Bank of England

Discussion Paper No.10

Bank lending and the money supply

by

B.J.Moore

and

A.R.Threadgold

July 1980

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Professor Moore of Wesleyan University, USA was visiting the Bank during the 1978/79 academic year.

The object of this series is to give a wider circulation to research work being undertaken in the Bank and to invite comment upon it; and any comments should be sent to Mr Threadgold at the address given below. The views expressed are the authors', and not necessarily those of the Bank of England.

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Contents

Introduction

1 The essence of monetarism is that monetary changes are the necessary and sufficient cause of changes in nominal income, swamping the temporary and minor influence of fiscal policy.

2 Abundant empirical evidence has by now amply confirmed that major historical accelerations and decelerations of inflation have been accompanied by accelerations and decelerations in the rate of growth of the money stock. Few or none would today accept the argument of the Radcliffe Committee that the income velocity of money in the short run is largely unbounded, particularly for upwards movements.[1] In Lord Kahn's words, 'it can be readily conceded to the monetarists that an increase in the quantity of money, though not the cause of inflation is a necessary condition' [Kahn (1976), page 6]. The controversy is over whether monetary changes are a sufficient cause of inflation, and in particular whether the money supply is exogenous to nominal income or whether the money supply is determined by nominal income and/or by other factors determining nominal income.

3 For example, wage or import (especially oil) price increases, which lead to faster inflation, may also provide major explanations for the behaviour of the money stock. A central area of the debate between monetarists and Keynesians consequently now concerns the sources of changes in the money stock.

4 Monetarists assume that the money supply is capable of being set exogenously by the authorities, although they acknowledge the distinction between a fixed and floating exchange rate regime. For an open economy, a commitment to a fixed exchange rate implies that the money stock becomes largely endogenous; prices, interest rates, and hence the rate of monetary expansion, are kept roughly in line

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[1] '... we cannot find any reason for supposing, or any experience in monetary history indicating, that there is any limit to the velocity of circulation; it is a statistical concept that tells us nothing directly of the motivation that influences the level of total demand.' [Radcliffe (1959), paragraph 391.]

with developments in the rest of the fixed exchange rate world by capital inflows and outflows over the foreign exchanges. However, under floating exchange rates, the monetary authorities' ability to pursue an independent monetary policy comes about because the exchange rate adjusts to reflect differential rates of monetary expansion between a country and its trading partners.

5 Keynesians, on the other hand, take as their starting point factors which directly determine the rate of wage inflation. Of central importance is the observation that wage rates do not adjust, at least in the short run, to equate quantities supplied and demanded. In the context of governments' commitment to full employment, the effective demand for labour appears highly inelastic with respect to the wage level. Trade unions, knowing this, will demand the highest rate of wage increase they believe they can get, with little fear for loss of jobs. Concern for fairness and comparability in the wage structure will tend to ensure that large settlements in one sector are copied through the entire economy, so roughly preserving the structure of wage differentials and raising the general overall wage level. With productivity growth being determined by long-term real and institutional factors, price inflation naturally follows as the consequence of producers' attempts to maintain conventional mark-ups over rising unit costs. Such wage push inflation is 'validated' or 'ratified' by monetary accommodation if steps are taken to avoid consequent increases in unemployment. If, as a result of this process, the rate of domestic inflation exceeds the rate prevailing elsewhere, the exchange rate will depreciate.

The policy debate: the inflation/unemployment trade-off

6 Monetarists see restrictive monetary policy, meaning a lower rate of expansion of the nominal money stock, as the necessary and sufficient instrument for reducing the rate of inflation over the longer term, albeit at the cost of higher unemployment in the interim. Keynesians, on the other hand, tend to view money wage increases as having a life of their own, largely independent of monetary policy. They argue that failure to validate wage increases through expansion of money and nominal aggregate demand would result primarily in rising unemployment, rather than in reductions in the rate of wage inflation.

