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RISING SECTORAL DEBT/INCOME RATIOS: A CAUSE FOR CONCERN?

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Abstract

Rising debt in relation to income of both the private and public sectors has been of increasing concern to the authorities of several of the major economies in recent years. For example, the ratio of the non-financial sector's gross debt to GNP in the United States rose sharply from around 1.5 in 1981 to approaching 1.8 at the end of 1985. Concern over the consequences of this increase in terms of financial instability has been expressed, inter alia, by Volcker (1986). In other major countries, too, rising debt of the household, corporate or public sectors has often been seen as a problem by the authorities in recent years, for example household sector debt in the United Kingdom and public sector debt in Japan. This paper seeks to analyse the implications of the growth of debt for the stability of the non-financial sectors, and hence indirectly for the financial system. We first offer a broad view of theoretical issues relating debt to stability as well as an overview of historical patterns in sectoral debt and related variables, before narrowing the focus to a direct test of the role of debt in risk pricing and default.

It is concluded from the empirical evidence and from economic theory that under certain conditions rising debt/income ratios may indeed be a cause for concern. In the case of the private sector such

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concern arises from increased risk of default, in the public sector from higher interest rates and the need for higher taxes. These conclusions contradict an important strand of economic theory which argues that methods of finance for the company and public sectors are irrelevant to real economic behaviour. It is suggested that these theories make excessively strong assumptions regarding market efficiency and the rationality of agents. We also reject the view often expressed in the literature that, even if bankruptcy may arise from debt issue, it has no real consequences for the economy but merely redistributes wealth. This view appears to underestimate direct costs of bankruptcy as well as ignoring important external effects on the real economy and the financial system that may arise if the rate of default reaches a critical level.

Nevertheless, it is found that economic theory does offer important insights into the conditions required for debt to lead to economic instability. Most importantly, it shows – for a given level of debt – that the extent to which potential default is realised depends on the behaviour of the other components of the sector's budget constraint, notably income, value of assets and real and nominal interest rates.

Theory also suggests indicators of the current likelihood of widespread default, which may be used to test for the strength and significance of effects of rising debt. One may distinguish between rising debt in a free market equilibrium and disequilibrium increases in debt caused by the loosening of rationing constraints. In the former case, the spread between the interest rate on private debt and a riskless rate provides, in principle, a measure of the market's perception of the riskiness of lending. However, the mechanism may not operate when interest rates do not clear the market; for example, where risk is not easily observable to lenders or interest rates are fixed at non-market-clearing levels by regulation. In such cases changes in default probabilities following rising debt can often only be observed by examination of actual defaults rather than interest rate spreads. The rationing case may have been of particular relevance to household credit until recent years, when a decline in

credit rationing has been an important cause of rising household debt.

Graphical analysis of the relationships between debt, income, default, spreads, asset values and interest rate levels illustrates the validity of these conclusions drawn from economic theory. The insights are further borne out by the econometric results, which suggest that private sector debt/income ratios have indeed been an important determinant of both expected and realised defaults. The results also indicate that the magnitude of the effects of debt on default may be estimated when set in a structural econometric specification which allows for the simultaneous effects of the other influences on financial stability. Meanwhile, preliminary results for public debt suggest that *growing* public sector indebtedness in relation to GNP has tended to increase interest rates, thus increasing pressures on the private sector, though the *level* of the public sector debt in relation to income apparently has no significant effect on interest rates. This implies that concern with the level should mainly be associated with problems of the higher taxation required to pay future debt interest costs.

1. Introduction: concerns of the monetary authorities

Rising sectoral debt/income ratios have been a feature of several of the major economies in recent years, as shown in Table 1.1 below. These developments have, in turn, often aroused concern on the part of the monetary authorities and other observers of the financial system. The reasons for this differ between private and public debt. For the private sector the principal concern is that rising debt/income ratios suggest higher leveraging, i.e. payments of interest and principal outstanding are increasing relative to income or net wealth. Although higher leveraging is not a problem per se, nonetheless, when considered in the context of households' and firms' budget constraints, it implies smaller safety margins if interest

Table 1.1
Sectoral gross debt/GNP ratios, 1975 and 1985[2]
(in percentages)

		Public sector	Personal sector	Corporate sector
United States	1975	42	49	37
	1985	54	61	42
	(1986)	(56)	(65)	(45)
United Kingdom .	1975	64	33	46
	1985	59	51	44
Germany	1975	25	42	63
	1985	43	57	73
Japan	1975	39	33	93
	1985	90	46	102
Canada	1975	77	52	65
	1985	107	51	64

rates should rise, income fall or gross assets decline in value, and hence a greater potential fragility of the financial system.[1] For the public sector concern arises partly from fears that rising public debt will push up interest rates, thus "crowding out" private expenditure and perhaps leading to a higher level of private sector default. Additionally, there is the problem of the increased burden of future

[1] The underlying assumption is that widespread default on debt will have severe adverse consequences for the economy. See the discussion in Section 3(c).

[2] The sectors were defined so as to maintain comparability between countries as far as possible. The exact sectoral definitions used were as follows: for the United States: public sector: Federal Government plus state and local government; company sector: non-financial corporate business; personal sector: households. For the United Kingdom: public sector: public sector (consolidated); company sector: industrial and commercial companies; personal sector: personal sector. For Germany: public sector: Government (total); company sector: enterprises excluding housing; personal sector: households plus housing sector. For Japan: public sector: central government plus local authorities plus public corporations; company sector: companies; personal sector: personal sector. For Canada: public sector: Federal Government plus provincial and local government, plus non-financial government enterprises (unconsolidated); company sector: non-financial private corporations; personal sector: persons and unincorporated businesses. Obviously some inconsistencies remain; the most serious are the inclusion of unincorporated business in the household/personal sector in the case of the United Kingdom, Japan and Canada, the inclusion of nationalised industries in the company sector in the case of Germany, and the inclusion of construction in the personal sector (including housing) in Germany.

taxes to repay interest and principal, and concerns arising from the relationship between government deficits, capital inflows and external indebtedness.

These concerns have been expressed most comprehensively in the United States, where recent years have seen a growth in public, corporate and household debt in relation to GNP. However, recent statements suggest that other countries share similar worries over aspects of this problem. In order to provide a background to the analysis there now follows an outline of some of these expressed concerns. These pronouncements offer preliminary indications of the causes and possible consequences of rising debt.

Commencing with the United States, increased private sector indebtedness was seen by Volcker (1986) to be caused by the interaction of underlying economic factors (inflation and the tax system) with financial liberalisation (which led to a reduction in credit rationing) and other financial market developments (such as the expansion in the use of floating rate instruments and the growth of secondary markets). Thus, growing debt was encouraged by:

(i) *taxation,* which by allowing deduction of interest payments encourages debt rather than equity finance by firms, and household borrowing. The tax code did not change in this respect (until 1987) so the tax code alone cannot explain the acceleration of borrowing. However, the tax system's interaction with inflation in earlier years may have had an effect on the incentive to issue debt, because during periods of inflation a tax deduction is given for that part of interest which is effectively capital repayment;

(ii) *inflation* in the 1970s encouraged borrowing, especially when inflation exceeded interest rates. In fact inflation directly reduces the debt/income ratio, as only the denominator increases, though some of the benefit to borrowers may be offset by higher interest rates. Although inflation has now declined, it may be that attitudes to debt formed by borrowers during the inflationary period have persisted.

(iii) *floating rate* instruments may support the growth of debt, as there is less risk to the borrower if interest rates decline as inflation

falls. On the other hand, if interest rates increase, the cash flow of variable rate borrowers is harder hit than that of borrowers at fixed rates, perhaps increasing the risk of default;

(iv) the development of *secondary markets* allows lenders to issue more credit than their own reserves and capital would permit, were they both to issue and hold the debt, because debt can be passed on in securitised form to other ultimate holders such as life insurers or pension funds. Markets also facilitate management of risk in the asset and liability portfolios of financial institutions and may reduce the incentive to monitor the loans, if it is assumed that risk may be minimised by appropriate portfolio diversification. Both of these factors may encourage the extension of more and riskier loans;

(v) *other new instruments* (swaps, securitisation, third-party guarantees) have given borrowers access to previously unavailable funds, and may have reduced lenders' perceptions of risk;

(vi) *abolition of interest rate and usury ceilings* permits greater competition for funds and makes quantity-rationing of credit less likely, though at the cost of a greater swing in interest rates over the cycle. It is suggested in Section 3(b) below that some of the other recent financial innovations and deregulations may also have eased credit rationing.

Other US commentators have suggested that a further important cause of rising private debt may be the increasing perception that the Government will not allow major financial institutions or firms to fail. In addition, the prevalence of deposit insurance may reduce pressure on institutions to avoid risky loans arising from fears of withdrawal of deposits should such unsound loans be made. These processes might be characterised as a problem of "moral hazard" resulting from the "socialisation of risk" – a process whereby the (social) insurance of an institution leads to an incentive to increase risk exposure.

Volcker points out that rising aggregate debt/income ratios may in some cases overstate the risk of default. Debts on credit cards, insofar as these are used as a means of payment and accounts are

settled each month, may not represent a burdensome form of debt. The same could be true of growth in trade credits on each side of a firm's balance sheet (i.e. increased intermediation by the non-financial sector), and increased debts caused by demographic shifts (which could arise, for example, if there is a rise in the number of young people wishing to buy houses using mortgage credit). More generally, debt issued to buy capital assets provides at least the means to repay itself. In sharp contrast, debt issued to retire equity, a marked feature of the recent wave of takeovers and leveraged buy-outs, increases interest payment obligations without creating a corresponding asset, apart from potentially better management of existing assets.

Volcker's concerns focus on the fact that while hedging techniques such as floating rate debt appear to have reduced the risk for the lenders by shifting it to the borrowers,[3] they have certainly not reduced the risks arising from the business cycle or rising interest rates. Borrowers have nonetheless been willing to accumulate debt, given the favourable circumstances prevailing in recent years (falling interest rates, etc.). In such a context the reduction in risk perceived by lenders may be illusory because borrowers may be unable to cope with their debts in adverse circumstances. The risks might be realised should monetary tightening and higher interest rates be required in the future – falling interest rates may have given agents a false sense of security. The risks may be particularly severe if liberalised financial markets – such as those in the United States – require greater swings in interest rates than in the past in order for the authorities to achieve any given degree of monetary restraint, and if private borrowers have failed to take this into account in their decisions to borrow.

Regarding rising US public sector debt, it is argued that there may be costs arising from the increased foreign capital inflows, the

[3] The degree to which risk is passed on in this way or shared between lenders and borrowers via fixed rate contracts is likely to depend on such factors as the relative size or market power of the lender and borrower and the potential importance to the lender of a default by the borrower in question.

counterpart to US trade deficits, combined with the need for future taxation to repay interest and principal. This is particularly the case if inflows of foreign funds have largely financed current expenditure,[4] which, unlike capital expenditure, does not provide income to repay the debt interest. Of course, there are also the risks that a future government might monetise the deficit, leading to inflation. Fears of this could lead holders to demand higher interest rates, thus increasing the danger of a crowding-out of the private sector from the credit market and hence increasing defaults.

It is to be emphasised that Mr. Volcker's speech is only one among many recent discussions of US debt. For example, Kaufman (1986a and b) adopts an even more pessimistic position regarding the likely outcome of debt growth. On the other hand, Eisner (1986) takes a rather sanguine view of the public debt issue. Friedman (1986) emphasises the asset counterpart to growing debt, which may reduce the dangers of a default crisis. Other economists go further and argue that private credit is of no relevance because the private sector cannot affect its net worth through debt issue (theories of the "irrelevance" of debt are examined in Section 3).

Pronouncements by other countries' authorities suggest that many of the above concerns are shared elsewhere. For example, in Canada the growth of debt issue in the late 1970s and early 1980s by the company and household sectors, largely to finance corporate takeovers and real estate acquisition, was seen by the authorities to have led to over-extended balance sheets and resulted in a sharper recession in Canada during the early 1980s than elsewhere. As late as 1982 (see Bank of Canada (1982), p. 6), the Governor stated that "overly large debt positions acquired in an inflationary climate ... will act as a drag on expansion for some time to come".

In the United Kingdom rapid growth of housing finance since 1980 has given rise to concerns that some personal sector borrowers are overextending themselves in terms of interest obligations, as well

[4] This is true even if one adjusts for the fact that the US National Accounts do not distinguish between public sector consumption and investment.

as to fears that excess borrowing has led to a liquidity overhang which could leak into consumption. More generally, for financial institutions in the United Kingdom, the Bank of England has urged that "in an environment where credit is allocated by price ... increased competition in a rapidly expanding market produces a greater risk of over-exposure. This could prove potentially destabilising" (General Assessment, Bank of England Quarterly Bulletin, June 1986).

Other European authorities, particularly the Dutch, have faced crises in their mortgage banking sectors. These were due to a cycle of overlending (up to 120 per cent. of a property's valuation) during the inflation of the early 1980s, followed by a stagnation of property prices. The German authorities have often expressed concern regarding the high level of corporate debt in relation to equity, a theme which was echoed by the Bank of England when it opposed a recent takeover[5] because it would have led to high gearing. Germany and Japan share a concern regarding the consequences of the growth of public debt in relation to GNP both in the last ten years and as projected to result from the increased proportion of pensioners in the population in the coming decades.

Finally, the recent Cross Report on Financial Innovation (Bank for International Settlements (1986a)), prepared by a study group established by the central banks of the Group of Ten countries, suggested that many financial innovations may be "credit generating" (i.e. they enable more credit to be issued than would be possible using traditional instruments) (pp. 177–8), and some may entail an underpricing of risk.

This paper analyses the relationship between debt/income ratios and economic and financial stability. After presenting historical data on debt/income ratios in Section 2, we examine in Section 3 the predictions of economic theory regarding the consequences of growing debt. These predictions lead on to further graphical analysis in Section 4 of the relationships between debt, default, assets,

[5] The proposed takeover of Allied-Lyons by Elders.

income and interest rates. The graphs offer support for some of the hypotheses put forward by theory, and also provide a background for a more rigorous econometric test of the debt/default relationship in Section 5. The focus throughout is on the existence of a debt/default relationship rather than on suggestions for a policy regarding debt or on estimation of the relationship between default and financial instability. However, in the conclusion some reflections regarding policy are offered (is debt a micro-economic or macro-economic problem? should debt issue be curbed? how can financial markets best be protected from the consequences of increased default?) as well as a summary of the main conclusion, namely that a measurable relationship does exist between rising debt/income ratios and defaults.

2. Debt/income ratios, 1966–85

As a first stage in the analysis, we present the data for the non-financial sectors' gross debt/income ratios which underly the concerns summarised above. The data reveal that the United States has until recently shown an exceptional stability both in its aggregate non-financial debt ratio (public plus private) and in the debt ratios of the individual sectors. Other countries' aggregate debt ratios have been far more unstable, and in the cases of Germany and Japan have grown considerably over the relevant period. The implications of this difference for the link between debt ratios and instability are examined below.

Before discussing in detail the long-run changes in these ratios, one may note the most striking features of debt growth in the countries concerned during the last few years. These are: a rapid growth of personal sector debt in relation to GNP in the United Kingdom and the United States, growing corporate debt in the United States, Japan and Germany, and growing public sector debt in the United States and Canada. Looking a little further back, there

was the extraordinary growth of Japanese public sector debt from 39 per cent. of GNP in 1975 to 90 per cent. in 1985. Apart from the increases in corporate debt in Japan and Germany, which are the normal concomitant of rapid economic growth, all of these examples are rather atypical of past behaviour. They form the subject of many of the authorities' concerns summarised above. It should be noted that growth of debt has also been strong in many other countries, for example public sector debt in Italy and Belgium and household sector debt in the Netherlands.

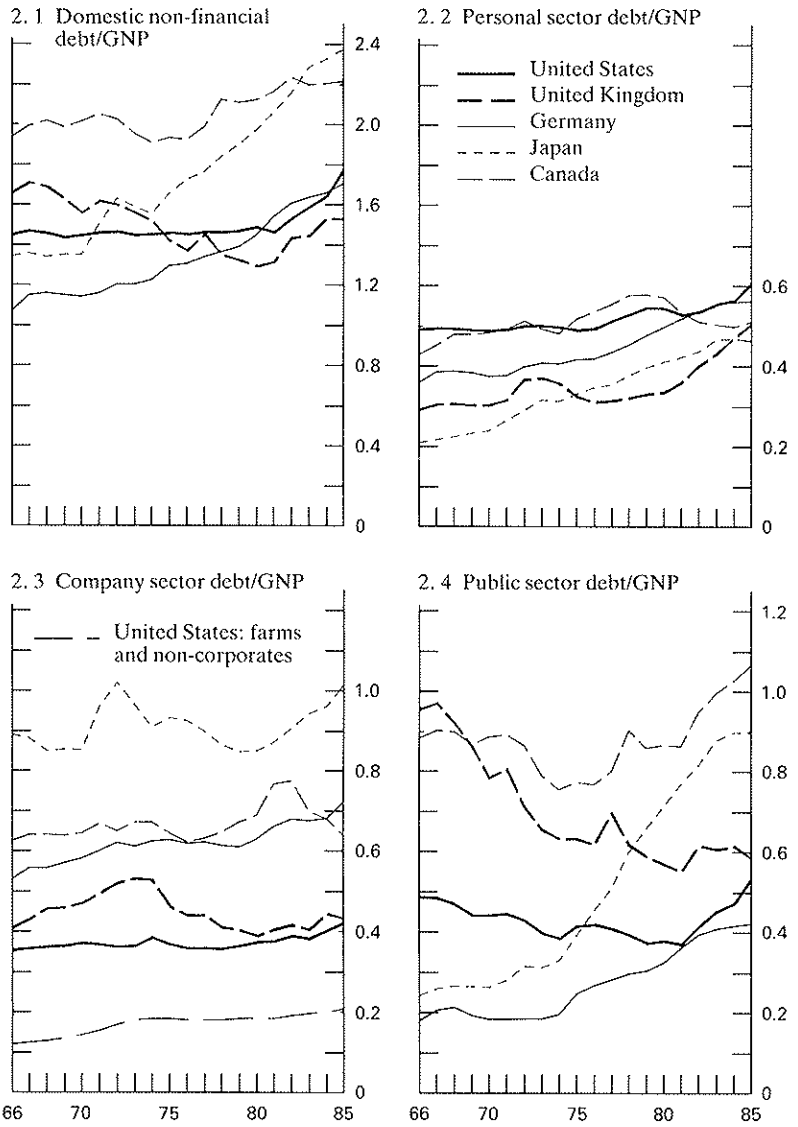
Graphs 2.1 to 2.9, from Davis (1986), show the debt ratio and its sectoral[6] components for the United States, the United Kingdom, Germany, Japan and Canada. Trade credits are excluded; debt is measured at book value except in the United Kingdom, where only market values are available.[7] The recent growth in the US total debt ratio is apparent from Graphs 2.1 and 2.5. However, the ratio has grown to a far greater extent in Japan and Germany, while in the United Kingdom it has also shown a rapid growth since 1980 and in Canada it did so in 1975–82. The United States is thus not atypical in its recent experience with the growth of public and private debt. In Japan and Canada a much higher level of total debt has been reached, of over twice annual GNP, while for the other countries the ratios in 1985 were all between 1.5 and 1.7.

Graphs 2.2 to 2.9 reveal the underlying sectoral components of the aggregate debt ratios for each country in turn. The United States is shown to have had a stable aggregate debt ratio as a result – at least until 1981 – of particularly stable sectoral debt ratios. Such trends as are observable over the period 1966–81 are a roughly

[6] We note that these data do not indicate the proportion of debt which is long or short-term, or fixed or variable rate, swapped, etc. These distinctions can have important economic implications; for example, holders of short-term or variable rate debt are more vulnerable to changes in market interest rates than are holders of long-term fixed rate debt. Evidence suggests that the fall in interest rates in recent years has led firms, particularly in the United States, to switch to long-term debt.

[7] It may be noted that market values of long-term fixed rate debt may have an economic importance independent of book values, for example, when a firm buys back its debt in the market below book value in order to carry out restructuring of the balance sheet. See Peek (1986).

