the return to the creditor of the firm. If the firm goes bankrupt, the government pays what is required to make the return to creditors equal to 5 percent. No risk premium to be paid in the good state is then required. In this case, the returns to the shareholder are shown in Table 5.A.4.

Compared to the previous case, there is a clear advantage to reducing the equity investment, i.e. using more debt. That is, the outcome for the shareholder is the same with an equity investment of 40. But it is better than before with an equity investment less than 40, and the improvement increases as the equity investment falls. In the case of 20 percent equity financing, the extra benefit to the shareholder is 14 in the good state and zero in the bad with an expected value of 7. In the case of full debt financing, the extra benefit is 35 in the good state and zero in the bad with an expected value of 17.5. Note that these amounts are equal to the expected credit guarantee payments in the two cases. Since these payments increase in the share of debt financing, a credit guarantee provides incentives to maximise leverage.