7 The evidence from the 1970-71 and 1975-78 episodes of extremely sluggish downward response of wage rates to higher unemployment has not led monetarists to modify their standard policy recommendation of monetary restriction to fight inflation, in part because they envisage a significant anti-inflationary influence from slow monetary growth via the exchange rate directly to prices, and thus indirectly to wages. Similarly the apparent inability of prices and incomes policies to secure any lasting reduction of inflation rates has not led Keynesians to abandon their policy recommendation of operating directly on wage increases through incomes policies to slow down the rate of inflation, because they do not see any more acceptable alternative.

8 These policy differences may be attributed in part to a lower rate of time preference implicit in the policy judgments of monetarists. The benefits in the perhaps distant future of reducing the rate of inflation outweigh the short-run costs of recession, whatever the latter's time duration. Exclusive focus on the short run will lead to a policy of validating ever-increasing wage and price inflation as each new shock is ratified by a more rapid expansion of nominal demand. Moreover, such a policy would not minimise unemployment over the longer term [see Friedman (1977)]. As a result, the monetarist focus on the longer-run effects of restrictive macro-economic policy appears to have obvious advantages over the shorter-run focus of Keynesian adherents. The difficulties, it is agreed, come in the process of changing inflationary expectations and/or real

wage targets. If restrictive monetary policy does not reduce expectations of future inflation by an equivalent amount, the short-run effects will be primarily a reduction in real aggregate demand and an increase in unemployment, if the income velocity of money remains stable.

9 Recognition that over the longer run a restrictive monetary policy will have its major effect on inflation rather than unemployment is of limited comfort when the full adjustment may stretch over many years. As Tobin [(1976), page 336] has observed, 'Distinctively monetarist policy recommendations stem less from theoretical or even empirical findings than from distinctive value judgments. The preferences revealed consistently in those recommendations are for minimising the public sector and for paying a high cost in unemployment to stabilise prices.'

10 This paper would like to suggest an additional difficulty. A restrictive monetary policy may be very much more difficult to pursue successfully than is commonly assumed by advocates of monetarism.

Money supply: exogenous or endogenous?

11 There is nothing necessarily inconsistent between monetarist reasoning and scenarios in which wage or import price increases induce the monetary authorities to expand the money stock in order to avoid the short-term increases in unemployment which would otherwise result. 'Nor is there anything in the monetarist models of which we are aware which would suggest that the monetary authorities would systematically validate "government push" pressures emanating from budget deficits, but not "cost push" pressures emanating from wage or import price increases.' [Willett and Laney (1978), page 321.]

12 These issues concerning the behaviour of the monetary authorities, while logically separable from the disputes between monetarists and Keynesians about the behaviour of the private sector in response to variations in monetary variables, do have a direct bearing on the interpretation of the empirical evidence for the monetarist explanation of a primarily one-way causal relationship between monetary growth and price inflation.

13 The central empirical evidence for the monetarist case that money is important is that in the United States, although the money stock has been determined by a variety of forces over the past hundred years, its long-run velocity has been relatively stable and predictable. As a result, changes in nominal income have been systematically associated with changes in the money stock. But a fairly close statistical association between the money stock and money income is one thing; the direction of the causal influence implicit in this correlation is another. Monetarists are, of course, aware of the two-way relationship between money and money income.[1]

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[1] 'Changes in the money stock are therefore a consequence as well as an independent source of change in money income and prices, though, once they occur, they produce in their turn still further effects on income and prices. Mutual interaction, but with money rather clearly the senior partner in longer-run movements and in major cyclical movements, and more nearly an equal partner with money income and prices in shorter-run and milder movements - this is the generalization suggested by our evidence.' [Friedman and Schwartz (1963), page 695.]