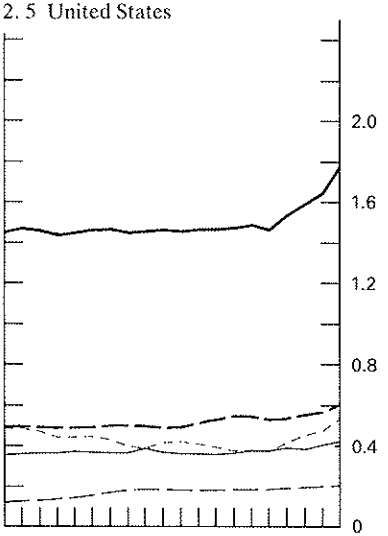
Debt/GNP ratios by sector



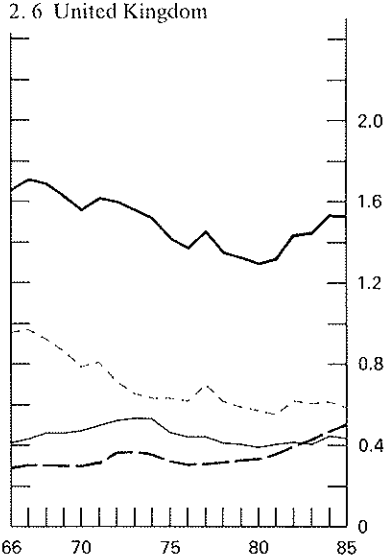
Debt/GNP ratios by country

Total
Personal
Company
Public
Farms and non-corporate business

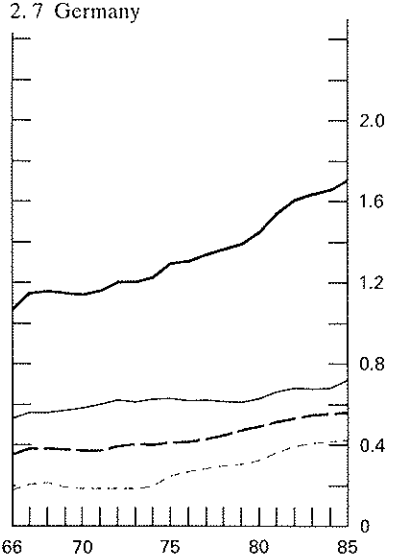
2. 5 United States



2. 6 United Kingdom



2. 7 Germany



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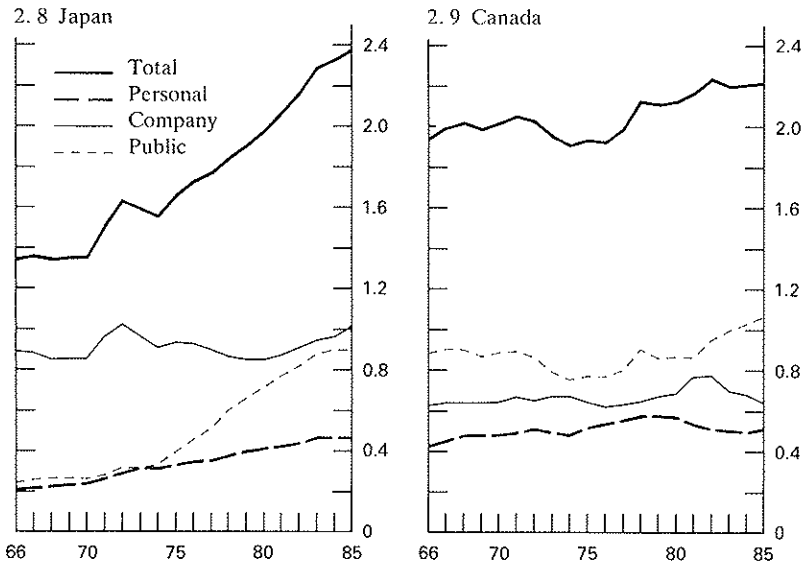


continuous increase for the personal sector, offset by a decline over most of the period in the public sector debt ratio, and also during the 1970s in the company sector.[8] Since 1981 the patterns have changed – personal and public debt/GNP ratios have grown, which, combined with a weaker increase for the company and non-corporate business sectors, has given rise to the observed increase in the *aggregate* ratio.

The experiences of other countries differ widely from those of the United States. In particular, their debt ratios have been considerably *less* stable. Thus in the United Kingdom the aggregate debt ratio declined over the period 1966–80, principally owing to a continuously declining public sector debt ratio, though aided by the slow growth of company sector debt since 1974. Like the United

[8] Friedman (1982, 1984) discussed some equilibrating mechanisms that may have been responsible for these patterns.

States and Canada, the United Kingdom accumulated much public sector debt during the Second World War. Unlike that of Japan and Germany, this debt was not dissipated (by inflation or currency reform) in the immediate aftermath of the war. The declining public debt/GNP ratio reveals the gradual unwinding of public debt incurred during the war, aided by relatively small government deficits in relation to GNP for much of the post-war period and by higher inflation over the last twenty years than in the other countries. The company sector has accumulated fewer liabilities since the mid-1970s owing to declining real growth and low rates of return on fixed investment. Meanwhile the personal sector has been increasing its debt ratio since the mid-1970s. Initially this occurred despite inflation's erosion of the real value of the outstanding stock, but the trend became even more pronounced after 1980, when inflation declined. The ratio rose from 30 per cent. of GNP in 1980 to 50 per cent. in 1985. Over the earlier period credit was cheap as a result of low real interest rates (see Graph 4.4), while more recently the removal of controls and credit rationing has encouraged borrowing. It is largely the personal sector's debt which underlies the recent growth in the aggregate debt ratio.

In Canada the aggregate debt ratio rose rapidly after 1975, before growth slackened in 1982. This pattern was largely a consequence of large and continuing public sector deficits, although after 1982 this has been offset by a decline in the company and household sectors' demands for credit.[9] The Canadian company sector accumulated large amounts of debt in 1978–82, partly as a result of the expansion of economic activity in the West, based on energy production, and partly as a result of the buy-outs of foreign firms (effectively substitution of debt for equity) after the "National Energy Program" was implemented in 1981. Both of these incentives to issue debt were compounded by assumptions of continuing

[9] It should be noted that some of the public sector debt resulted from investment by nationalised industries and would thus not be included in "general government debt". This is also true of the United Kingdom and Japan.

inflation, and more recently by "distress borrowing"[10] to avoid default (as is seen in Section 4, Graph 4.10, debt expansion led to a sizable increase in income gearing and bankruptcies as inflation fell). A similar but more muted pattern of sharply rising debt followed by distress and retrenchment for households led them, too, to reduce debt in relation to GNP in the early 1980s. These patterns may be in line with the concerns expressed in other countries.

Germany and Japan both show growing aggregate debt ratios, reflecting growth in every sector's debt relative to GNP, though the main contrast with the Anglo-Saxon countries lies in the behaviour of the public sector. These countries ended the war with their public debts effectively written off, and thus public sector deficits over the post-war period have tended to raise the debt ratio. This rise in debt ratios in Germany and Japan has tended to accelerate recently, owing to low inflation and high budget deficits. This is particularly the case for Japan, where the public sector accounts for most of the growth in the aggregate debt ratio since 1974. The personal sector in both countries has experienced a steady growth in its debt ratio, as in the Anglo-Saxon countries. The debt of the Japanese company sector shows a somewhat irregular pattern relative to its German counterpart, but has remained far higher in relation to GNP.[11]

Several general comments may be made regarding these patterns; firstly, the contrast between the US and other economies may result from the fact that until recently the size of external trade vis-à-vis GNP was so small in the United States that it could be characterised as "closed". This would mean that a domestic equilibrium of supply and demand for "loanable funds" would obtain, expansion of debt being limited by the domestic supply of loanable funds, which in turn grows in line with GNP. In support of this suggestion it may be noted that in recent years increased

[10] Macro-economic data cannot, of course, distinguish "distress borrowing" from debt resulting from other motives.

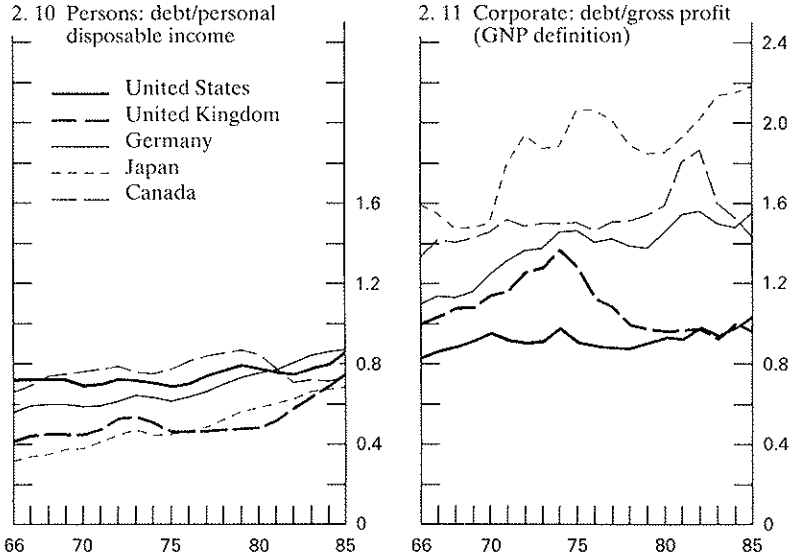
[11] This may be a result of the "compensating balance" system for bank loans and traditionally higher debt/equity ratios.

openness has given access to supplies of saving abroad, and this has coincided with the instability of debt ratios. Other countries were not "closed" to the same extent over the historical period shown, which may help to explain the relative instability of debt ratios. Secondly, the fact that debt ratios in other countries have grown, while the financial systems in those countries are not obviously any less stable than that in the United States, suggests that growth of the debt ratio alone will not necessarily lead to instability, especially if there are offsetting factors such as parallel growth in asset values, as illustrated in Sections 4 and 5. It may, at least, be necessary to distinguish trend growth from *abnormal* growth, where there is an underlying change of behaviour, release of constraints on borrowers and lenders or a deterioration in other financial conditions. Recent growth in the US and UK ratios and the experience of Canada in 1980–82 may indicate just such abnormal growth.

Thirdly, it should be noted that the implication of a given debt/income ratio for stability may depend on the proportion of debt which bears variable interest rates, the proportion which is short-term and the current instability of interest rates. For many countries these factors have tended to worsen in recent years. Fourthly, however, the role of the financial markets and private debt in the growth of total debt should not be exaggerated. The graphs also suggest that the major force underlying changing debt ratios in most countries has been the public sector, which entails a different set of concerns.

The debt/GNP ratio may also not give an accurate representation of a sector's position if the income distribution changes. Graphs 2.10 and 2.11 show sectoral debt for persons and companies deflated by personal disposable income and profits respectively. Comparison with Graphs 2.2 and 2.3 in fact reveals relatively minor differences in patterns, except to some extent in Japan, where the flatter personal and steeper company traces in Graphs 2.10 and 2.11 reveal the shift from profits to wages that has come about since the 1960s. This similarity is taken as justification for concentrating largely on GNP as a denominator in the empirical work below.

Sectoral debt/income ratios



Having shown the historical changes in sectoral debt ratios, we now examine some economic theory for predictions of the causes and likely consequences of recent patterns of debt accumulation.

3. Is increased debt a problem? A theoretical analysis

In this section economic theory is examined in a selective manner for an explanation of the causes, and prediction of the consequences, of rising sectoral debt. Aspects of the theory of the supply of debt, bankruptcy and the demand for debt by each non-financial domestic sector in turn are covered.[12] Analysis of the economic theory of debt in the light of the patterns and concerns discussed above offers the following key insights.

Firstly, the assumptions of perfect capital markets and fully rational individuals, as detailed below, would lead one to conclude that rising debt has no effect either on the corporate cost of capital or on GNP via fiscal policy. However, it is suggested that the required conditions are too stringent to be met in the real world; hence rising debt may have real effects. Fiscal deficits may raise the level of output in the short term in a situation of under-employment and/or raise interest rates. Corporate debt may lead to a rising cost of capital and eventually to an increased risk of default. Household indebtedness may equally increase vulnerability to bankruptcy.

Secondly, the extent to which the risk of default is realised for a given level of debt depends on the behaviour of the other components of a sector's budget constraint, notably income, the value of assets and real and nominal interest rates.

Thirdly, in a free market the interest rate on private debt relative to a risk-free rate provides a measure of the market's perception of the riskiness of lending.[13] However, the theory of credit rationing suggests that the mechanism may only operate, for example, where risk is easily observable to lenders and when interest rates are not fixed at non-market-clearing levels. When these conditions do not hold, interest rates may not indicate the degree of default risk, which in such cases can only be observed directly via realised defaults.[14]

These considerations, which arise for each sector in different ways, provide theoretical support for concerns regarding debt ratios

[12] It should be noted that an analysis such as is presented here, largely based on the "efficient markets hypothesis" (i.e. that all currently available information is reflected in the prices of assets and liabilities in financial markets), would not be accepted by all commentators. In particular there appears to be accumulating evidence of the lack of market efficiency in such markets as those for foreign exchange.

[13] To the extent that this risk is *non-diversifiable* in the sense of modern portfolio theory, as discussed on page 26, i.e. it cannot be removed by holding a diversified portfolio of assets.

[14] It is suggested in Section 4 that credit rationing for the household sector in several countries obscured the relationship between spreads and risk in this way until recent years. This also accounts for the failure of some of the econometric tests in Section 5. It is emphasised that more recently a decline in credit rationing has led to the re-establishment of a more normal spread-risk relationship, as well as being an important cause in itself of the growth of debt.

as well as testable propositions regarding the relationship between debt and stability, which are developed in Section 5 into an econometric specification.

We first analyse the demand for, and supply of, debt in general as well as the nature of bankruptcy before focusing on the implications of growing debt for the individual sectors. (Considerations differ for the various sectors as they vary in their objectives and means of finance.) The following simplified matrix may be used to structure the discussion.

Balance-sheet components and income sources of the domestic sectors

	Assets	Income	Debt	Other liabilities
Government	–	Taxes	Bonds	Money[15]
Non-financial companies	Capital, liquidity	Profits, interest	Bonds, loans	Equity
Households	Housing, debt claims, equity claims	Wages, interest, dividends	Loans, mortgages	–
Memo: financial companies	Loans	Net interest, fees	Deposits, bonds	Equity

(a) Issue of debt: general comments

Debt is generally incurred by an agent in order to finance current or capital expenditures that is not financed by the current stream of income. A pledge is made to repay the interest and principal from future income.[16] In the case of fixed rate debt the nominal income forgone is known, while with variable rate debt it is uncertain. There is an important difference between finance of consumption and

[15] In some countries constitutional or legal provisions restrict the ability of governments to finance themselves by money creation.

[16] However, in practice the principal is often rolled over at the end of the contract. Such a process takes the additional risk that interest rates may be high or credit unobtainable when rollover becomes necessary.

investment,[17] as the latter usually provides the income to repay the loan, while repayment of the former implies forgoing some future expenditure, i.e. consumption is shifted over time.

Many debt contracts require collateral, which must generally come from the assets of the agent incurring debt.[18] These assets may vary in their liquidity, likelihood of valuation losses, etc.; hence their assessment is an important task for the lender. To the extent that collateral retains its value, financial difficulties of a borrower need not also affect the lender. By contrast, declines in the value of collateral, as in the recent case of North American farmland, can be an important component of financial difficulties of both borrowers and lenders. A decline in the value of collateral is, of course, most likely during a financial crisis when many borrowers wish to liquidate their assets at the same time. Not all assets may be used as explicit collateral, as a result of legal or physical constraints, for example households' pension rights and human wealth. Finally it should be noted that some classes of borrowers have available sources of funds other than debt (money, equity, etc.). In such cases somewhat different considerations are required than are applicable to those for whom debt is the only possible liability.

The borrower may be expected to weigh the costs of debt, viz. the cost of forgone future consumption or net income, the cost of possible loss of assets and the relative costs of alternative finance, against the benefit of the current or capital expenditure to be financed. These considerations suggest that demand for debt is likely to rise as the interest rate declines and the cost of alternative finance (equity) increases. It will also increase if any non-price rationing is eased, or, if borrowing is limited by availability of collateral, as the valuation of collateral assets increases. Finally, it will increase should costs of default fall (as occurred with the changed US bankruptcy law of 1978).

[17] Residential investment is intermediate; it does not provide income directly, but does release a household from the obligation to pay rent.

[18] An exception is when another agent makes a guarantee. However, *sectoral* wealth is then still relevant.

(b) The supply of credit, portfolio theory and the determination of spreads

This section analyses the determinants of market interest rates on debt in cases where the risk of default on debt may be assessed fairly easily (for example, for large firms), and shows why in other cases factors such as controls on interest rates or the inability of the lender to assess risk (for households and small firms) may lead to rationing of credit by quantity rather than by price. (We define "rationing" as a situation where among loan applicants who appear to be identical some receive a loan and some do not.)

The analysis offers the following key insights into the relationship between debt and financial stability: firstly, in a free market without rationing the spread of the interest rate on a private sector debt instrument over a risk-free rate reflects the market's perception of default risk. This offers a complementary hypothesis to test alongside the basic hypothesis of this paper that higher debt leads to the likelihood of increased defaults; one can test for a causal relationship between debt and spreads. However, if rationing obtains, one would not expect spreads to be a good indicator of risk, so the debt/default relationship can only be tested directly. Secondly, the default risk is conditioned not merely by debt and income but also by assets in the balance sheet and macro-economic variables such as the trade cycle, the level of interest rates and prices of factors of production. Thirdly, credit markets for households and small firms have often been characterised by non-price rationing of credit, a mechanism for which strong economic justifications may be adduced. This analysis implies in turn that increased issue of debt to households and small firms is likely to result from a reduction in credit rationing. Various reasons are suggested as to why this may have occurred in recent years.

Debt must be held by another agent as an asset. Portfolio theory suggests that the return demanded by that agent will depend on the risk and the expected return on the asset. For example, an unsecured consumer loan will command a higher rate of interest than a Treasury bill of the same maturity owing to its relative risk

characteristics. A consumer may default on interest and principal, while the government can keep its promises via its power to tax and print money.[19]

These considerations may be formalised into a theory of the structure of interest rates (as summarised in Robinson and Wrightsman (1980)). The spread between the yield on a private issue of debt and a risk-free public bond in the same national market depends on six factors: the risk of default as discussed above, the call risk that bonds (or loans) may be liquidated early at a possibly inconvenient time for the lender; tax exemption status; the term or period to maturity; any screening costs; and market liquidity. In the current analysis the major focus is on default risk, because bankruptcy or default is often the main focus of the monetary authorities' concern. However, it is important to bear the other factors in mind because observed changes in spreads may arise from any of them.

Default risk refers to the possibility of not collecting interest and principal as promised in the debt contract, even if a loan is collateralised.[20] The lender receives a higher expected return to compensate for the extra risk. An indicator of the market's assessment of default risk is the differential between the yield on a private bond and public bond of the same maturity, callability and tax features.

The overall default risk on a debt instrument varies with the risk position of the borrower and the economic environment. The risk position of the borrower is obviously conditioned by the ability to generate enough cash flow to cover interest and principal (the coverage ratio, or its inverse, income gearing), the variability of cash flow and the availability of liquidity or other assets to repay the debt.

[19] Even government debt is not free of the risk of monetisation via inflation, and, for foreign holders, of the additional risk of exchange rate changes.

[20] One may distinguish illiquidity risk – that the collateral may cover the value of the loan, but be hard to sell – and insolvency risk – that owing to changing relative prices the collateral no longer covers the value of the principal. Many of the recent worries concerning rising debt concentrate on this aspect.

There may also be changes in the incentive to default, which may arise from changes in the bankruptcy law.

Traditional theory suggests that for an individual agent default risk may be broken down into three elements. Firstly, the risk position varies "internally" with the ratio of debt to equity for firms (there is no contractual obligation to pay equity holders) and for households with the ratio of debt to income. These ratios are choice variables arising from the budget constraint. Secondly, "business risk" is defined to depend largely on the type of business the agent is in and is thus partly beyond his control. Thirdly, default risk for all firms depends on the state of the economic cycle and other macro-economic variables such as interest rates and factor prices; most defaults occur during recessions.

In the sense of modern portfolio theory, the first two types of risk may be characterised as *diversifiable* by the holder (see Malkiel (1985) for a non-technical discussion), as they can in principle be minimised by holding a diversified portfolio of bonds or loans. These types of risk should be reflected in the mark-up of a firm's securities in relation to the market return, to an extent dependent on the covariance of such risks with corresponding risks for other firms. On the other hand, risks that affect the aggregate economy are *non-diversifiable* by the holder and should be reflected in the spread of corporate debt yields over the risk-free yield offered by government bonds.

Studies confirm these insights. For example, coverage, earnings variability and other measures of capital structure have been shown empirically to influence relative market default risk premia between firms (see Hickman (1958)). In the case of bonds these risk elements may be assessed by bond rating agencies; for loans it is the responsibility of the bank or other financial institution. As an example of magnitudes, the average differential between BAA and AAA bonds in the United States was about 50 basis points in the 1960s, 100 in the 1970s and 150 in the 1980s. This may partly reflect changes in the perceived quality of the obligations. As suggested, average default risk premia also vary over the cycle; the premium

widens during recessions for all firms, but especially for lower rated bonds, which are more vulnerable to default (see Jaffee (1975)). One might expect default premia to fall during periods of intense competition between financial markets and institutions when lenders offer ever-finer terms on loans in order to gain market share. If this is anything more than a temporary phenomenon, and it is not accompanied by a significant fall in realised defaults, then accurate pricing of risk may be eroded, a process which may lead to increased vulnerability of financial institutions. The graphs in Section 4 below suggest that this may also be the case now. A further factor may be "socialisation" of risks. If it is assumed that the central bank or government will rescue certain debtors via bailouts (or monetisation), the perceived risk of lending may decline.

Default risk premia are, of course, ex ante concepts reflecting the market's judgement of the probability of future defaults. Although it would be a cause for concern if risk pricing were totally inaccurate, it should not be a surprise that there are discrepancies between spreads and ex post bankruptcy experience, which reflect, obviously, a lack of perfect foresight.[21] Studies do indeed suggest that prediction of bankruptcy by observed spreads is rather inaccurate. For example, Fons (1986) suggested that risk was being overpriced in US corporate bonds in the 1980s, though the risk premium did track the *sign* of the change in defaults. Research to date has suggested that prediction of default may be best carried out by fundamental ratio or discriminant analysis (see Altman (1968) and the quotation reproduced on page 42). Obviously, such key ratios may include the debt/income and debt/equity ratios.

Risk pricing may, of course, be inaccurate in a more fundamental sense in the case of an unanticipated shock to the system, such as disinflation and the associated changes in relative prices since 1980.

[21] This is even more true for bond ratings, which are only intended to measure the internal financial strength of the firm at the time of issue. Even at the time of issue, firms may find it costly to improve their rating, for example, because of the high liquidity demanded.

It can be argued that this shock underlies both the LDC debt crisis (via falling commodity prices) and the farm debt crisis in the advanced countries (due to changing relative prices of commodities and land vis-à-vis other goods). Recent experience has shown that such inaccurate ex post risk pricing, where realised defaults far exceed those which were anticipated, may lead financial institutions into severe difficulties. Some would go further and suggest that quantity-rationing of credit (as discussed below), with some potential borrowers being refused credit on any terms, was the approach that institutions should have adopted.

The above description of the determination of free market interest rates offers several insights into the relationship between debt and stability. They indicate that, given the qualifications noted above, the spread is a function of the ex ante probability of default, and that ex post bankruptcies have often followed excessive debt accumulation. As is seen in Section 4, this analysis can be used to interpret many aspects of the recent growth in debt, particularly for companies. However, other aspects of the supply of credit may also be important when analysing the supply of credit to the public and household sectors.

Firstly, the portfolio analysis discussed so far has implicitly assumed that a borrowing sector faces an infinitely elastic supply of credit for a given level of risk. In fact any sector that increases its borrowing may eventually face higher interest rates regardless of risk. Two mechanisms come into play. A rational asset holder is likely to hold a diversified portfolio of assets which maximises return for a given level of risk. Holding a diversified portfolio rather than a single asset helps to reduce risk to the extent that the returns on the various assets are imperfectly or, ideally, negatively correlated. Thus, when a sector increases its borrowing it needs to offer a greater return to offset the increased risk to asset holders from holding a less diversified portfolio. One example is an investment institution such as a pension fund, which will demand higher returns when constrained to hold a larger proportion of its portfolio in any one asset, such as government bonds. However, there are also

elements of this mechanism in the case of money held by households which may not be reduced beyond a certain minimum for transactions purposes, whatever the returns offered by other assets. Similarly banks may face constraints on the proportion of their assets lent to a particular sector, either for legal or prudential reasons (implicitly the authorities prevent the banks from pursuing return at the expense of risk beyond a certain point). Eventually a second factor also comes into operation, when a sector's demand for credit drives up interest rates across the board. In a closed economy this leads to the crowding-out of other sectors; in an open economy it may also lead to an inflow of funds from abroad. These mechanisms may be of particular importance to the supply of funds to the public sector.

Secondly, in some cases the normal market equilibrium of supply equalling demand at a market-clearing price may not operate. There may be rationing of credit at a non-market-clearing price with excess demand (or supply) of loanable funds, in the sense that among loan applicants who appear to be identical some receive a loan and others do not. A brief survey of credit rationing paradigms is essential in the context of this paper for several reasons. Firstly, it facilitates an assessment of the causes and consequences of the recent growth of household debt, which has been viewed as partly resulting from a release of rationing constraints. It is also important to an understanding of the historic behaviour of spreads between mortgage rates and government bond yields. As shown in Graphs 4.1–4.10, these have at times been zero or negative in several countries despite the higher default risk on mortgage loans, thus contradicting the theory of the determination of spreads in a free market discussed above. The paradigms also offer insights into the recent growth of corporate debt.

Most authors have characterised credit rationing as a disequilibrium[22] phenomenon resulting from a market failure such

[22] In this case a situation in which lenders are artificially prevented from offering the price for loans that will clear the market.

as interest rate controls. However, Stiglitz and Weiss (1981) have shown that credit rationing *can* still arise in equilibrium[23] when there is imperfect and asymmetric information (i.e. the borrower knows more about his characteristics than the lender) and lenders cannot control all aspects of the borrower's behaviour. This equilibrium paradigm is used below to provide several useful insights into the recent growth of debt.

Stiglitz and Weiss's analysis entails some imperfect substitution, i.e. the agent has access only to banks and not to the bond market. In general, it is thus applicable to small firms and households and not to large firms or governments. The key is that the interest rate offered to borrowers influences the riskiness of loans in two main ways. Firstly, borrowers willing to pay high interest rates may, on average, be worse risks. They may be willing to borrow at high rates because the probability that they will repay is lower than average. This is a problem of *adverse selection,*[24] i.e. a reduction in the average quality of the mix of applicants for loans due to the increased price. Secondly, as the interest rate increases, firms which were previously "good risks" may undertake projects with lower probabilities of success but higher returns when successful – a problem of *moral hazard,* that the *incentives* of higher interest rates lead borrowers to undertake riskier actions.

These considerations suggest that under such conditions there may exist an optimal interest rate on loans beyond which the return

[23] In this case a situation in which lenders are unwilling to change the conditions under which loans are offered. Thus rationing is not *necessarily* a consequence of market disequilibrium resulting from sticky prices or government regulation, though obviously these may also lead to rationing.

[24] Akerlof (1970) illustrated the concept of "adverse selection" by reference to the market for used cars. He assumes that there is asymmetric information – sellers know the quality of their cars, but buyers only know the average quality of cars on the used car market, and will only offer a single price that reflects this average. At this price, potential sellers of high quality used cars stay out of the market, thus reducing the average quality of second-hand cars as well as the price. The market is likely to reach an equilibrium where cars of low average quality are sold at a low price. The asymmetric information has resulted in an externality which causes a degree of market failure. Traders on both sides of the market would be better off if the informational asymmetries were removed.

to the bank falls despite excess demand for loans at that rate,[25] because at a higher interest rate increased defaults more than offset any increase in profits. The bank maximises profit by denying loans to individuals who are observationally equivalent to those receiving them. They are unable to obtain loans at *any* interest rate at a given supply of credit.[26]

The authors also argue – perhaps less convincingly – that increasing collateral requirements (or reducing the debt/equity ratio) may reduce bank profits in a similar way, because wealthier individuals may be less averse to risk than poorer individuals[27] and so those who can put up most capital would be willing to take the greatest risk with the lowest probability of repayment. The analysis can be generalised to any number of control instruments – rationing is possible so long as the bank cannot directly control the choice of project under every possible contingency (see Stiglitz and Weiss (1986) and Hart (1986)). The analysis also applies in the case of several observationally distinguishable groups; a group may be excluded although there is excess demand for credit, and its expected return on investment is highest.

Other explanations for credit rationing besides asymmetric information have been proposed. For example, credit rationing might arise from the desire of banks to share interest rate risks with customers, especially with a system of short-term or variable rate loans which imply a continuing relation in the future between lenders and borrowers (Fried and Howitt (1980)). This leads banks and their customers to enter into informal agreements or "implicit

[25] Implicitly the bank is using the interest rate as a screening device, to help identify "good" borrowers.

[26] This is distinct from the question as to why an individual faces an upward sloping interest rate schedule – primarily because the default probability rises as the amount borrowed increases.

[27] "Wealthy individuals may be those who, in the past, have succeeded in risky endeavours. In this case they are likely to be less risk averse than the more conservative individuals who have in the past invested in relatively safe securities, and are consequently less able to furnish large amounts of collateral." (Stiglitz and Weiss (1981), p. 402.) Obviously, collateral also has positive incentive effects.

contracts" to guarantee stable loan rates, which allow the bank to deny credit to a predetermined fraction of (newer) customers when market interest rates are high. Alternatively banks might wish to charge a uniform rate to ensure equitable treatment between broad classes of heterogeneous borrowers, fully accommodating the demand of the most preferred borrowers in each class but rationing credit to the least preferred members (Jaffee and Modigliani (1969), Cukierman (1978)). Finally, Stiglitz and Weiss (1986) note that government controls on loan rates may also lead to rationing, as may quantitative controls on banks' balance-sheet growth.[28]

These analyses, highlighting credit rationing, appear to contradict the theory of market interest rate spreads discussed above. In fact it is likely that there is a distinction between small agents such as households and unincorporated businesses, who may often face credit rationing, and large firms and government for whom risks are easily assessed, and to whom the former scenario of rationing by price applies. The boundary will not be fixed; more firms may be rationed in a recession, while large firms may become rationed if they lose their credit rating.

[28] At first glance, these explanations fit more accurately than that of Stiglitz and Weiss (1981) the most widespread form of credit rationing observed until recently in some countries, mortgage rationing. This rationing basically arose from shortages of funds on the deposit side, given a mortgage rate below the market-clearing level. Why were mortgage interest rates not increased? Stiglitz and Weiss (1986) show that US mortgage rates never reached their "usury" ceilings, while UK rates, despite being uncontrolled, fell as low as 4 percentage points below rates on government bonds (see Graph 4.4). These facts suggest that an explanation of rationing based solely on government controls of loan rates is not completely satisfactory. Although "risk sharing" and "equitable treatment" could be the correct explanations for mortgage rationing, one can equally put forward an "optimal loan rate" explanation partly based on Stiglitz and Weiss's analysis. Firstly, a higher rate (especially with variable rate loans) may lead to defaults by borrowers sufficient to lower profits, perhaps because borrowers already have debt that they have not declared to the lenders, or because their incomes are highly variable. Secondly, even if such defaults are not sufficient to lower profits, the social opprobrium of some foreclosures may lead to less deposits, government action to lower tax benefits or increased profits taxes. Thirdly, if the loan rate had been increased, the institutions concerned may have feared the disintermediation of loan supply.

The analyses are important, firstly, because they show that for some agents rationing may occur in equilibrium, and hence spreads in such cases may not always reflect lenders' ex ante predictions of default. For such agents, in the context of a time series including periods of such rationing, the relation between debt and stability can only be analysed directly by assessing the effect of rising debt on default. Evidence for this perhaps counter-intuitive hypothesis is given in the table on page 37 and the econometric results in Section 5.

Secondly, if one accepts the hypothesis that credit rationing has been a frequent phenomenon for households and small to medium-sized firms in certain countries in recent decades, the theory of credit rationing may be able to provide insights into the causes of the rapid increase in credits to these sectors in recent years. Although it is conceivable that part of increased debt results purely from an increase in credit demand in equilibrium – i.e. a pure "free market" story can be told – it seems likely that a key factor in the credit boom has also been a loosening of rationing constraints on the supply side which were previously binding (i.e. there has been a shift from a situation of excess demand for credit at the current price towards a market equilibrium where credit is rationed by price).

The survey of credit rationing paradigms above has outlined several channels which could lead to a loosening of rationing. Among the factors highlighted are risk of lending, the importance of information, the degree to which markets are segmented and government regulations. Risk aversion of lenders will clearly also be important.

It seems unlikely that the risk of lending has fallen (see Graphs 4.1 to 4.10). Although in some cases information may have improved, or new and more restrictive contracts or covenants been introduced, generally the contrary appears to be the case.[29] There does, however, appear to have been increased entry into lending to the relevant sector (e.g. UK mortgage lending, bank lending to finance takeovers in countries such as the United Kingdom and Germany, US investment banks willing to underwrite junk bonds) –

or at least high-cost credit has become available to those previously refused credit completely. Removal of quantitative controls on the growth of banks' balance sheets was often an important factor. There has also been an increase in the supply of marketable debt, often at a fixed rate. This has reduced the degree to which agents have access only to banks and not the bond market, i.e. "imperfect substitution" between types of credit, which Stiglitz and Weiss pinpointed as a necessary condition for their paradigm to operate. This is the case for the recent growth of commercial paper in many countries outside the United States and for US junk bonds.[30, 31] These types of securities may have been instrumental in causing many firms to shift from a quantity-rationing to a price-rationed credit system, though it should be emphasised that costs of rating

[29] We note, however, that some authors such as Jensen (1986) argue that debt finance (for example, via "junk bond" issue) has the effect of a restrictive contract or effectively increased information in the sense that managers are forced to meet a market test in their investment, because the return has to cover interest payments. This argument largely contrasts debt issue with the use of retained earnings for investment (in the situation of a leveraged buyout or takeover) rather than arguing that contemporary forms of debt have an increased information content over traditional forms such as bank loans. On the other hand, it can be argued that the development of junk bonds was necessary in the United States in order for the system of leveraged buyouts and takeovers to operate, and hence the rise of such a market for high-yield, high-risk securities has led to an improvement in information and control. In other countries, bank lending has sustained the recent takeover wave. This view of the effects of debt issue contrasts with that shown in footnote 36 below.

[30] Elsewhere, however, the opening of markets to small firms has led to greater equity rather than debt issue, for example in the United Kingdom Unlisted Securities Market. As well as easing credit rationing for small firms, the development of these securities markets may also have reduced the price of funds to firms which were previously price-rationed.

[31] It is of interest to note that Cable and Turner (1985) have argued that differences in the information available to banks regarding their client firms have an important influence not only on credit rationing within a country for different firms and across time, but also on the relative cost and availability of debt between countries. This may thus explain higher equilibrium debt/income ratios in Germany and Japan than in the United Kingdom and United States. Superior information is available in Germany via the representation of banks on the supervisory boards of industrial companies, and in Japan via the intermarket business units of the "Zaibatsu" type. This analysis thus suggests that credit rationing may be eased by a shift to closely-knit links between firms and banks, as well as a shift from bank to market credit.

and underwriting may still make bond issue too costly for small firms.

For households, the loan rate (for example on mortgages) has been forced up relative to free market rates by the deregulation of the deposit rates (as in the United States), leading to some degree of replacement of quantity-rationing of credit by price-rationing for households, too. (Increases in the loan rate may have been cushioned by reductions in non-price competition between lending institutions or reductions in margins due to increased competition.) Obviously, some restrictions on household borrowing remain, as discussed in Section (d)(ii) below. Conversely, for companies, the higher and often floating loan rates offered recently by banks, due to deposit deregulation, higher capital ratios or the burden of non-performing loans, have accelerated the shift from bank to market-based funding and hence aided the reduction in quantity-rationing of credit.

Finally, it appears that in many cases banks and other financial institutions have become more tolerant of risk. Several underlying factors can be suggested. Risk tolerance by lending institutions might have increased because, for example, they can pass on the debt in securitised form to other institutions (so there is less incentive to monitor the debt). Alternatively, the implicit government guarantee on their assets may have become stronger as suggested by Wojnilower (1985), their "safe" customers have often been lost to the bond market and competition may have reduced their margins so much that profitability can only be maintained by rapid growth.

Institutional investors, too, appear to be more ready to hold high-risk, high-yield securities, perhaps because the market-making investment bank is ready to supply a ready market, while the risk associated with individual securities can be reduced by appropriate portfolio diversification. Use of such securities can provide large quantities of credit at prices that banks could not match, owing both to credit risk and to the cost factors noted above. However, on the other hand, this process of securitisation may mean that market

liquidity in these instruments is vulnerable to failure of the market-maker or desire of certain holders to disinvest.

These tendencies differ in importance between countries, though in several of them a shift can be discerned from quantity-rationing to price-rationing of credit and towards use of marketable debt. To the extent that credit rationing was based purely on market failures such as interest rate controls, rising debt may merely reflect a shift by agents to equilibrium levels of debt, and as such may not entail a cause for concern. However, to the extent that previous credit rationing was based on objective assessments of risk, several of these suggestions back up the concerns summarised in the introduction, i.e. that recent increases in debt threaten to lead to greater instability. Some authors, such as Wojnilower (1980, 1985), would go further and suggest that demand for credit is so interest-inelastic that a loosening of rationing leads to a permanently increasing level of debt at any interest rate. The only way this situation may be resolved is a supply blockage, with either credit control imposition or a default crisis.

Detailed empirical support for the hypotheses offered in this and the following theoretical sections is given in Sections 4 and 5. However, indicative support for the argument of this section is given in the table on page 37. For the corporate sector in most countries there is a fairly strong correlation between spreads and defaults, as predicted by the theory of free market interest rate determination. By contrast, for households the relationship is weaker and often negative. This may be attributed to the greater importance of credit rationing for the household sector. However, it is notable that the correlation for households is generally stronger if one includes the period 1981–85. This is in line with the hypothesis of a weakening of quantity-rationing in recent years, with a shift towards price-rationing of credit.

To summarise, this section has outlined two basic paradigms of the supply of credit, the free market approach, where supply and demand are equilibrated by the interest rate, and an approach based on quantity-rationing of credit. It has been suggested that the former

Correlations between changes in spreads and changes in default rates, 1966–85

	Corporate sector	Household sector	Household sector (1966–80)
United States	0.41	0.27	0.22
United Kingdom	0.52	−0.31	−0.47
Canada	0.30	0.51	−0.30
Germany	0.24	−0.03	−0.24
Japan	0.05	−0.05	–

typically applies to the public sector and large firms, the latter to households and small firms. However, recent years have seen a decline in quantity-rationing, a trend for which various reasons can be adduced, notably deregulation and financial innovation. This shift away from rationing may be an important factor underlying the growth of credit for households and small firms in recent years.

Besides offering explanations of the causes of the recent growth of debt, the analysis of this section offers insights into the relation between debt and financial stability. In particular, default risk is dependent not merely on debt or income but also on the other assets in the balance sheet of the borrowers, and macro-economic variables such as interest rates and the trade cycle. In addition, the spread between the interest rate on a private sector debt instrument and the government bond yield offers a measure of the markets' expectations of default risk. However, this mechanism only operates when interest rates equilibrate supply and demand for credit (i.e. there is no quantity-rationing), and even then the discrepancies between offered spreads and realised defaults have often been large. Historical examples include the LDC and farm debt crises; some commentators fear that the current intense competition for loans in domestic markets, too, is leading to the offer of spreads which are too small in relation to the risk of default.

(c) Bankruptcy

Broadly speaking, bankruptcy occurs when a company or household does not pay interest or repay principal due to its creditors. (The precise circumstances under which bankruptcy arises vary from country to country.) It may arise because the market is unwilling to advance more credit, i.e. because it feels that the present value of returns on such a loan is negative, and profit is maximised by realising the assets of the debtor. (In this crude sense, default can be said to be caused by *inadequate* growth of debt. However, much debt issue must have occurred before a debtor reaches this situation.) Default may also occur when shareholders declare themselves unable to pay their debts, even if further credit is available, leaving the creditors to recover such assets as they may.

The nature and consequences of bankruptcy are important to this paper, because the underlying assumption of many of the concerns expressed in Section 1 is that widespread default on debt will have severely adverse consequences for the economy. One argument against this is the common observation that a rapid turnover of small businesses is often a feature of a dynamic economy. Some economists, for example Warner (1977), would go further and argue on the basis of empirical evidence that even for large firms (bankrupt railroads) the legal and administrative costs of default are in fact so low as to be trivial; hence even if increased debt leads to bankruptcy, the only effect is distributional, debt claims being effectively changed to equity. On the other hand, other economists have suggested that the legal and administrative costs of bankruptcy *are* significant and form a sizable deadweight loss. Gordon and Malkiel (1981) estimated corporate bankruptcy costs as a proportion of market value to be between 2½ and 9 per cent. but felt that these estimates were biased downwards, while Baxter (1967) estimated costs as 20 per cent. of assets in the case of households.

We would argue further that, especially when default is widespread and involves households and large businesses rather than only small businesses, all of these analyses may be guilty both of taking a partial view (of an agent or firm in isolation), and of

ignoring certain costs which arise even in a case where such an approach is legitimate. Thus it can be argued that distributional shifts may often be socially undesirable and involve costs of portfolio readjustment; that debt issuers who default may face difficulties in issuing debt later ("loss of reputation"); that banks may face problems of illiquidity or declining valuation in disposing of collateral; also imminent bankruptcy may change a firm's stream of cash flow, for example owing to inability to obtain trade credit or retain key employees; finally there may be significant *externalities* to widespread loan default.