14 For the United States, their chief evidence for the unidirectional causality of monetary change is based on the behaviour of 'determinants' of the money stock, the monetary base, the public's currency ratio and the banks' reserve ratio. They argue that the Federal Reserve System could, if it chose, control the monetary base, since it clearly dominates the sources of the base. They then demonstrate that, except in the very short run, the money multiplier is fairly stable, so that most of the change in the money stock is attributable to changes in the monetary base. Their case for the exogeneity of monetary change rests on the fact that the money stock is ultimately under the control of the central bank.[1]

15 It is this view that the money stock is exogenous, in the sense that it is ultimately controlled by the central bank, that has recently led monetarists to ask 'what affects the willingness of monetary authorities to allow monetary expansion?' Machlup (1978) has argued that all monetary expansion should properly be viewed as active intervention, since irrespective of whether it comes about by a policy of holding the price of eligible financial assets at a set level, or by changing their price towards a targeted level, it necessarily involves the acquisition of financial assets by central banks. However, he goes on to argue further that in a world where money wages cannot be reduced, practically anything that happens in an economy - demand shifts, supply shifts, technological changes, changes in import prices or market power - will lead to a loss of job opportunities and increased unemployment, unless an expansion in the stock of money is engineered so that real wages may be depressed by price increases to permit the relative price changes necessary for equilibrium to occur.

16 For the case of the United Kingdom, it is generally conceded that the working arrangements with the discount houses, particularly the lender of last resort facility, would prevent the Bank of England from exercising rigid day-to-day monetary base control over the money stock. But these institutional arrangements could be changed and a less strict adherence to monetary base targets which nevertheless gave

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[1] For a more extended discussion, see Moore (1979).

reasonable control over broad money within conventional target periods could be envisaged [see Foot et al.(1979)].

17 Even if the money stock is formally exogenous in the control sense, there are, in practice, clear limits to the extent to which the monetary authorities have discretionary ability to alter its behaviour. Undoubtedly the major change in monetary policy in industrial economies has been the move away from the pursuit of an interest rate objective to the formal announcement of a target rate of growth for some monetary aggregate. Caution in the enforcement of the target has been urged by 'practical monetarists', who doubt the responsiveness of wages to the price constraints implied by monetary targets. For the operation of targeting to be of lasting value, the credibility of the authorities in the eyes of financial markets is crucial. Doubts have been expressed about the practicability of persevering with monetary targets by several of the monetary authorities concerned. As one study of targeting recently concluded, 'Economists may differ over the value of monetary targets, but most would agree that to set them up as a key policy aim and then persistently to overshoot them may, in a sense, afford the worst of both worlds'. [Foot (1979).]

18 Decision-makers in the public sector, no less than in the private sector, should be regarded as attempting to act in a rational and efficient manner. If excess monetary growth is in fact necessary and sufficient for continuing inflation, as monetarists insist, why have the authorities in all countries continued to allow such growth to persist? Why are rates of monetary growth in most countries now in excess of 10%, double the rates observed in the 1960s, at a time when inflation is increasingly viewed as the major policy problem? It is sometimes argued that the electorate is myopic, and would vote against politicians who carried out 'responsible' policies. However, an alternative explanation is that the perceived illiquidity costs from failure of the authorities to 'accommodate' are viewed as larger than the perceived inflationary costs of accommodation.

19 The process of monetary accommodation, the validation of money wage increases, is regarded by both monetarists and Keynesians alike as an active policy, to be pursued or not pursued, by the monetary authorities. The notion appears to be that central banks,