If defaults in the non-financial sector affect banks too, these effects may include declining confidence in the financial system, bank failures – for example the recent growth of US bank failures in line with defaults in the non-bank sector – and in extreme cases a disruption of credit intermediation and significant macro-economic effects on aggregate consumption and investment (see Bernanke (1983) for an analysis of the 1930s depression based on similar arguments). Such externalities may amplify themselves, because in a world of imperfect information the failure of one company, especially in the financial sector, raises doubts about the liquidity and solvency of others[32] – the so-called problem of contagion.

It should be emphasised that the relationship between default and financial instability is unlikely to be linear. Rather, there is likely to be a threshold level of defaults, beyond which bank failures and instability in securities markets increase sharply. The height of the threshold will depend on such factors as capital ratios of financial institutions, and the degree to which their sources of income are diversified. The degree to which these externalities arise for individual financial institutions is likely to depend also on the relative size of the lenders and borrowers and the precise nature of the debt contract. Thus, for example, the recent downturn in

[32] The interdependence of agents may be greater in the case of some financial innovations which, for example, "unbundle" risk (see Bank for International Settlements (1986a), p. 204, (The Cross Report).

inflation had a severe impact in North America on relatively small banks which had made fixed rate loans to energy and agriculture. On the other hand, the LDC debt crisis tended even to affect large banks, given the size of the borrowers who had got into difficulty (sovereign borrowers) and the terms of the debt contracts, which tended to demand repayment in dollars.

We now go on to discuss the demand for credit by each sector in turn.

(d) The sectoral demand for credit

The main conclusions that we draw from an analysis of credit demand in the following section are, firstly, that increased debt in relation to cash flow for the corporate sector is likely to lead, ceteris paribus, to an increased probability of bankruptcy. Increased debt of the household sector may equally lead to default, though the probability of default will depend on such factors as the assets held by the household sector which can be used as security for loans, the distribution of the debt and the underlying cause of increased debt. Three cases may be distinguished: rising debt in "equilibrium" due to an increase in demand for credit on the part of a previously unconstrained household; a "disequilibrium" increase in credits due to release of credit-rationing constraints on households; and a rise in sectoral debt due to a changing age distribution. In the first case it is fairly clear that rising debt leads to an increased risk of default while in the third case such risks are probably small. The second case is less clear and depends on the extent to which prior credit rationing was based on assessments of risk on the part of lenders. The analysis in Section (b) suggests that this second case, emphasising the release of constraints, may be a key factor underlying recent growth in household debt. Finally, increased debt of the public sector is likely to lead to higher interest rates and taxes, which may have repercussions on the level of default in the private sector.

These conclusions implicitly refute an important corpus of economic theory, which suggests that under certain conditions debt issue by the corporate and public sectors is "irrelevant". The

Necessary conditions for irrelevance of debt; corporate and public sectors

Companies	Public sector
Unlimited borrowing by creditors at market interest rates	Unlimited borrowing by creditors at market interest rates
Low or zero transactions costs	Low or zero transactions costs
No taxes favouring either form of finance	Lump sum and distributionally neutral taxes
No bankruptcy	(Bankruptcy ruled out)
Separation of firms' real and financial decisions	Indifference of creditors to uses to which funds put (defence, schools)
Rationality of individuals	Rationality of individuals

analyses in Sections (i) and (iii) below discuss this issue. The following summary table shows the main conditions required for irrelevance in each case.

While there are no comparable "irrelevance" theorems for the household sector, it is seen from Section (ii) below that it is, inter alia, the absence of conditions similar to those shown in the table above, i.e. "perfect capital markets", which leads to the distinctive features of demand for credit by that sector.

(i) The corporate demand for credit

This section examines briefly the Modigliani-Miller and "traditional" views of corporate finance for insights regarding the relationship between debt and financial stability. It is concluded that increased corporate debt in relation to equity or cash flow is likely to lead to a greater probability of bankruptcy.

As shown in the summary table on page 22 above, firms have a choice of external financing methods between debt and equity. Equity is more risky to holders because creditors are paid before stockholders. Hence equity is costlier, as well as being discriminated against by most tax systems[33] (see Tanzi (1984) and King and

[33] Brealey and Myers (1981), pp. 373–383, discuss the effects of tax on corporate financial decisions. See also Miller (1977), who emphasised the importance of personal as well as corporate tax in determining the net tax gain from borrowing.

Fullerton (1984), who show that this is the case in all the countries considered here). Meanwhile debt may increase the risk to the firm of bankruptcy. The analysis of spreads above included some discussion of corporate bankruptcy and debt issue, which suggested that increased debt in relation to equity increases financial risks and hence the cost of finance offered by the market when adverse conditions arise. The nature of these potential adversities, which affect the components of firms' budget constraints, was summarised by Robinson and Wrightsman (1980), who concluded (author's italics):

> "The surest way for a firm to avoid bankruptcy is, of course, to keep its financial house in order. The main lessons learned by the survivors of the 1970s bankruptcy wave are (1) to go easy on debt financing when operating *earnings* are unstable, (2) to go easy on short-term borrowing when operating *assets* are illiquid, and (3) to pay much more attention to expected *cash flow* and *bank balances* than to reported earnings and assets."

Some economic theory appears to contradict these assertions. Modigliani and Miller (MM) (1958) proved that under certain rather strict conditions the debt/equity ratio even under uncertainty is *"irrelevant"* to the cost of capital, and, implicitly, to the lenders' assessment of risk. Hay and Morris (1979) discussed these conditions. Obviously under certainty (i.e. no uncertainty regarding the future) gearing ("leverage" in the United States) has no effect, because under certainty a bond is the same as an equity, both having a known return and thus selling at the same price per unit return. However, the irrelevance of gearing may also apply under uncertainty. Suppose there is uncertainty, but two firms have the same mean and variance of return. One is geared, the other is not, and initially the value of equity is the same in each firm; hence the geared firm has a higher total value (debt plus equity). Then (given the lower legal priority of shareholders' than bondholders' claims to the income of the geared firm) there is an incentive for shareholders in the geared firm to increase their income by selling their shares or borrowing at a given interest rate, and buying shares in the ungeared

firm. The process depresses share prices in the geared firm and raises them in the ungeared until returns to the shareholders in each firm, net of interest payments, are equal. At this point the valuation of the firms is the same and so, therefore, is the cost of capital (expected profit divided by valuation), which is equal to that of an equity-financed firm of the same risk class. The equity yield of the geared firm is of course higher, reflecting the larger proportion of debt in the capital structure. "Homemade gearing" thus offers a shareholder the advantages that the geared firm seeks, and the cost of capital is the same for all firms with the same mean and variance of return. The diagram overleaf contrasts this with the traditional view as summarised above.

Are there implications for the growth of debt? The analysis concerns firms in the same risk class. MM allow firms in *different* risk classes to have different costs of capital. Hence even if the theorem applied, increased debt might be of concern should the distribution of debt issue shift to riskier firms. However, the main problems with the theorem are that MM's analysis excludes taxation and the possibility of bankruptcy, and assumes perfect capital markets. If bankruptcy is admitted, the story changes. Market interest rates will rise with gearing because of the higher risk of default, as the traditional theory suggests. In fact there is an incentive with costly bankruptcy to issue only equity. This is offset by tax deductibility of interest payments which, as noted above, gives a spur to debt issue.[34] Gordon and Malkiel (1981) concluded that observed corporate financial structures comprising both debt and equity arise from a balance between these offsetting forces.

A further objection to MM is that investors may not be able to borrow at the same interest rate as firms[35] because their credit rating is lower or, as discussed below, because of credit rationing they may not be able to borrow at all. In these cases homemade gearing may

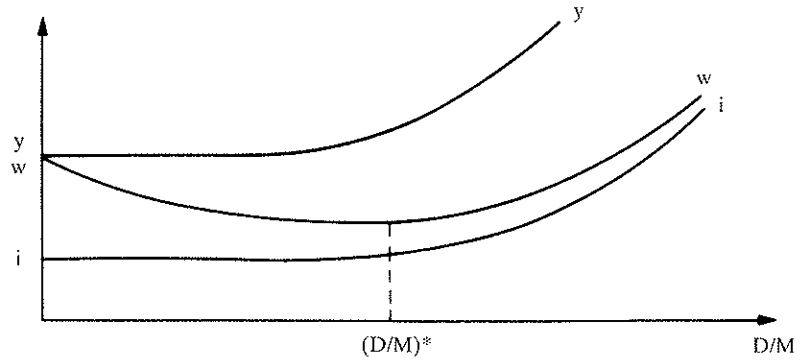
[34] This may be especially the case if, as suggested by Greenwald and Stiglitz (1986), problems of asymmetric information in capital markets lead to limits on equity issues.

[35] That is to say, capital markets are imperfect.

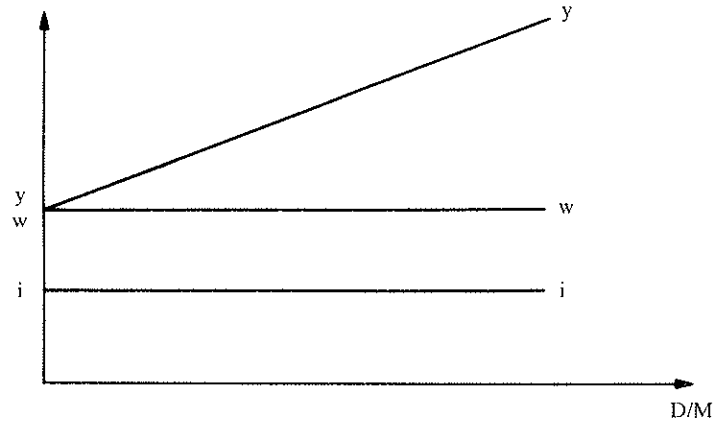
Debt/equity ratios and the cost of capital

D/M : Leverage
i : Cost of debt
y : Cost of equity
w : Weighted cost of capital

"Traditional" view



Modigliani and Miller's view



Source: Hay and Morris (1979).

not be possible (though this may not be the case for institutional investors). Thirdly, transactions and information costs are likely to prevent fully offsetting financial moves by investors. Fourthly, MM assume that the choice of project is independent of finance, when in fact a more highly geared firm may choose riskier investments – a problem of "agency costs", i.e. costs arising from the conflict of interest between a firm's owners and creditors[36] (see Jensen and Meckling (1976), Myers (1977)).

All these suggest a U-shaped cost-of-capital curve, increased debt leading to higher risk which is reflected in the spread of corporate over government debt yields. These hypotheses are empirically tested in Section 5 below. Of course, with imperfect capital markets the problems of excessive debt issue may go further; indebted firms may face limits on borrowing and have to miss opportunities for profit. This may be the case particularly if firms are dependent on the capital market for funds rather than on banks (which may be more prepared to accept short-run losses before refusing further credit or foreclosing). Firms may also find it hard to finance inventories or retain key personnel.

(ii) The household sector demand for credit

The exposition of household sector credit demand commences by outlining the behaviour of households in a perfect capital market,

[36] Auerbach (1985) explains this phenomenon succinctly as follows: "In dynamic models, managers may have the incentive to choose socially inefficient investment plans, because they do not internalize the effects of such plans on the value of outstanding long-term debt. For example, firms with high levels of outstanding long-term debt can choose to undertake very risky projects that increase the probability of bankruptcy. Under limited corporate liability, this transfers resources from debt holders to equity holders, and may do so to a sufficient extent that risky projects with low total payoffs will dominate (from the equity holders' viewpoint) safer projects with higher total present value. The inefficiency induced by this moral hazard is a social cost that, presumably, must be borne by the firm and its owners ex ante in the form of higher coupon payments to holders of long-term debt. It would clearly be in the stockholders' interest to constrain the firm's behavior in order to avoid such costs. While mechanisms to achieve this do exist (e.g., bond covenants restricting future borrowing), it would be costly if not impossible to use them to replicate the desired outcome." Auerbach (1985), p. 304.

before showing by contrast the important constraints on borrowing that households are likely to face in practice. These two polar models offer important insights into the implications of increased household debt; in particular, that the loosening of liquidity constraints is likely to lead to a sharp increase in borrowing. In addition, increased borrowing by an unconstrained household may be more likely to lead to default than increased borrowing of a household previously facing liquidity constraints, and will almost certainly be more risky than increases in household sector debt arising from changes in the age distribution. We also consider the difference between unsecured consumer lending and loans for house purchase and conclude that the latter are somewhat less risky for the lender.

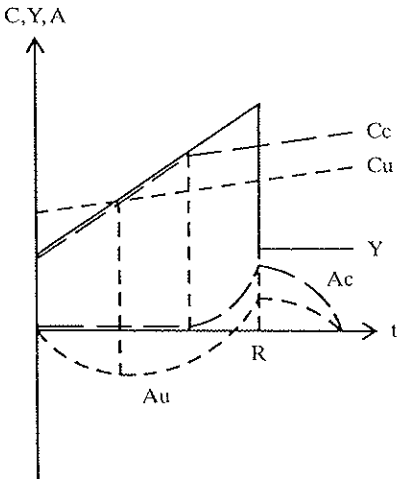
Consider first personal finance in a perfect capital market. In the basic Becker-Lancaster neo-classical theory of consumer behaviour (see Lancaster (1966, 1971)) the consumer carries out "intertemporal optimisation" by borrowing freely in perfect capital markets against the security of his human (i.e. future wage income) or non-human wealth. Given a normal income profile, this is likely to mean heavy borrowing early in the life cycle and corresponding repayments later (see footnote 38 below). In the real world, the consumer faces several additional constraints on lifetime optimisation.

In particular, capital markets are not perfect – this is especially due to the difficulty of pledging the present value of the return on human wealth (i.e. future wage earnings) as a security on loans.[37] Therefore, in general, households may not borrow freely at the market rate of interest. Constraints on borrowing may also arise from asymmetries in information between lenders and borrowers, given an inability of lenders to control borrowers' behaviour, as discussed by Stiglitz and Weiss (1981) and summarised in Section (b) above. Such asymmetries regarding important risk factors as

[37] We concentrate at present on unsecured consumer borrowing, i.e. we assume the loan is not used to purchase an asset which itself forms an adequate collateral.

income, assets and employment prospects may make the risks of lending to certain individuals too great. In addition, credit to households has often been subject to regulations such as usury ceilings or direct controls on credit which are likely to compound rationing. As a result, consumers have often faced limits on borrowing, or penal rates of interest. Such consumers are *liquidity constrained* (see Tobin (1972), Flemming (1973), Pissarides (1978)) and their consumption will be closely tied to receipts of income, though current non-human wealth (especially that which is mot liquid) will also be available for consumption (see Townend (1976)).

In most cases, liquidity constraints imply that consumers cannot consume at the level defined by their lifetime consumption plan, particularly at the points where heavy borrowing would be required early in the life span.[38] Welfare losses are incurred by these consumers, even though consumption can be made up later in the life cycle, owing to forced intertemporal rearrangement of



[38] This point is illustrated in this diagram from Davis (1984b). The common life cycle earnings path of the constrained and unconstrained is Y. The unconstrained are able to borrow, making their net assets Au negative early in the life cycle and hence their consumption Cu can be above their income. After Cu=Y the borrowing is paid back and net assets are built up to maintain consumption after retirement at R. The unconstrained are forced to consume Cc at a level equal to their income until income exceeds their modified optimal consumption path, with more consumption than the unconstrained later in the life cycle. To this point, net assets Ac are zero, i.e. greater than Au. After this point, saving is required, such as to give a higher level of net assets at retirement than the unconstrained, in order to continue the higher desired level of consumption. This analysis assumes no bequests and zero interest rates.

consumption. This may apply even to consumers with substantial assets if these are illiquid, i.e. either costly to encash or unacceptable as collateral for short-term loans. Pension rights, used consumer durables, houses, equities and bonds fall into at least one of these categories in many countries. This has a major implication for the indebtedness of consumers. To the extent that liquidity constraints bind – and there is strong evidence for this[39] – then a loosening of these constraints will be marked by a rising debt/income and debt/wealth ratio.

A second implication of liquidity constraints is that the marginal propensity to consume of the constrained will be higher than that of unconstrained consumers – those able to borrow less than they wish will spend any increase in their resources in order to move towards their optimal consumption path, while those already on this path will save a proportion of the increase, distributing the resulting increase in consumption over the life cycle (see Deaton and Muellbauer (1980)). This suggests that a loosening of liquidity constraints should be indicated by a falling marginal propensity to consume.[40]

Thirdly, the life cycle model together with the existence of liquidity constraints suggests that one should view the household sector as containing different groups. While some households are relatively unconstrained, others will be liquidity constrained, and also households will differ in age and hence borrowing needs as well as income and assets. Changes in the weights of these groups will affect sectoral debt. We return to this subject below when we

[39] If liquidity constraints were not operative, there would not be a strong relationship between disposable income and consumption. Most studies of the consumption function have found such a relationship.

[40] We have not carried out a formal analysis of this question. However, an informal analysis of results for the United Kingdom shows elements of such a pattern (see Davis (1984a)). Hayashi (1985) suggests an alternative test for liquidity constraints; that the rate on personal loans in the United States in 1982 was almost 6 percentage points above the yield on US Treasury notes of the same maturity. His definition suggests that "liquidity constraints", as broadly defined, may include the existence of large default premia in a price-rationed market as well as quantity-rationing of credit. In this analysis our emphasis is largely on the quantity-rationing mechanism.

summarise the relationship between debt and default. Firstly, the implications of *secured* lending to households are analysed.

The discussion so far relates largely to consumer credit, because it has been assumed that no collateral is available other than human wealth. Whether these arguments apply as strongly to credits for personal sector investment, i.e. house purchase, is less clear. Collateral for house purchase is immediately available in the form of the title deeds to the property. Additionally, loans are generally tax subsidised, and in many countries only housing loans are thus deductible[41] (thus income gearing net of the subsidy is relatively low). In some countries the social welfare system will pay interest during periods of unemployment. Compared with consumer credit, the risk to the lender is thus largely confined to the risk that owing to regional or national depression the value of the collateral will have fallen below the outstanding principal of the loan. There are obviously also transactions costs to foreclosure. However, despite this lower level of risk, it can be argued that certain non-price constraints on such lending are still generally operative and thus the earlier insights regarding rationing are not invalidated. Mortgage lending has often been rationed administratively, while even in a free market households may not borrow an unlimited amount at the market interest rate to purchase a house. Loans are typically limited to a certain multiple of income or a percentage of the property value. As discussed by Wojnilower (1985), one aspect of the recent

[41] Tanzi (1984) gives a discussion of tax deductibility on debt interest payments in the various economies, of which the following table gives a summary.

	United States	United Kingdom	Germany	Japan	Canada
Corporate debt	Yes	Yes	Yes	Yes	Yes
Household loans for house purchase	Yes	Yes[1]	Yes[2]	Yes[1]	No
Consumer credit	No[3]	No	No	No	No

[1] Deductibility is limited, which reduces the potential benefit.
[2] In Germany, deductibility is limited and imputed income on "housing equity" is taxed, which reduces the potential benefit further, though, unlike in other countries, saving for house purchase is also tax subsidised.
[3] Since January 1987.
See also Bingham (1985), Annex 2.2

growth of US debt has been a loosening of such multiples (this has also occurred recently in the United Kingdom). These indicate a more relaxed attitude to risk by lenders,[42] though they may also reflect changing characteristics of households, with more two-earner families.

The same arguments as for house purchase apply in principle to lending to buy securities; collateral is immediately available. The valuation risks to the lender may be large, however, and in most countries it is difficult to borrow in order to buy bonds or equities (owing, for example, to margin requirements).

We conclude by drawing together some of the implications for default risk. It has been noted that the household sector consists of groups with differences in age, assets, income and liquidity constraints. We suggest that if debt increases following demographic shifts or increases in asset values *which are sustainable,* there should be no widespread increase in default risk, as individual agents are not over-extended in this case. If liquidity constraints ease, the situation is harder to judge. Individuals are then able to attain their life cycle optima and hence welfare gains are realised. However, to the extent that liquidity constraints were based on analyses of risk, as suggested above, their relaxation may increase the default risk faced by financial institutions. Finally, an increase in the desired level of debt by an individual,[43] with no change in income, appears unambiguously to increase the risk to that individual, especially if his assets do not increase, i.e. the loan merely funds consumption. Income gearing and capital gearing both increase in this case and the consumer is henceforth more vulnerable to changes in income or

[42] However, since this may have resulted in turn from a shifting out of risky business lending to less risky household lending, one cannot conclude that banks' total portfolios have become riskier as a result. Some re-tightening of income multiples has occurred in the United States more recently.

[43] If the equilibrium rationing characterisation of the credit market is correct, increases in debt due to changes in preferences may be an exception – rather than allow a further loan, which will increase an individual's riskiness, at a higher interest rate, banks may not lend more at all. Credit constraints may thus be more prevalent than they appear.

interest rates. In all of these cases, the analysis also suggests that the risk of a default leading to a loss for a lending institution is greater, the greater the proportion of a household's debt constituted by unsecured consumer lending.

The importance of credit constraints, interest rate regulation and the difficulty of screening in the case of households may have prevented the operation of market clearing by interest rate adjustment with an appropriate allowance for lending risk over much of the historical period 1966–85, particularly in the United Kingdom and the United States (see the table in Section 3(b)).[44] Hence, in the context of a time series including such periods of rationing, evidence of the effects of debt ratios on default risk, rather than being sought indirectly via the spread over the government bond rate, may need to be assessed directly via delinquency and repossession rates. Tests of these relationships are reported in Section 5 below.

(iii) Public sector demand for credit

We now discuss briefly the corpus of theory relating to the macro-economic effects of government debt issue. It is concluded that in a situation of near-full employment government debt may lead to the crowding-out of other expenditures via increased interest rates, exchange rate appreciation, inflation or a trade deficit. All of these may lead to increased probabilities of default by the private sector. By contrast, we find unrealistic the arguments that suggest government debt issue is "irrelevant" to nominal demand. Also, it should be noted that increased debt issue may have an important role to play in a situation of under-employment. These hypotheses regarding the relationship between public debt and interest rates are tested in a preliminary manner in Section 5.

[44] However, "points" systems of an extra charge on issue of a mortgage have often been used in the United States as a way around usury ceilings, and the securitisation process for mortgage loans may lead to a system of price discrimination between classes of borrowers according to the proportion of the house value advanced. (Implicitly the interest rate depends on the debt/equity ratio.)

The public sector issues bonds to finance its expenditure as an alternative to increasing taxes and increasing the money supply. All three methods have disadvantages, but it could be argued that, especially at full employment, taxation is the most desirable means of finance, printing money the least. Taxes do not need to be repaid but, unless they are lump-sum, they distort the price mechanism. Debt issue, as is discussed below, may "crowd out" other sectors' credit demands. In principle printing money is an alternative, but it may lead to inflation, an implicit "tax" on cash (and, when unanticipated, on other nominal assets) and in some countries such finance is restricted by constitutional or legal provisions. It should be noted that the need to issue bonds or money occurs automatically as tax revenues fall during a recession, the "automatic stabiliser" which is offset during a recovery. However, most of the concern regarding bond issue relates to discretionary fiscal policy which leads to a permanent growth of debt. The following comments concentrate on the latter.

The public sector generally does not need collateral to issue debt,[45] as its power to raise taxes is usually regarded as sufficient, at least for a domestic lender in an advanced industrial country. The public sector's risklessness should not be exaggerated, however, especially for foreign lenders who are often the marginal suppliers of funds. They risk depreciation of their assets via both interest rate and exchange rate changes. Such risks are expressed in the exchange-rate-weighted rates of return required on bonds issued by the governments of different countries.

What are the macro-economic effects of a budget deficit? While this is too broad an issue to discuss fully in this context, an important contrast should be drawn between a traditional IS/LM view and the Barro/Ricardian analysis. A traditional IS/LM view of a closed economy (see Branson (1979)) is that compared with tax finance, bond issue has a positive effect on economic activity, at least when the economy is operating below capacity. This operates via

[45] Some local government debt is collateralised, for example revenue bonds.

increased investment in addition to, and following, the rise in government expenditure, and may also operate via the increased wealth of bondholders who raise their consumption. These are offset to the extent that increased bond-holding raises the demand for money via wealth effects in the money demand function without the authorities increasing its supply, thus raising the interest rate and reducing investment. Roley (1983) gave estimates of these effects for the United States. In an open economy crowding-out may occur via an inflow of funds from abroad, leading to exchange rate appreciation and the crowding-out of exports and import-competing sectors. Crowding-out is complete at full employment, arising via exchange rate changes, higher interest rates, inflation and a trade deficit, each of which may lead to distress for agents in the private sector.

Barro (1974), drawing on the earlier views of Ricardo, has put forward a somewhat different view: that consumers are "ultra-rational" and hence discount the future tax liabilities implied by government bond issue. This means that the effects of government bond issue are equivalent to those of increased taxation. A bond-financed public sector deficit calls forth increased saving as individuals prepare to pay the taxation which will be needed later to repay the interest and principal of the bonds. Thus the expansionary effect of bond issue is zero or negligible,[46] as consumers offset the government's intentions.

These views have different implications for other sectors. Barro's *debt-irrelevance* view implies that when the fiscal deficit increases, the composition of GNP shifts, between private investment or consumption and public expenditure, but the level of GNP does not change. Unlike the traditional view, interest rates do not increase, and distress is limited to those industries specialised in serving the private sector. The Barro view is perhaps more demanding than the Modigliani-Miller result for companies, as it requires perfect arbitrage across time and not merely across "space" between firms.[47]

[46] The effect will depend on the size of the balanced budget multiplier.

Stiglitz (1981) established other irrelevance propositions; for example, that a change in maturity structure of public debt will be offset by changes in the demands for different securities and hence changes in maturity have no effect on the cost. Such an argument conflicts with portfolio theory, which would argue that a change in the maturity structure of government debt requires a change in the term structure of interest rates. In fact ultra-rational individuals perceive the change in the structure of taxes across time and exactly offset it.

Blinder and Stiglitz (1983) tested for the effects of government debt on nominal GNP, and found that the hypothesis of zero effects was rejected. This led them to examine the lack of realism of the foundations of ultra-rationality, and propose an alternative transmission mechanism. Irrelevance in fact depends on strong perfect market assumptions such as lump-sum taxes, distributionally neutral taxes and perfect capital markets, as summarised in the table on page 41.[48] These suggest that ultrarationality can be rejected.

Debt issue may be of concern for other reasons. As shown by Bispham (1986), if the interest rate exceeds the rate of growth of nominal GNP, debt service obligations may grow faster than tax and

[47] Wallace (1981) shows that if fiscal policy is held constant in an appropriate way, then different government portfolios are irrelevant in the same way as different corporate liability structures are irrelevant under the Modigliani-Miller theorem. Wallace's results require assumptions such as the existence of lump-sum taxes and a full set of contingent markets, and are for a closed economy.

[48] Blinder and Stiglitz suggested that the importance of monetary policy could be re-established by reference to the credit-rationing argument presented by Stiglitz and Weiss (see Section 3(b) above), where, for example, an open market sale of government bonds causes a drain on bank reserves, and, due to rationing, the loan supply is tightened. Then borrowers are unable to obtain alternative credit and activity declines although the interest rate is little changed. It is the market segmentation discussed above (small firms and households being unable to enter the capital market) which gives leverage to the central bank over the economy. They warned that further innovation may weaken the link between bank credit and the economy; if banks prove an unreliable source of funds, alternative institutions may arise, serving the same function as banks, which would reduce the effectiveness of monetary policy. The advent of junk bonds, securitisation and other innovations (which mean more credit is raised on the capital market) may be signalling just such a change.

therefore the government may be obliged to issue ever-increasing numbers of bonds.

Secondly, as shown by Friedman (1982, 1984), complete crowding-out can occur through various channels. Suppose the private sector has a target gross wealth/income ratio, as predicted by the life cycle model, and thus reduces tangible asset holdings when the supply of government debt rises. Then, if there are restrictions on credit, meaning collateral is required to obtain a loan, a reduction in tangible wealth tightens the constraint on credit and forces private sector liabilities to fall, balancing the rise in government debt. One might, however, ask why government debt may not be offered as collateral instead?

In the light of the insights gleaned from economic theory, we now go on to examine the historical patterns of the relationship between spreads, default, debt, income, assets and interest rate, before carrying out a more rigorous analysis using a formal econometric model.

4. Debt and financial stability: experiences of the major economies

The theoretical considerations discussed above have suggested that a link may exist between rapid debt accumulation by the private sector in relation to income and default risk. This is basically because income and assets may prove insufficient to cover repayment of interest and principal in adverse circumstances. To the extent that credit is rationed only by price, the extent of this risk of default may be measured ex ante by the spread between lending rates and a risk-free rate of the same maturity and other features. It has also been suggested that over some historical periods spreads are unlikely to be strongly correlated with the risk of default because of credit rationing, especially for households. For companies, too, the markets' expectations of the risks of lending may be inaccurate (and, as noted in Section 3, default risk is not the only determinant of the

spread). One therefore also needs to consider the relationship between debt ratios and realised defaults.[49]

A close relationship between debt/income ratios and both spreads and defaults would give a priori support to concerns regarding the debt/income ratio. It would imply that on average rising debt ratios have led to increased default risk (both expected and realised).[50] Theory has also shown that the variables debt and income are not the only determinants of default risk. One therefore also needs to consider the relationships between debt, default, liquidity and valuation of assets and interest rate levels, in order to assess their importance to rising defaults and financial instability. This graphical analysis leads on to an econometric analysis of the determinants of default in Section 5.

Graphs 4.1 to 4.10 show the annual *percentage changes* in the debt/income ratio of households and companies together with the spread[51] of corporate bond yields (companies), and mortgage rates (persons) over the government bond yield in percentage points (all at constant maturity),[52] and a measure of the default rate.[53] The spread and the default rate are measures of "ex ante" and "ex post"

[49] It is also of interest to observe the correlation between defaults and spreads, as it indicates the efficacy of the markets' pricing of risk. See the table on page 37.

[50] That is to say, not merely entailed new agents becoming indebted.

[51] This measure may overstate the spread at high interest rates; however, conversely, a percentage measure would exaggerate it at low rates. (Although the corporate bond yield is used in the graphs it should be noted that bank lending has historically been the main form of corporate finance in Japan, the United Kingdom and Germany. However, in the absence of controls the same considerations should guide banks in setting their loan rates as lenders in the corporate bond market.) As noted above, this measure is an imperfect indicator of the default premium as it is also affected by variations in call provisions, market liquidity and other such factors.

[52] The yields used were as follows: corporate bond yield: for the United States: yield, secondary market, corporate bonds (AAA); for the United Kingdom: yield, secondary market, debentures and loan stock; for Germany: yield, secondary market, industrial bonds; for Japan: yield, secondary market, industrial bonds; for Canada: yield, secondary market, industrial bonds; while government bond yields chosen were: for the United States: yield, secondary market, US Treasury bonds and notes, 20 years; for the United Kingdom: yield, secondary market, government stocks, 20 years; for Germany: yield, secondary market, public sector bonds, all issuers; for Japan: yield, secondary market, government bonds; for Canada: yield, secondary market, Government of Canada bonds, over 10 years.

risk of default on debt respectively, as discussed above. The ex post measures of the default rate are as follows (the rates are defined as defaults per annum divided by the total number of firms or households, except where otherwise stated):

US companies:	rate of business failures (per cent.);
US households:	1. rate of non-business bankruptcy (per cent.);
	2. rate of delinquency on consumer credit (per cent. of number of loans);
	3. rate of mortgage foreclosure (per cent. of number of loans);
UK companies:	rate of company liquidations, excluding those initiated by members (per cent.);
UK households:	proportion of mortgages foreclosed annually (per cent. of number of loans);
Japanese companies:	rate of business failure (per cent.);
Japanese households:[54]	rate of suspension of business transactions with banks (per cent.);
German companies:	rate of company insolvency (per cent.);
German households:[54]	rate of other bankruptcy (per cent.);
Canadian companies:[54]	rate of corporate bankruptcy (per cent.);
Canadian households:[54]	rate of non-business/consumer bankruptcy (per cent.).

Although the patterns are not totally clear, some relationships between the series are perceptible. To summarise, we find that in most countries rising debt/income ratios for companies and households have tended to coincide with rising rates of default, and also for companies with rising interest spreads. For households there appears to be no strong relationship between debt/income ratios and spreads for most countries over the historical period, though some indications of such a developing relationship are observable in

[53] A rate of default does not, of course, measure the costs to the economy, as no allowance is made for firm size. Most defaults occur among small firms. However, given that the size distribution of firms in an economy changes slowly if at all over time, it does give a consistent measure usable in time series analysis. Also definitions of default and bankruptcy and coverage of the measures used vary between countries. However, they should still be comparable in index form.

[54] The denominator was estimated for these cases.

Interest rate spreads, rates of default and changes in debt ratios: United States

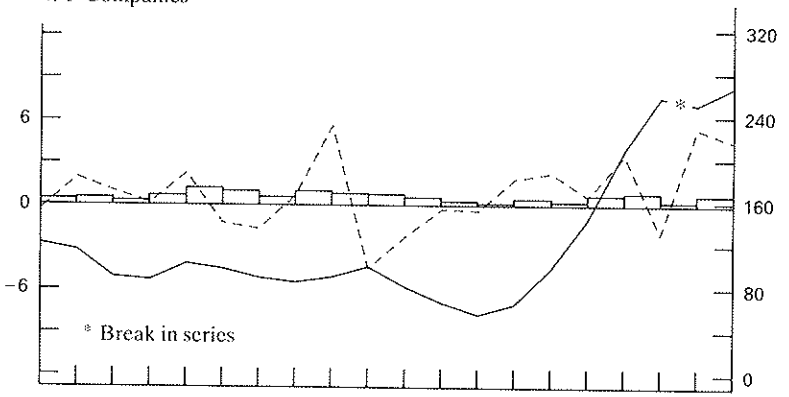
Left-hand scale:

- Spread of the representative yield over the government bond yield
- Percentage change in sectoral debt/GNP ratio

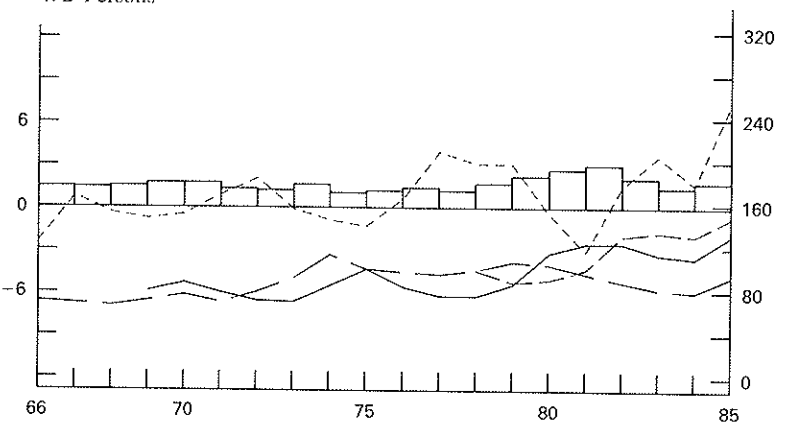
Right-hand scale:

- Rate of default (1975=100)
- Rate of default – consumer credit (1975=100)
- Rate of default – mortgage credit (1978=100)

4. 1 Companies



4. 2 Persons



United Kingdom

Left-hand scale:

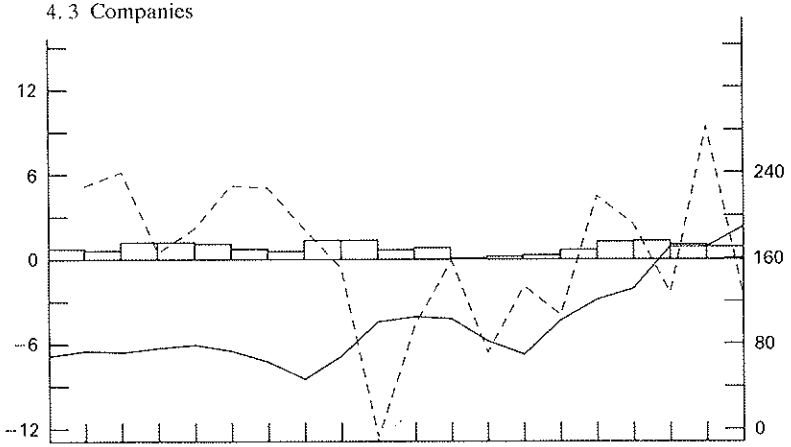
Spread of the representative yield over the government bond yield

Percentage change in sectoral debt/GNP ratio

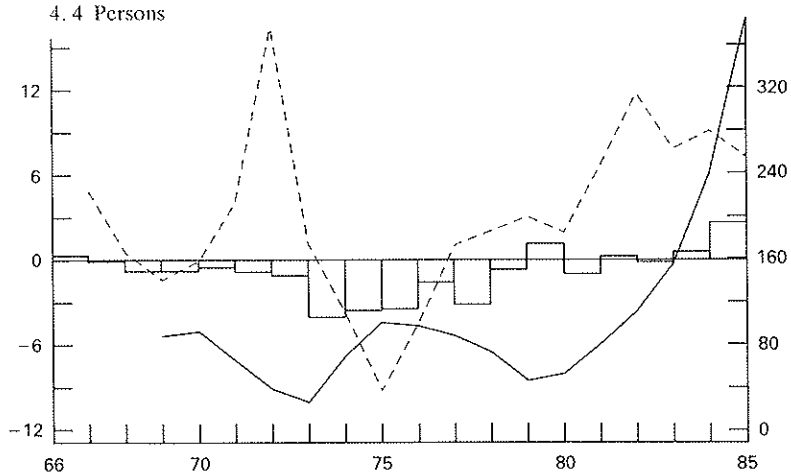
Right-hand scale:

Rate of default (1975=100)

4. 3 Companies



4. 4 Persons



Germany

Left-hand scale:

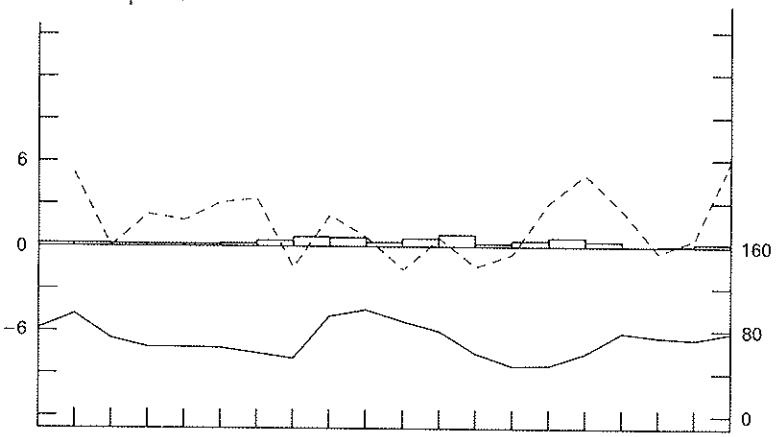
Spread of the representative yield over the government bond yield

Percentage change in sectoral debt/GNP ratio

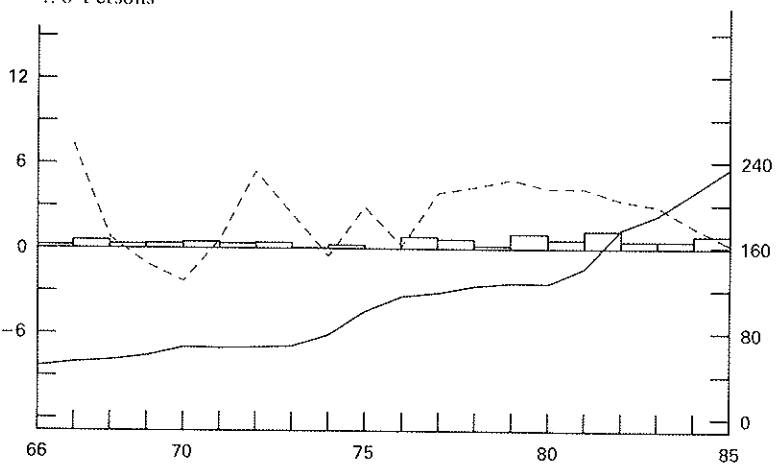
Right-hand scale:

Rate of default (1975=100)

4. 5 Companies



4. 6 Persons



Japan

Left-hand scale:

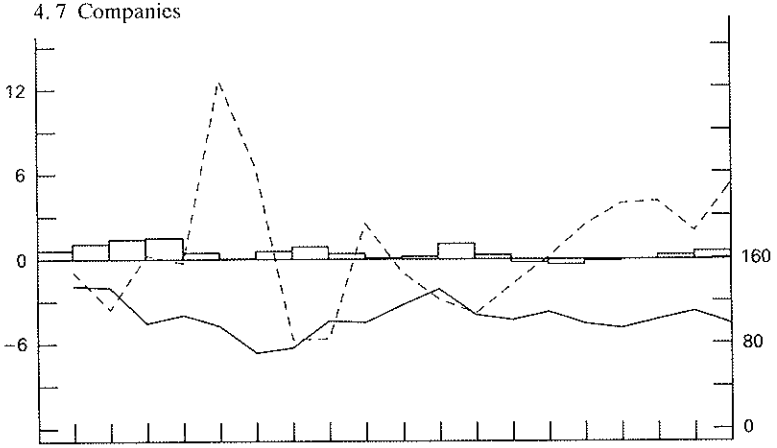
Spread of the representative yield over the government bond yield

Percentage change in sectoral debt/GNP ratio

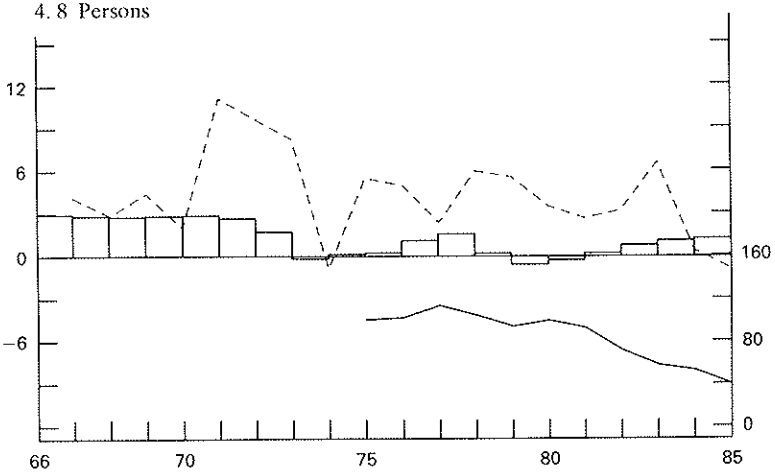
Right-hand scale:

Rate of default (1975=100)

4. 7 Companies



4. 8 Persons



Canada

Left-hand scale:

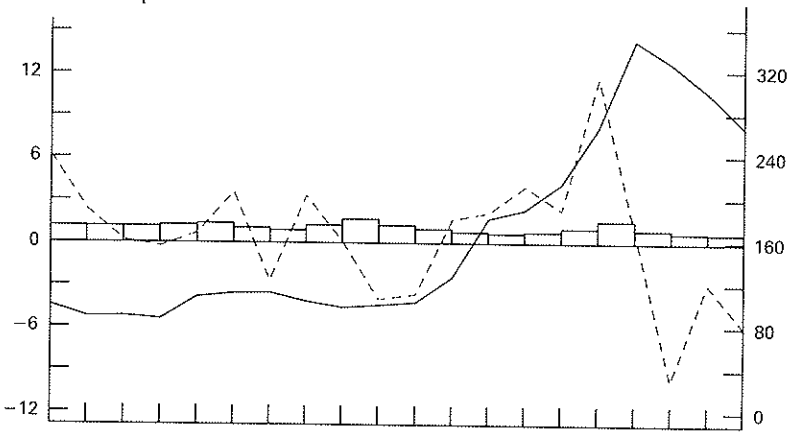
Spread of the representative yield over the government bond yield

Percentage change in sectoral debt/GNP ratio

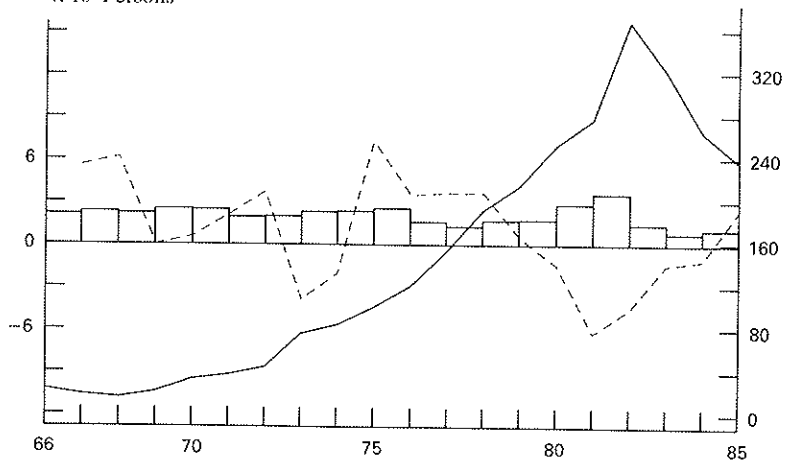
Right-hand scale:

Rate of default (1975=100)

4. 9 Companies



4. 10 Persons



recent years, particularly for countries where financial liberalisation has been a significant factor.

In the United States the growth of corporate debt has coincided historically with an increase in the business failure rate, though since 1978 this has also been associated with a change in the bankruptcy law. Increases in the spread of corporate over government bond yields have often also coincided with a growing sectoral debt ratio, though since 1983 growing debt and default have coincided with declining spreads. This recent pattern may be related to greater competitiveness in the financial system; on the other hand, rising margins in early 1986 (not shown in the graph) may merely suggest a delayed reaction to debt growth. For households the spread/debt relationships appear weaker; the change in the debt ratio appears to be negatively related to the spread, particularly during the "credit crunches" of 1969 and 1974. However, the unprecedented growth of the personal debt ratio in 1985 (when "Regulation Q", which helped to cause credit crunches, had been abolished) has been associated with a rising margin, which may show that the mechanism of spreads begins to operate when the market is deregulated. There has also been some increase in delinquency, as measured by the bankruptcy rate, by the percentage of consumer credit loans which result in default and the percentage of mortgages foreclosed. As in the case of corporations, the 1978 bankruptcy law probably boosted the bankruptcy rate. These increases in default came about despite a continuing buoyancy in the economy; however, regional economic problems, which are hard to capture in such an aggregate analysis, were undoubtedly important. (Farm debt is excluded from the graph.)

In the United Kingdom it is apparent that the debt ratios are more unstable than in the United States. For companies the spread does not appear strongly to follow the debt ratio, at least until 1976. Credit controls were often stringent in the earlier period, leading to sharp falls in lending and equally sharp increases when they were relaxed (especially in 1971). Bankruptcies increased with the downturn of 1980–82, and it is notable that the growth rate of the

debt ratio also increased over this period. "Distress borrowing" in the recent recession was well documented and, to the extent that some firms were eventually refused credit, this meant that a rising debt ratio would be strongly associated with financial instability. However, it is less clear that this is independent of the cycle. In 1984–85 the spread fell despite a high level of default, perhaps due to intense competition in the financial system. As in the United States, household debt in the United Kingdom was often subject to credit controls (consumer credit) or periodic rationing (mortgages) leading to cycles of rapid growth and decline. The spread was negative for most of the 1970s. This may be related to the factors relating to credit rationing discussed in Section 3(b) above[55] and also to the variable rate nature of mortgage lending in the United Kingdom.[56] Since 1980 lending has been liberalised, especially after the entry of the banks into the mortgage market, and building societies have ceased to restrain mortgage rates below market clearing levels. The debt ratio has risen since then together with the margin of mortgage rates over government bonds. Household mortgage delinquencies rose sharply in the "economic recovery" of 1983–85, after following a largely cyclical pattern over the 1970s. This suggests, as in the United States, that the current increase in the debt ratio has entailed riskier lending, although again for households this has been reflected in pricing.

In Germany the company sector debt ratio shows a number of cycles. A rather strong, positive relationship with the spread is apparent, as it rises and falls with the debt/GNP ratio in almost every case. There have historically been few controls on lending in Germany, as well as a prevalence of fixed rate lending. Hence spreads may accurately reflect lenders' assessment of risk. For persons the relationship appears less strong, ast least until 1976. The

[55] Additionally, as mutual organisations, building societies, which dominated the personal sector credit market during this period, had less incentive than banks to maximise profits by raising rates.

[56] Lending at 5 per cent. below government bond yields did not therefore lock lenders permanently into unprofitable assets.

business failure rate appears to be largely cyclical. (The number of bankruptcies has risen strongly over the period shown, but so has the number of firms.) By contrast the household rate shows an upward trend. It may be significant that the strongest growth has coincided with a continuous rise in debt (and increased spreads) since 1977.

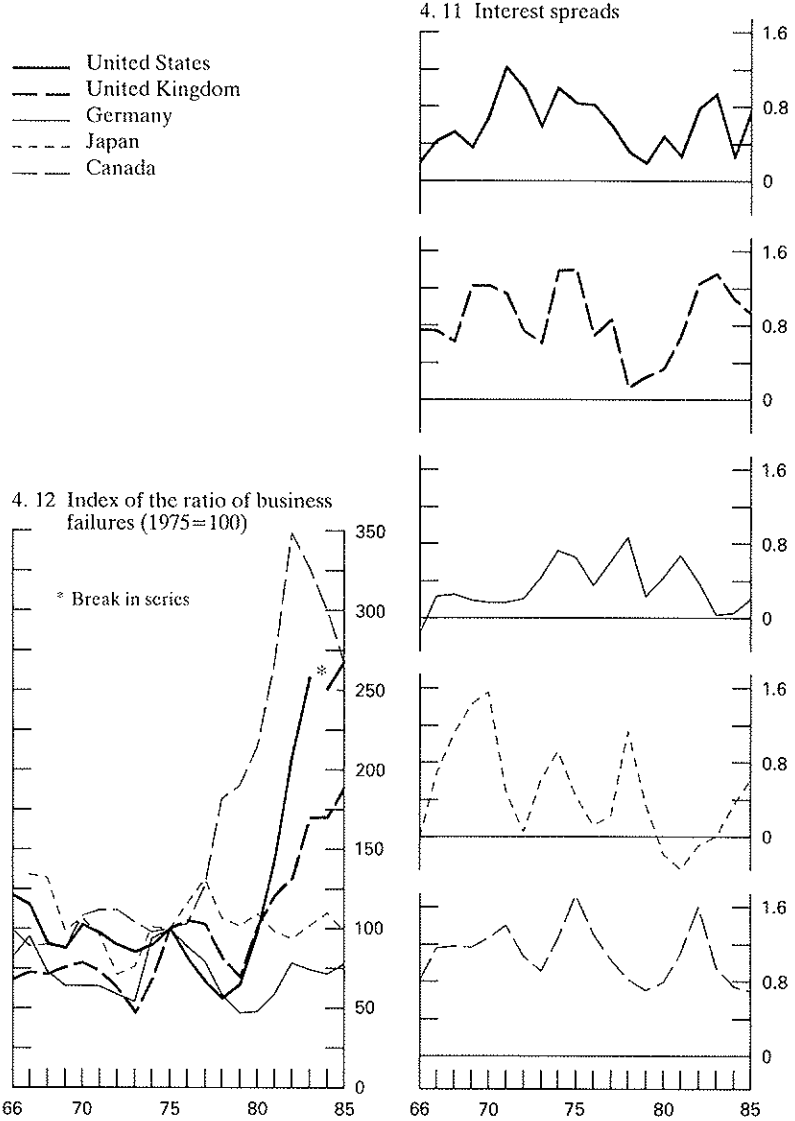
In Japan the relationship for companies between growth in the debt ratio and the spread of corporate over government bonds appears negative, but it also appears to have become less so since 1980. Again, this may be significant as liberalisation of the Japanese financial system has proceeded apace since then. The rate of bankruptcy has declined somewhat since the high-growth period of the 1960s and does not appear strongly related to changes in the debt ratio. Japanese households' debt ratios also appear at best a weak predictor of bankruptcies and the spread; for example in 1977 and 1984 the growth of the ratio declined while the spread increased.

The Canadian company sector has experienced sharp swings in debt outstanding since the mid-1970s. As discussed in Section 2, this period has also been associated with a large increase in the rate of bankruptcy. It is noteworthy that the peak rate of business failures came about one year after unprecedented growth in debt (combined with a steep recession). The spread has been somewhat higher and more stable than elsewhere, but the measure shown here does at least follow the rise in defaults in 1979–81. For persons the debt ratio has again been unstable, and has featured continuous debt reduction in relation to income between 1979–84. The spread for mortgages appears to follow changes in default and (except in 1979–81) growth rates of debt quite closely. It is perhaps significant that mortgages are often packaged and resold as bonds in Canada, perhaps leading to a market-related approach to pricing. Personal bankruptcy has shown a long-term increase in Canada. Though partly due to such legal changes as the "small debtor programme" introduced in 1972–73, this has also coincided with rising debt in relation to income.

Graphs 4.11 and 4.12 make an international comparison of spreads and of business failures to assess the degree to which trends are common between countries. It is apparent from Graph 4.11 that,

Interest spreads and default rates

4. 11 Interest spreads



4. 12 Index of the ratio of business failures (1975=100)

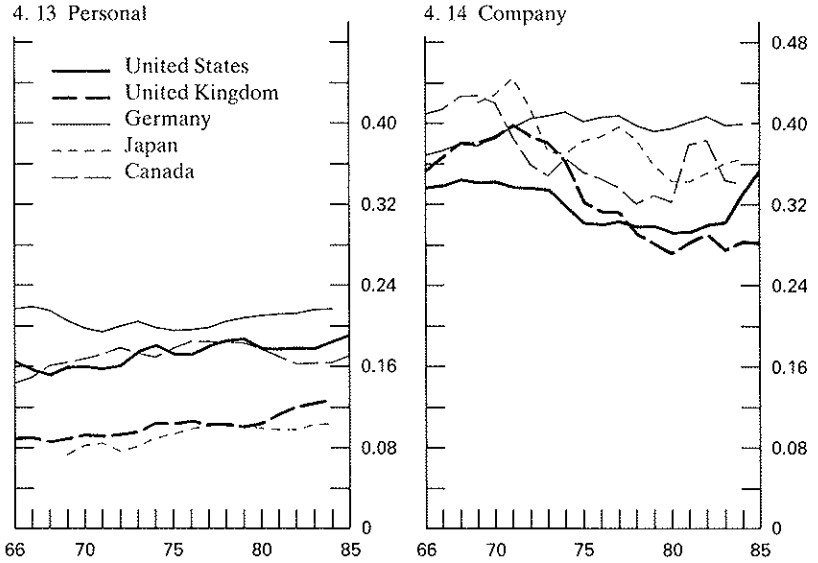
at least since 1977, spreads in Germany, the United States, the United Kingdom and Canada have risen and fallen together, with a peak in 1980–82 and troughs in 1978 and 1985. By contrast, the mark-up on Japanese corporate bonds peaked in 1978, was negative in 1980 and again reached a high level in 1985.[57] Before 1977 Germany behaved somewhat differently from the others; the spread was particularly low before 1973, and the cycles were less marked than elsewhere. This was, of course, a particularly expansionary period for Germany. The expectation of default on bonds by the market would probably therefore be low.

Business failure rates are defined as an index with 1975=100. The principal common pattern observable is the rapid growth of defaults in the United Kingdom, United States and Canada since 1976–79 (in parallel with spreads until 1982), which was only weakly echoed in Germany and not at all in Japan. This growth has coincided with recession, growing debt, disinflation and rising real interest rates. The econometric analysis in Section 5 below attempts to assign weights to these different factors, which have brought the business failure rate in the Anglo-Saxon countries in 1984 to at least 2½ times its 1975 level. In the period before 1975 there appear to be few strong common trends.

Graphs 4.13 to 4.16 show various debt/asset ratios for households and companies. As in Section 2, trade credits are excluded from both sides of the balance sheet. As discussed in Section 3, assets provide both collateral and income to service the debt; thus a rising level of capital gearing (or, equivalently, declining net worth) is an a priori indicator of greater risk. One the face of it, Graph 4.13 suggests that for households the level of debt is neither excessive nor accelerating in relation to gross assets, though a very slight upward trend is detectable in most countries. However, since much of gross wealth is in the form of housing and pension rights, the liquidity of

[57] Many of the Japanese bonds in question are issued by utilities. They may behave differently from other firms' bonds, and few issues have been made in recent years. However, in our view this does not fully explain the aberrant pattern.

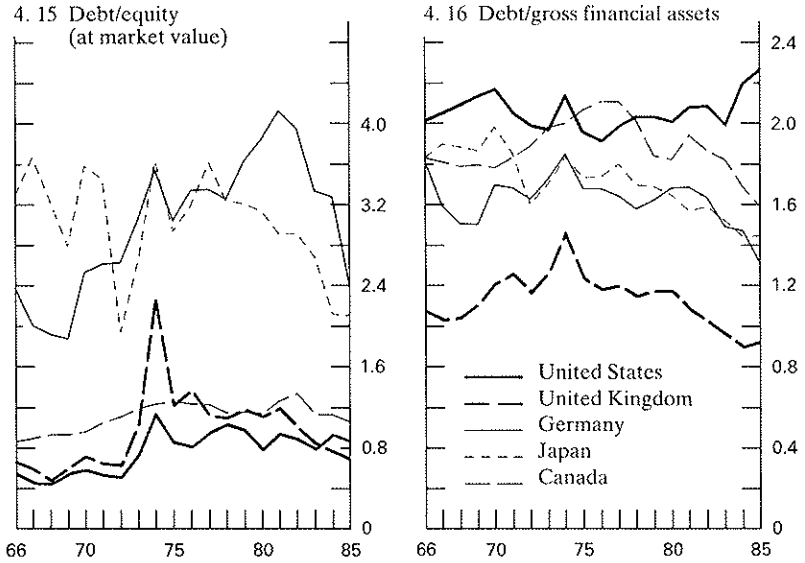
Sectoral capital gearing ratios
(debt/gross assets)



the denominator is not high, and may be vulnerable to valuation changes during a recession. Also, as wealth tends to be more unequally distributed than income, particularly for bonds, equities and housing which have recently increased in value, it is likely that aggregate capital gearing tells rather less about average individual positions than debt/income ratios. (Friedman (1986) confirms this suggestion for the United States.)

Corporate capital gearing is higher and more unstable. The levels obviously depend on the different measures of the capital stock and real assets, as well as on the definition of the corporate sector. The graph shows that, although the company sector has increased its capital gearing in each case since 1980 (most steeply in the case of the United States), the current levels are not exceptional in relation

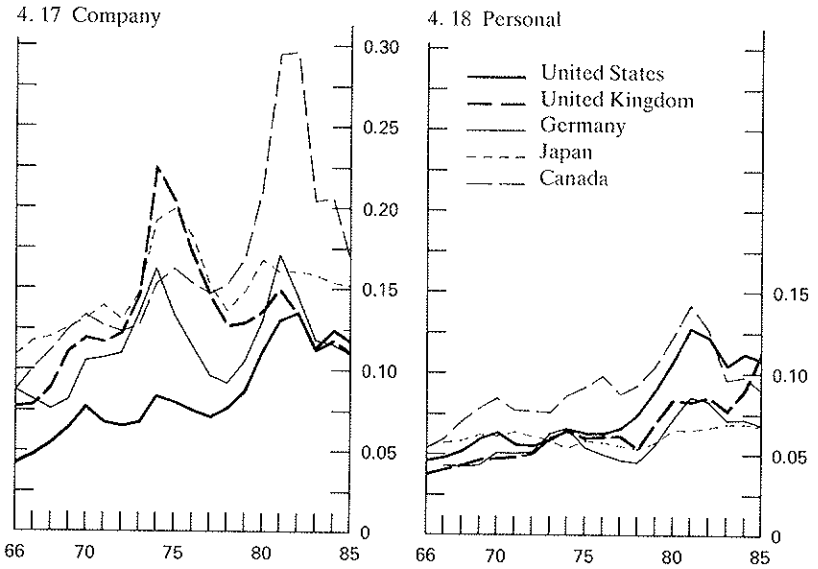
Other company gearing ratios



to past experience. Additionally, as shown in BIS (1986b), page 24, an increase in the real return on gross assets has in fact come about since 1980 to offset increased risk due to rising capital gearing.

Graph 4.15 depicts the corporate debt/equity ratio (at market prices), which could be characterised as the market equivalent of capital gearing. As discussed above, on the traditional view it is an important indicator of risk to a firm. On this basis the ratios for Germany, Japan, Canada and the United Kingdom give little cause for concern, as they have fallen since 1981. The decline has been quite dramatic in the cases of Japan and Germany, as growth in equity values has far outstripped the quite rapid growth of debt. In the United States the debt/equity ratio (at *market* value) has been relatively stable, owing to a strong increase in share prices, despite growth of debt and retirement of equity.

Sectoral income gearing ratios
(gross interest paid/sectoral income)



Graph 4.16 shows the ratio of debt to corporate financial assets. It indicates the coverage of debt by the most liquid of a firm's assets, which can be sold if cash flow is exhausted; obviously if calls on assets go beyond this, the firm is heading for difficulties as it must sell its physical capital. In recent years the corporate sector in many industrial countries has run financial surpluses, and also equity holdings (as an asset) have increased in market valuation. These factors may explain the decline in this ratio in the United Kingdom, Japan and Germany, while, as noted, in Canada debt has also been run down. In the United States, by contrast, the debt/financial asset ratio has been rising sharply to a level not previously seen during the observation period. Partly this is a consequence of the omission of corporate bonds and equities from US firms' financial assets (the

flow of funds nets them out). However, if bonds and equities have not been increasing as a share of the portfolio, the sharp increase does give cause for concern, should firms need to call on their financial assets to repay debt interest, when cash flow is squeezed.

To summarise, the graphs depicting gearing suggest that in most countries corporate gearing in recent years has not deviated strongly from earlier norms, thus suggesting somewhat less cause for concern than would emerge from a consideration of debt and income only. Meanwhile, the household sector generally has not over-extended its capital gearing, though some problems with household capital gearing as a measure of default risk have been noted. The main exception to these trends has been the growth of corporate debt in relation to financial assets in the United States.

The stock gearing ratios are complemented by two graphs showing rough estimates of the rate of *income* gearing, i.e. gross interest payments divided by sectoral income. This is obviously an important indicator of potential financial distress complementary to debt/income or balance-sheet ratios when interest rates change. The measure used is:

$$\frac{\text{Gross debt} \times \text{corporate bond yield}}{\text{Gross profits (national income definition)}}$$

for firms, and for persons,

$$\frac{\text{Gross debt} \times \text{mortgage rate}}{\text{Personal disposable income}}$$

The measures thus ignore corporate taxes, depreciation, etc. and assume in each case both that debt is variable rate (or short-term), and that the reference rate used is an adequate summary variable for the actual interest rate. Obviously this was not the case for much of the period, when fixed rate lending predominated in several countries, particularly in the United States and Germany; nor does the mortgage rate allow for the higher interest rate on rapidly

expanding consumer debt. Nonetheless the ratios should at least be indicative, especially more recently with the growth of variable rate debt.

For companies (see Graph 4.17) the most notable feature is the exceptional peak in Canada in 1981, which, as shown in Graph 4.12, also corresponded to an exceptional peak in business failures. A smaller peak occurred for other countries, though the pattern was least marked in Japan. The rate of decline from the 1981 peak has been slowest in the United States, illustrating the rapid growth of debt and the continuing strength of interest rates. It is only in the United States that rates of income gearing since 1980 have been unprecedented over the period shown, suggesting a continuing danger for the corporate sector despite the relatively low (measured) level in relation to other countries.

For the personal sector a trend increase in the measure of income gearing is apparent for most countries, though this is least marked in Germany and Japan. As noted, the omission of the consumer credit interest rate from the calculation suggests that in fact growth in the Anglo-Saxon countries is underestimated. The extreme level of income gearing in Canada in 1980–81 is again apparent; the fall since then relates to repayment of debt (and bankruptcy) as well as declining interest rates. The graph suggests that the greatest pressure on households is currently in the United States and United Kingdom. In the latter, for instance, gearing is at a record level despite lower interest rates than in the early 1980s. Examination of the trends in delinquency in Graphs 4.2 and 4.4 suggests that this has had an observable effect on defaults.

On balance, the graphs in this section appear to show that a relationship between debt/income ratios, spreads and default rates has obtained in many industrial countries over the last twenty years. High levels of default have also sometimes coincided with high debt/asset ratios and income gearing, suggesting that other factors such as wealth and interest rates are also important to default risk. This is as predicted by the theory discussed in Section 3. In the next section the relative importance of these factors is assessed econometrically.

5. An econometric analysis of the determinants of lending risk and interest rates

The graphs in the last section have suggested that changes in debt/income ratios, together with asset and interest rate developments, may lead to changes in default risk. In this section we attempt to use the insights offered by economic theory to develop a more rigorous empirical approach, in order to test for effects of company and household sector debt on financial stability. The modelling approach is to estimate effects of debt simultaneously with the effects of the other determinants of default risk. A simple test is also made for a relationship between public sector debt and interest rates. It should be noted at the outset that important factors such as taxation and the distinction between fixed and variable rate debt are omitted from the analysis. Nonetheless we would still argue that the results show that private sector debt has had a significant and measurable effect on insolvency rates and market default premia, on average and across countries. Meanwhile, growing public sector debt has gone hand in hand with increasing interest rates.

(a) Company sector

For the corporate sector the aim was to test for a significant effect of debt/GNP ratios on default rates and spreads, given the other determining variables. The model uses a specification similar to that used by Wadhwani (1986) to investigate effects of inflation on liquidation rates and default premia. His technique is to model the behaviour of an individual firm, and then to test the resulting specification using macro-economic data. Thus, his model combines the objective function of a firm in perfect competition, a borrowing constraint and the budget constraint to derive an equation in which the probability of bankruptcy (μ), measured as the proportion of all firms that go bankrupt in the year in question, depends on wages (W), real interest rates (ϱ), debt (D), the firm's market value (MV) and the mean ($\bar{p}$) of the output price.[58]

In the perhaps more likely case of imperfect competition, where a firm chooses the output and price to maximise profits net of expected bankruptcy costs, taking other firms' outputs and prices as given, the bankruptcy function will include a measure of aggregate demand (AD).

Wadhwani augmented this basic specification in three ways, all of which are adopted for the current analysis. Firstly, allowance was made for the effects of inflation on the probability of bankruptcy. Given limits to borrowing, a firm which is in "financial distress" because its debt exceeds its borrowing limit will have to survive increasingly on its cash flow. But with non-indexed and variable rate debt, inflation hurts cash flow, because, for any positive real interest rate, a given rise in inflation leads to a greater proportional increase in the nominal interest rate. Such an effect can be tested by including a nominal (r) as well as real interest rate in the estimating equation. Secondly, he extended the production function to include raw materials, which implies that their price (PM) enters the bankruptcy

[58] We suppose that in a world of perfect competition and zero inflation a firm chooses the level of employment (L) to maximise expected profits (π), net of expected bankruptcy costs to the firm (C), where

$$E(\pi) = E(\tilde{p})\,F(L) - WL - C\mu(\cdot) \qquad (5.1)$$

where E is the expectations operator, $\tilde{p}$ is the uncertain output price, W the money wage, F(L) is a twice-differentiable production function with $F_{LL}<0$ (capital being given in the short run), C is the cost of bankruptcy and $\mu(\cdot)$ is the probability of bankruptcy.

We also assume that the firm owes debt of D with rate of interest, and that if the firm cannot meet its current commitments from cash flow, it can raise up to $S = MV - D$ to finance its losses, where MV is the present value of expected earnings and S is the value of shares.

These assumptions regarding the availability of credit mean that the firm goes bankrupt when

$$\tilde{p}F(L) - WL - \varrho D + S < O \qquad (5.2)$$

Then combining (5.1) and (5.2), employment is given by

$$L = L(W, \varrho, D, MV, \bar{p}, \sigma) \qquad (5.3)$$

where $\bar{p}$ and σ are the mean and variance of the output price. Using (5.2) and (5.3), the probability of bankruptcy is a similar function

$$\mu(\cdot) = \mu(W, \varrho, D, MV, \bar{p}, \sigma). \qquad (5.4)$$

In practice, the variance of the output price was never significant.

function along with W (the price of labour). Thirdly, the mean of the output price was replaced by the actual output price (GNP deflator).

The default premium on corporate bonds (ε) is a function of the market's ex ante view of the probability of bankruptcy, as discussed above. It can thus be shown that the default premium rises with the probability of bankruptcy and therefore may be related to the same variables.[59] The general estimating equation used by Wadhwani was

$$B_0(L)\begin{bmatrix}\mu\\ \varepsilon\end{bmatrix} = B_1(L)\ln\left(\frac{W}{P}\right)_t + B_2(L)\ln\left(\frac{PM}{P}\right)_t + B_3(L)\left(\frac{D}{MV}\right)_t \qquad (5.9)$$

$$+ B_4(L)\varrho_t + B_5(L)r_t + B_7(L)\ln\left(\frac{AD}{P}\right)t + \text{const},$$

where (L) is the lag operator, price level homogeneity having been accepted by Wadhwani.

Wadhwani showed, using this model for the United Kingdom, that price inflation had a significant effect on bankruptcy and default premia, independent of real interest rates, though he found the structure of default premia and bankruptcy equations rather different (as noted above, market perceptions ex ante may not be good predictors of ex post bankruptcies; also there are other influences on the spread besides default risk).

[59] Assume the investor recovers a proportion R of his original investment in the case of bankruptcy. Then a risk-neutral lender equates expected returns to corporate lending with those to risk-free lending G (to the government). The real interest rate on corporate lending B must include an allowance for the risk $(1 - \mu(\cdot))$ and cost k of bankruptcy;

$$(1 + \varrho G) = (1 + \varrho B)[1 - \mu(.)] + k\mu(.) \qquad (5.5)$$

giving the default premium ε.

$$\varepsilon = \varrho B - \varrho G = \frac{(\mu(.)[(1 - R) + \varrho G]}{[1 - \mu(.)]}$$

where

$$\frac{\delta\varepsilon}{\delta\mu(.)} > 0 \qquad (5.6)$$

i.e. the default premium rises with the probability of bankruptcy. This means that the default premium may be related to the same variables as affect the probability of bankruptcy, i.e.

$$\mu(.) = \mu(W, PM, \varrho, r, D, MV, \tilde{p}, \sigma, AD) \qquad (5.7)$$
$$\varepsilon = \mu(W, PM, \varrho, r, D, MV, \tilde{p}, \sigma, AD) \qquad (5.8)$$

We commenced with a version of the general equation (5.9), and tested directly for effects of debt ratios on bankruptcy and market default premia in the major economies. Wadhwani's model seemed useful for this, as it sets the problem of debt within a well-structured specification drawn from the firm's production function, objective function, borrowing limit and budget constraint. However, given our focus, some changes were made to his specification. Firstly, in the basic equations the net debt to market value ratio was replaced by gross debt to GNP. This allows testing of the ratio which is the primary focus of this analysis; of course, it assumes that GNP is an adequate proxy for expected profits and that gross debt is relevant independent of corporate liquidity (a test using net debt is reported below). Secondly, aggregate demand was proxied by the deviation of real GNP from trend.[60] As well as being a better measure of capacity utilisation than a pure levels measure, detrending avoids the entry into the equation determining a *rate,* of an *inherently* trended variable, which would otherwise lead to objectionable long-run properties. All other variables are prices or ratios. Apart from the interest rates which were entered as a percentage the equations were specified in logs, thus facilitating analysis of elasticities. The general specification was set up in error-correction format rather than as an autoregressive distributed lag, i.e. each variable was specified in differences and levels. This allows separation of short and long-run effects on the dependent variable, while also avoiding the "spurious regression" problem by differencing of the dependent variable (see Hendry et al. (1983) for a discussion). Finally, given the simultaneity between debt and bankruptcy, instrumental variables were used to replace the current debt/income ratio.

Given the limited number of observations, we did not set out to estimate the pair of equations (5.9) for each country. Instead a "least

[60] We regressed the lag of GNP on a constant and time trend; the residuals show the (percentage) deviation from trend. (It should be noted that the results were similar whether demand was detrended or not.)

squares with dummy variables" (LSDV) approach was used, stacking the observations and testing for stability of coefficients (i.e. similar behaviour) by use of F tests for structural stability of the parameters (see Maddala (1977)). Results are presented on pages 81–82 for the general and most restricted specification acceptable. For the F tests our prior view was that Japan, with its rather different pattern of interest rate spreads, bankruptcies and debt ratios (see particularly Graphs 4.11 and 4.12 and the table in Section 3(b)), would not behave similarly to the other countries. This proved to be the case, while for the other countries one could not reject the hypothesis of stable coefficients between countries at the 95 per cent. level.

The results may be summarised as follows: the corporate debt/income ratio had a significant positive effect both on defaults and on spreads. The following table shows, ceteris paribus, the short and long-run elasticities and the effect of a sustained 5 per cent. increase in the debt ratio (which, as shown in Graphs 4.1 to 4.10, has often been observed in the past). Of course, in practice, other variables would not be held constant – GNP growth above trend, falling interest rates and lower factor prices could offset the deleterious effects of rising debt ratios. The results suggest that quite sizable changes in defaults and spreads are likely to result from rising debt ratios.

Looking at the results in more detail, the equation for insolvency rates shows a specification close to first differences, the strongest *levels* effect coming from nominal interest rates. Within this framework, the differences of real detrended GNP, the debt ratio, real wages and real raw material prices were all significant, with the expected sign, while differenced nominal and real interest rates entered weakly with the correct sign. Separate entry of the difference of detrended GNP from the difference of the debt ratio ensures that we capture the discrete effect of debt ratios separately from the trade cycle, i.e. the differenced debt ratio does not enter merely due to the significance of the denominator. Also significant was the dummy for the new US bankruptcy law of 1978, which

Effects of debt/GNP ratios on corporate defaults and spreads

	Elasticity	Effect of a sustained 5% increase in the debt/GNP ratio
Default rate: short-run .	+ 2.8	14% increase in probability of default
long-run . .	zero	zero
Spread: short-run	+ 5.7	29 basis point increase in spread
long-run	+ 3.1	16 basis point increase in spread

reduced the costs of bankruptcy. The stronger effect of nominal than real interest rates suggests that it is income gearing rather than the level of real interest rates which leads firms to insolvency; as noted above, this can be related to problems with cash flow when borrowing constraints are binding. The results suggest that a 5 per cent. (not percentage point) rise in the corporate debt/GNP ratio leads to a 14 per cent. increase in the business failure rate. Obviously, given the log-linear specification of the equation, an increase in the debt ratio has a greater effect on the *number* of bankruptcies, the more adverse other economic conditions are (a given percentage increase is applied to a higher base). This is in line with the earlier theoretical discussion, and would not have been the case had a linear specification been chosen.

Turning to the default premium equations, the most restricted equation has an autoregressive element, with an implicit lagged dependent variable coefficient of 0.17. The signs for the variables are similar to those in the defaults equation, suggesting that risk was being priced correctly. For example, the difference of real detrended GNP, the debt ratio, real wages and the real interest rate enter with the expected sign as in the bankruptcy equation. However, in this case the debt ratio also has a levels effect, suggesting that the markets draw their expectations from the previous year's debt ratio

as well as changes during the year. The lagged real raw materials price and real wages enter negatively; while both probably capture cyclical effects, we attribute the coefficient on the raw materials price largely to heavy domestic lending to energy, real estate and agriculture at low margins in the 1970s, followed by the debt crises when relative energy and commodity prices declined. A similar effect was found for bankruptcy. As shown above, the equation suggests that a 5 per cent. increase in the corporate debt/GNP ratio leads to a 29 basis point rise in the spread between government and corporate bonds, while the long-run effect is 16 basis points. For comparison, a 1 per cent. fall in real detrended GNP leads to a 7 basis point increase.

Variants on the basic equations reported above were also run using net instead of gross debt (i.e. debt minus gross financial assets) and equity instead of GNP. As shown in Sections 3 and 4, some consideration of assets as well as debt may be important to an analysis of potential default, while equity rather than GNP is the correct denominator to use in the theoretical model employed here. As above, in each case the current debt ratio term was replaced by instrumental variables. The other variables had generally the same signs and magnitudes as above; therefore only the debt ratio coefficients in the most restricted equations are reported. These were as follows:

Effects of alternative debt ratios on default rates

	Default rate equation
Net debt/GNP difference .	0.877
	(3.3)
Net debt/GNP level	0.231
	(1.8)
Debt/equity difference . . .	–
Debt/equity level	–
Net debt/equity difference .	0.204
	(3.9)
Net debt/equity level	–

None of the terms was significant in the most restricted spreads equation. These estimates suggest that net debt may be as important as, or more important than, gross debt in determination of defaults, but that market spreads are best predicted by gross debt. Meanwhile GNP appears superior to equity as a denominator of the debt ratio, despite the theoretical superiority of the latter. The reason may be that while equity values reflect market expectations of future profits, these expectations may be falsified. Thus, for example, if the market expects profits to decline, then the value of equity falls and the debt/equity ratio rises. However, if this decline is not realised, then no increase in defaults will follow. By contrast, GNP and profits tend to move together. The results may also stem from the thinness of the equity market in Germany, where the prevalence of corporate cross-holdings may have often prevented equity prices from reflecting market expectations of future profits.

To conclude, Wadhwani's framework has allowed derivation of the effects of increased debt issue on the stability of the corporate sector, both ex ante and ex post. The results suggest that, for all the countries studied except Japan, a fairly common effect of debt ratios on spreads and business failures has been observed in the past. They suggest that a significant growth of the corporate debt/GNP ratio, if not offset by changes in other determining variables (strong real growth, real wage moderation, lower interest rates or lower real commodity prices, for example), will lead both to an increase in the relative cost of credit to the corporate sector, and to an increased rate of business failure. The latter may, of course, have indirect effects on employment and on the financial system. Further experimentation suggests that net corporate debt may also be a useful indicator of default risk.

(b) Personal sector

Wadhwani's methodology was utilised to derive a similar specification for the household/personal sector, within which effects of debt ratios on loan default may be analysed. As suggested above and indicated by the table in Section 3(b), it seems less likely that

Structural equation for rate of corporate insolvency
(Company sector data for United Kingdom, United States, Germany and Canada, stacked)
Dependent variable: difference of the log of business failure rate
Data period: 1969–83

Estimation technique	Instrumental variables[1]	
Variable	General	Restricted
Dummy UK	−1.3	−1.11
	(2.0)	(3.1)
Dummy US	−0.98	−0.67
	(1.8)	(1.6)
Dummy DE	−1.25	−1.17
	(2.8)	(3.1)
Dummy CA	0.24	0.37
	(0.8)	(1.7)
Lagged dependent	−0.12	−0.12
	(2.0)	(2.1)
Δ Real interest rate$_t$	0.005	0.003
	(1.0)	(0.7)
Real interest rate$_{t-1}$	0.005	–
	(0.9)	
Δ Nominal interest rate$_t$	0.014	0.016
	(1.0)	(1.3)
Nominal interest rate$_{t-1}$	0.045	0.048
	(2.6)	(3.4)
Δ ln real GNP (detrended)[2]	−4.4	−3.91
	(4.5)	(5.2)
ln real GNP$_{t-1}$ (detrended)[2]	−0.06	–
	(0.1)	
Δ ln debt ratio	1.9	2.8
	(1.2)	(2.5)
ln debt ratio$_{t-1}$	−0.2	–
	(0.5)	
Δ ln W/P$_t$	0.42	0.5
	(1.9)	(2.8)
ln W/P$_{t-1}$	−0.008	–
	(0.1)	
Δ ln PM/P$_t$	0.55	0.49
	(2.2)	(2.1)
ln PM/P$_{t-1}$	−0.34	−0.4
	(1.5)	(1.9)
US Law change dummy	0.174	0.18
	(1.9)	(2.2)
$\bar{R}^2$	0.68	0.7
Se	0.11	0.11
Number of variables (K)	18	14
Number of observations (N)	60	60
LM (2) (X^2 (2) = 5.99)	1.2	0.8

[1] Current debt ratio instrumented by a constant and two lagged dependent variables.
[2] Residuals from a regression of log of GNP on a constant and a time trend.

Structural equation for default premium on corporate bonds
(Company sector data for United Kingdom, United States, Germany and Canada, stacked)
Dependent variable; difference of the default premium on corporate bonds
Data period: 1969–83

Estimation technique	Instrumental variables[1]	
Variable	General	Restricted
Dummy UK	3.3	3.3
	(2.2)	(3.0)
Dummy US	4.1	4.5
	(2.7)	(3.7)
Dummy DE	1.3	1.3
	(1.9)	(2.5)
Dummy CA	3.2	3.6
	(3.2)	(4.4)
Lagged dependent	−0.77	−0.83
	(4.8)	(6.4)
Δ Real interest rate$_t$	0.013	0.014
	(1.0)	(1.4)
Real interest rate$_{t-1}$	−0.002	–
	(0.1)	
Δ Nominal interest rate$_t$	0.012	–
	(0.4)	
Nominal interest rate$_{t-1}$	−0.011	–
	(0.3)	
Δ In real GNP (detrended)[2]	−7.2	−6.74
	(2.9)	(3.4)
In real GNP$_{t-1}$ (detrended)[2]	0.17	–
	(0.1)	
Δ In debt ratio	5.84	5.68
	(1.4)	(1.6)
In debt ratio$_{t-1}$	2.42	2.57
	(1.8)	(2.3)
Δ In W/P$_t$	1.21	1.25
	(1.9)	(2.1)
In W/P$_{t-1}$	−0.34	−0.31
	(1.3)	(1.4)
Δ In PM/P$_t$	0.203	–
	(0.3)	
In PM/P$_{t-1}$	−1.76	−2.0
	(2.9)	(4.5)
$\bar{R}^2$	0.45	0.49
Se	0.3	0.29
K	17	13
N	60	60
LM (2) (X^2 (2) = 5.99)	4.1	4.1

[1] Current debt ratio instrumented by a constant and two lagged dependent variables.
[2] Residuals from a regression of the log of GNP on a constant and a time trend.

determinate results can be achieved for the "default premium" given the prevalence of credit rationing over much of the period analysed and the historical regulation of the mortgage rate. This proved to be the case; results for the spread are not reported below. We also note that the measures of household default differ between countries; delinquency (lateness in payment) in the United States, foreclosure in the United Kingdom, bankruptcy in Germany and Canada. These may explain some aberrant results, but also suggest that caution should be employed in drawing conclusions.[61]

For households the maximisation exercise may be set in terms of consumption;[62] hence, we have in real terms the objective function:

$$E(C) = E(\varrho A + WL - \varrho D) - K\mu H(\cdot) + \Delta(D - A) \qquad (5.10)$$

Expected consumption (C) in a period is maximised by expenditure of disposable income and issue of net debt subject to minimisation of the expected cost (K) of the probability of bankruptcy ($\mu H(\cdot)$) and accumulation of assets (A), to provide future income and expenditure and for precautionary purposes. Disposable income derives from real labour income WL, income from gross assets ϱA where ϱ is the real rate of return, and net of interest to be paid on debt ϱD. It should be noted that all debt and some assets are monetary; for such instruments ϱ incorporates a nominal receipt offset by some erosion of purchasing power. Other assets (housing, equities, pensions) are real, and provide real returns via capital appreciation as well as dividends/services.

The theory discussed above suggests that households will generally face a tighter borrowing constraint than firms; future income alone may not be legally pledged against increased debt, while some assets such as pensions may not be used as collateral.

[61] Experimentation did show, however, that the results were robust whether bankruptcy rates or consumer credit delinquency were used as an indicator of the probability of default in the United States.

[62] Obviously this ignores the disutility of labour, but in practice labour hours are not likely to be flexible for many households.

Some households lacking assets may not be able to borrow at all. This suggests a borrowing constraint

$$S \leqq A - D \tag{5.11}$$

where borrowing may not exceed the value of pledgable assets (proxied here by total assets). (Implicitly we ignore the possibility of sizable unsecured loans.) Obviously (5.11) also shows that funds may be raised by liquidating assets, to the extent that this is possible in a given period.

Finally, the bankruptcy condition for households is as follows:

$$PDI - C + S < 0 \tag{5.12}$$

where PDI, personal disposable income, equals $(WL + \varrho A - \varrho D)$. Clearly there are different groups in the household sector; rentiers rely on income from assets, while employees rely on their income from employment.

Using these considerations, we derive the following bankruptcy function from equations (5.10 to 5.12)

$$\mu H = \mu H\ (PDI, \varrho, r, D, A, U, CC, P) \tag{5.13}$$

Personal disposable income (PDI) shows the basic effect of income. In line with the methodology for the company sector, it was detrended. Unemployment (U) and the interest rates ϱ and r show the vulnerability of employees and asset holders to bankruptcy. Interest rates obviously also affect both groups via debt interest payments. Debt outstanding is an indicator of income gearing and of the likelihood of the borrowing constraint biting. Real gross wealth (A) shows the possibility of running down assets during periods of financial difficulty as well as offering collateral for borrowing. Given the thrust of the paper, both debt and gross wealth were entered as a ratio to GNP and instrumented (similar results were obtained when they were entered as a ratio to RPDI). CC is a dummy for

credit tightening, which has historically affected households to a greater extent than companies. Income, debt and assets were defined in real terms.

The F test for structural stability showed that one could not reject similarity of behaviour between countries for which data are available (United States, United Kingdom, Germany and Canada), given the specification, which was again set in a log-linear error-correction format. The household sector debt ratio has a positive long-run effect on the probability of default, though the short-run effect is negative. Hence, the results suggest that households tend not to run into difficulties when *accumulating* debt, but rather when the flow of credit is cut off, perhaps owing to rationing, and when a high *level* of debt has been incurred. Accumulation of assets reduces the probability of default in the short and the long term, but the coefficient in the long run is not large enough to keep the probability of default constant should assets and debt rise at the same rate – a result which is of some interest given the current tendency in several countries for debt and assets to rise together. Such a result can be justified by the uneven distribution of assets and debt within the household sector, which was highlighted in Sections 3 and 4 above.

The table below shows the effects of a 5 per cent. increase in debt in relation to GNP and a parallel increase in debt and gross assets of 5 per cent., as a proportion of GNP. Growth of household debt in the United Kingdom and the United States for 1984 far outstripped these rates. Although the effects of a 5 per cent. change in debt and wealth seem large, it should be noted that the *level* of the default rate for households is typically rather low. Therefore a large percentage change in the rate need not entail a large number of actual defaults.

Other results are that in the short run a higher real interest rate increases the default rate, while a higher nominal rate reduces it, though only the real rate is significant in the long run. Inflation in the 1970s encouraged borrowing without leading to widespread default, since real interest rates fell and the burden of debt declined rapidly as the value of the principal was eroded despite high nominal

Effects of debt and wealth on household defaults

	Elasticity	Effect of a sustained 5% increase
Debt/GNP:		
short-run	−4.4	−22.0%
long-run	+5.7	+28.5%
Wealth/GNP:		
short-run	−1.7	− 8.5%
long-run	−2.7	−13.5%
Parallel percentage growth of debt and wealth:		
short-run	−6.1	−30.5%
long-run	+3.0	+15.0%

rates. Also, as the household sector is a net creditor in each country, it benefits directly from higher nominal rates. It was also the case in the 1970s that rationing was generally tighter when nominal rates increased. The negative effect of nominal rates on default will capture these effects, while conversely the positive sign on real rates shows that real interest payments impose a heavy burden on debtors. These effects need not be symmetric. Deviations of real income from trend enter strongly as a lag with a positive sign. The level of unemployment entered with the expected sign, as did the ad hoc "credit control" dummy.

The equation is autoregressive, with an implicit lagged dependent variable of 0.54. The static solution is

$$\begin{aligned}\text{ln default rate} = {} & 0.041 \text{ real interest rate} \\ & + 6.0 \text{ ln detrended RPDI} \\ & + 5.7 \text{ ln debt ratio} - 2.7 \text{ ln real wealth} \\ & + 0.15 \text{ ln rate of unemployment}\end{aligned} \tag{5.14}$$

A 1 per cent. increase in the debt ratio is associated with a reduction in the default rate in the first year by 4½ per cent. In the long-run the steady state effect is positive, with an elasticity of 5.7.

Structural equation for rate of household default on debt
(Household/Personal sector data for United Kingdom, United States, Germany and Canada, stacked)
Depdendent variables; difference of the log of default rate
Data period: 1970–83

Estimation technique	Instrumental variables[1]	
Variable	General	Restricted
Dummy UK	3.45	2.9
	(3.1)	(3.1)
Dummy US	3.65	3.26
	(4.1)	(4.4)
Dummy DE	1.4	1.02
	(1.8)	(1.5)
Dummy CA	0.72	0.4
	(0.8)	(0.5)
Lagged dependent	−0.46	−0.46
	(6.7)	(6.9)
Δ Real interest rate$_t$	0.026	0.019
	(2.2)	(2.0)
Real interest rate$_{t-1}$	0.024	0.02
	(0.8)	(2.0)
Δ Nominal interest rate$_t$	−0.049	−0.045
	(3.1)	(3.0)
Nominal interest rate$_{t-1}$	−0.009	–
	(0.6)	
Δ ln RPDI$_t$ (detrended)[2]	0.9	–
	(0.8)	
ln RPDI$_{t-1}$ (detrended)[2]	3.02	2.74
	(4.7)	(4.7)
Δ ln debt ratio	−4.98	−4.42
	(2.8)	(2.8)
ln debt ratio$_{t-1}$	2.9	2.62
	(5.5)	(5.7)
Δ ln gross asset ratio$_t$	−1.94	−1.72
	(2.5)	(2.5)
ln gross asset ratio$_{t-1}$	−1.36	−1.22
	(3.0)	(2.9)
Δ ln unemployment$_t$	0.042	–
	(0.3)	
ln unemployment$_{t-1}$	0.077	0.067
	(1.2)	(1.1)
Credit controls	0.115	0.108
	(2.1)	(2.2)
$\bar{R}^2$	0.72	0.73
Sc	0.13	0.13
K	18	15
N	56	56
LM (2) (X^2 (2) = 5.99)	5.8	3.0

[1] Current debt ratio and gross wealth ratio instrumented by a constant and two lagged dependent variables.

[2] Residuals from a regression of the log of RPDI on a constant and time trend.

Although preliminary, the specification for household default does offer insights into the determinants of financial distress, and the importance of debt therein. It suggests that a high level of debt for households in relation to income may lead to financial problems, in the same way as for companies, albeit more slowly. This problem may be particularly severe should there be concomitant high real interest rates, low inflation, declining real gross wealth, perhaps due to falling asset prices, and high unemployment.

(c) Public sector

For the public sector we present a simple, reduced-form regression relating the public sector debt/income ratio to interest rates. This aims purely to indicate whether growing public debt has tended to coincide with high interest rates, as the crowding-out arguments above suggest, without developing in detail the transmission mechanism (which would require construction of a macro-economic model with a fully specified set of portfolio demand and supply equations). As shown in the preceding sections, interest rates are an important determinant of default in the private sector – however, even without such an effect, public sector debt may lead to default in the private sector via higher tax rates, pre-empting cash flow. The results of such a regression should cast light on the relevance of the neo-Ricardian view of government debt issue, as discussed in Section 3(d) above. This view would anticipate a zero effect of government deficits on interest rates. However, it should be noted that most attempts to prove the hypothesis have not taken this form, but rather the insertion of a term in government debt into a consumption or savings function. See Kochin (1974), David and Scadding (1974) and the critique in Tobin (1980).

The specification used is based on the Fisher equation. The basic form of the Fisher equation suggests that real interest rates equal nominal rates plus anticipated inflation. Taking the real rate as a constant, we invert this equation, use actual instead of anticipated inflation and add terms in the foreign interest rate and in the stock of government debt as a proportion of GNP. We therefore regress

nominal yields to maturity on public sector debt on country dummies, the rate of inflation, a foreign interest rate and the difference and lagged level of the government debt ratio. The results, stacking the data for all five countries and without performing F tests, were as follows:

$$IG = \underset{(5.4)}{7.3}\,DUK + \underset{(4.8)}{4.65}\,DUS + \underset{(4.8)}{3.9}\,DBD + \underset{(3.0)}{3.1}\,DJP + \underset{(4.2)}{6.2}\,DCA \qquad (5.15)$$

$$+ \underset{(4.7)}{0.22}\,INFL + \underset{(4.7)}{0.39}\,FIR + \underset{(2.2)}{10.8}\,\Delta\frac{DG}{GNP} - \underset{(1.0)}{1.63}\frac{DG}{GNP}$$

$$\bar{R}^2 = 0.98 \qquad Se = 1.4 \qquad DW = 0.8 \qquad N = 85$$

where Dii are country dummies, INFL inflation, FIR the foreign interest rate[63] and DG government debt. The equation suggests that inflation and foreign rates have both tended to increase interest rates as proxied here, as would be expected. The effect of increased government debt ratios on interest rates is only significant in the short run. The equation suggests that *on average* a one *percentage point* rise in the government debt ratio has been associated with an 11 basis point rise in the interest rate in the first year, but in the long run the effect of such an increase is statistically indistinguishable from zero. The result thus distinguishes a sharp disequilibrium effect when the markets are obliged to absorb an increased *flow* of debt in relation to GNP, as the "real" government deficit[64] widens (together

[63] For Germany, the United Kingdom, Japan and Canada, the foreign interest rate used was the US bond yield. For the United States, a simple average of the UK, German and Japanese bond yields was used as the foreign rate.

[64] The difference of the debt ratio is a measure of the "inflation (and real growth) adjusted" public sector deficit. For a given nominal deficit, the difference of the debt ratio is smaller, the higher the rate of inflation, because inflation affects only the denominator. This deduction represents the losses incurred by debt holders (gains by issuers) on the real value of their (money-fixed) debt during inflationary periods. See Taylor and Threadgold (1979), Eisner (1986). The difference is also smaller, the faster is real growth. If one assumes that investors desire a certain wealth/income ratio, then it is sensible to anticipate that government debt only drives up real rates when it grows faster than nominal output, which is our result here.

with the multiplier effects on other expenditure of fiscal expansion), and the longer-run effect of an increased *stock,* which is rather smaller, perhaps because private demand for credit is "crowded out".

This equation should obviously not be seen as definitive; as pointed out, it is in extremely reduced form, it has no explicit monetary policy variables and according to the Durbin-Watson statistic suffers from severe autocorrelation. However, it is at least of some interest in showing the expected effect of increased public sector debt on interest rates, even when averaged across five countries with somewhat different experiences of fiscal policy. Hutchinson and Pyle (1986) found similar significant effects of government deficits on interest rates, again using stacked cross-country data. This result tends to contradict the "irrelevance" view of government finance noted in Section 3(d).

As a further experiment the effects of public debt, foreign rates and inflation on interest rates were broken down across the different countries, by dropping the separate dummy variables and entering inflation, foreign rates and debt ratios for each country separately multiplied by the country dummy in each case. The results of this exercise may be summarised as follows:

Effects of individual country variables on domestic interest rates (5.16)

Dependent variable: yield on public sector debt	Domestic inflation	Foreign interest rate	Difference of debt ratio	Lagged debt ratio
United States	0.25	0.27	58.4	− 0.16
	(1.6)	(0.9)	(4.8)	(0.1)
Canada	−0.02	1.07	− 2.0	− 4.8
	(0.2)	(6.3)	(0.3)	(2.4)
United Kingdom . .	0.34	0.44	− 7.6	− 0.9
	(6.9)	(4.7)	(1.0)	(0.5)
Japan	0.12	0.38	8.5	− 2.9
	(1.9)	(1.6)	(0.8)	(0.9)
Germany	0.47	0.48	−19.1	−10.3
	(2.3)	(1.7)	(0.9)	(1.2)

There are considerable differences in behaviour between countries. Thus the foreign interest rate is a determinant of interest rates in all of the countries except the United States, while only in the United States is the budget deficit (i.e. the difference of the debt ratio) a significant positive influence on interest rates. Inflation effects are insignificant for Canada. It could be suggested that these results illustrate the dominant effect of the US public deficit in raising domestic real interest rates; elsewhere other factors have been more important, notably world interest rates, determined in turn largely by the United States.

Canada is the most extreme case of this; domestic inflation has a negligible effect on interest rates, while the foreign rate (the US bond rate) has a coefficient of one. However, to a considerable degree this is also true for the United Kingdom, Germany and Japan.

Effects of alternative debt ratios on interest rates
(government bond yield)

	Difference	Level
Public debt/GNP (5.15)	10.8	−1.63
	(2.2)	(1.0)
Public debt/GNP (5.17) . . .	10.3	−2.60
and	(2.0)	(1.3)
Private debt/GNP	− 1.8	2.30
	(0.3)	(0.8)
Total debt/GNP (5.18)	5.8	−0.30
	(1.5)	(0.3)

Finally, we examined the hypothesis that total debt may be more important in the determination of interest rates than public debt, perhaps because total debt shows the magnitude of the demand for loanable funds as a whole. The equation (5.15) was re-estimated as above, but with the difference and level of total debt instead of public debt equation (5.18). We also tested simultaneously for whether the effects of public debt were different from those of private debt (equation (5.17)). The results for the coefficients on the

debt ratio in the equations are as shown above, with the results from equation (5.15) repeated for comparison.

The results suggest that private debt is less important than public debt in the determination of the level of interest rates (as opposed to spreads between rates): the terms for total and private debt were both insignificant at the 95 per cent. level. As before, it is the difference of public debt and not the level which is significant. This result may be due to the different cyclical frequencies of private and public debt ratios.

6. Conclusions

Both economic theory and econometric estimation tend to show that the concerns of the monetary authorities regarding rising sectoral debt are not without foundation. All other things being equal, rising private debt in relation to income will raise default risk, while rising public debt may increase interest rates, and may have deleterious effects on the structure of output and the trade balance, as well as leading to higher taxation.

For private debt the econometric results have shown that a positive relationship exists in the various countries, on average, between debt ratios and default risk, as indicated both by interest rate spreads and actual defaults. This is as predicted by theory. However, equally, other determinants such as aggregate activity, factor prices, asset values and interest rates are shown to be important simultaneously in determining the rate of default. In itself debt does not cause economic instability: and, in principle, increasing debt can be continually offset by changes in other variables. However, the greater the debt owed, the worse will be the consequences of falling income or a deterioration of the other components of agents' budget constraints, as might happen in a recession.

Growth of public debt ratios in the short run has tended to be associated with increasing interest rates, either directly (in the United States) or, largely via international interest rate arbitrage,

set off by rising deficits elsewhere. Results for the private sector suggest that such rising interest rates may lead to a worsening of the situation for the private sector, both directly and if they induce a reduction in output. This is in addition to the eventual need to raise tax revenues to pay public debt interest and repay principal, which may also weaken private sector positions. However, for an underemployed economy, increased public sector debt issue may have beneficial effects which may outweigh these disadvantages. Furthermore, no long-run effect of the level of public debt on interest rates was detected.

Of course, it should be remembered that imprecision in estimation and changes in financial market behaviour (deregulation, changing maturity of debt, fixed or variable rate lending) mean that the estimates are unlikely to be able to predict precisely the current effects of debt on risks of default. We would still suggest that they indicate important tendencies that should not be ignored.

This paper aims to test the *hypothesis* that debt/income ratios are important by use of theory and empirical analysis. Detailed analysis of possible policy responses have been deliberately avoided. However, by way of a conclusion we outline some of the points that could be borne in mind in framing such a policy, which arise from the discussion. For public debt the issues are fairly clear-cut, once agreement has been reached on the results of greater or lesser debt issue. For the private sector the issues are more subtle.

Firstly, it must be considered whether private debt is a micro-economic problem, requiring policies such as stricter control of risk by lending institutions, or is it a macro-economic issue requiring adaptation by fiscal or monetary policy? It has been noted that widespread deterioration of balance sheets sufficient to lead to defaults is generally a *consequence* of adverse macro-economic conditions. The question thus relates to the degree to which defaults will feed back onto the initial adverse macro-economic situation, and to how far high-risk lending has already developed.

The magnitude of feedbacks from default risk to the real economy and financial system is likely to vary from case to case.

However, their potential importance may be illustrated by reference to regional problems in North American energy and agriculture, which originally began with a regional recession – connected with the process of disinflation and the change in the relative prices of real and financial assets – but which soon had severe additional "feedback" effects on bank solvency, regional prosperity and even national activity levels. This shows how debt problems can easily spill over into the economy as a whole if not adequately controlled at an early stage or, conversely, that beyond a certain threshold level defaults in the private sector begin to have severe effects on economic and financial stability. The level of this threshold is, of course, impossible to measure, but important factors for financial stability may include adequacy of capital formation of financial institutions and diversification of their sources of income, both of which can be encouraged by appropriate supervisory policy. In considering these issues the authorities must also decide how widely the "safety net" of assistance should expand beyond its traditional coverage of deposit banks. For example, should it cover investment banks, financial markets and non-financial corporations?

Secondly, we noted the problem facing the authorities in recent years posed by the combination of rising debt and greater interest rate fluctuations, particularly given the declining degree of segmentation between money markets and longer-term capital markets. In order for this problem to become acute, suppliers or issuers of debt must have failed to make the necessary adjustments to this volatility in their interest rate hedging activities and in the adequacy of their capital relative to debt. This suggests that there is an underlying problem of inaccurate judgements by debtors and creditors. To the extent that it is not resolved, it reduces the degree of freedom of the authorities and places an extra constraint on them in the pursuit of an anti-inflationary monetary policy.

Thirdly, the importance of the tax system for the incentive to issue debt has been emphasised in the discussion of the theory of debt issue. Thus, the issuance of corporate debt instead of equity issue is encouraged by lower effective taxation of the former.

Similarly accumulation of debt by the household sector may be stimulated by the deductibility of interest payments from taxable income. Changes in the tax treatment of debt may thus have an important role to play in reducing undesirable tendencies towards debt financing.[65]

Fourthly, it should be emphasised that a complete consideration of a possible policy reponse to rising debt should not concentrate solely on the problem of default risk. It has been noted that many forms of rising debt do not imply an increase in potential default risk while offering benefits to credit users, for example credit card debt used purely as a medium of exchange. Similarly we noted the benefits to individuals who were previously constrained in their borrowing when credit rationing is relaxed. More generally, it should be borne in mind that debt is only issued when a private benefit in terms of investment or intertemporal redistribution of consumption is expected to accrue. Any policy response to growing private debt must weigh these benefits against the cost of rising default risk.

[65] For example, the recent US tax reform reduced the incentive to debt finance. The lower rate of corporation tax reduces the subsidy on debt interest payments – at least for profitable firms, while repeal of the "General Utilities Doctrine" reduces the benefits to mergers of exemption from capital gains tax. For households the reform removes the tax subsidy on interest on non-mortgage debt.

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