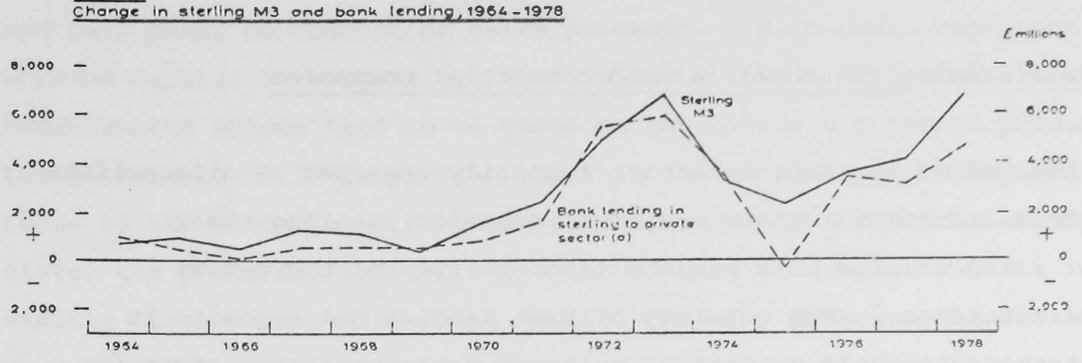
mistakenly from the viewpoint of monetarists, rightly from the viewpoint of Keynesians, keep their eyes focused on the state of the economy in general, and on the level of unemployment in particular. When unemployment rates approach, or threaten to approach, politically unacceptable levels, the central bank pursues an accommodatory policy.

20 Such a view tends to overlook the fact that the universal rationale for the creation of central banks, and still by far their most important role, was to support the essential viability of the financial system. If financial assets are to possess liquidity, they must be capable of being exchanged quickly, cheaply and conveniently into cash; institutional market-makers must exist who are willing to purchase such assets for cash. To ensure the liquidity of financial assets, central banks perform the role of lender of last resort. Commercial banks are the central institutions in the liquidity-creating process, and by far the most basic obligation of all monetary authorities is to support, encourage and maintain orderly conditions in financial markets generally, and in the commercial banking system in particular. In the United Kingdom, the discount market provides the link between the commercial banks and the Bank of England acting as lender of last resort.

21 In the United Kingdom, annual changes in the volume of bank intermediation are determined primarily by the quantity of bank lending, although changes in the public sector borrowing requirement, public sector debt sales and external capital flows play an important short-run role. The historical relationship between annual changes in bank lending and the money stock (sterling M3) is shown in Chart A. In most years, bank lending has been the predominant source of monetary growth.

22 It is through the credit markets that the process of monetary acccommodation to higher nominal incomes comes about. The ability of central banks to control the rate of monetary growth may thus hinge on their ability to control the rate of growth of bank lending, rather than the monetary base. In all countries, banks' legal reserve ratios are based on the lagged value of deposits; once the deposits have been created, the central bank must somehow make the

Chart A
Change in sterling M3 and bank lending, 1964-1978



(a) Including Bank of England Issue Department's holdings of commercial bills.

required reserves available at the settlement date. Otherwise the banks, no matter how hard they scramble for funds, could not meet their reserve requirements. Once loans and deposits have been granted, the central bank must provide the banks with the necessary reserves if orderly conditions in the financial markets are to be maintained.

23 Since in the United Kingdom changes in bank lending have been the prime proximate source of changes in the money stock in the last fifteen years, the next section attempts to isolate the forces governing the amount of credit granted by the UK banking system to industrial and commercial companies (ICCs), the largest borrowers from banks. It also attempts to outline, and where possible to quantify, those channels, both direct and indirect, whereby the Bank of England may be able to control the volume of company borrowing. Not surprisingly in view of the supportive role of the Bank of England to the financial system, the controllability of bank lending to ICCs appears distinctly limited. As will be shown, such bank lending is largely demand-determined. In the United Kingdom, total bank debt in existence at any time is typically only about 60% of total lines of credit previously committed.[1] Assuming that their loan demands meet the banks' customary collateral requirements, ICCs appear to be justified in making contractual commitments on the assumption that they will be able to finance their legitimate working capital needs.

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[1] Utilisation is about 50% for overdraft facilities and 75% for loan and acceptance facilities in the case of the London clearing banks. See Hall (1979).

Bank lending to industrial and commercial companies

24 In the United Kingdom, banks are typically regarded as oligopolists in advances and retail (sight and time) deposits, setting their interest rates in line with minimum lending rate and short-term money-market rates. The quantity of bank lending and deposits is then determined largely by demand, although banks have some scope for affecting the quantity of loans through non-price terms [see, for example, Spencer and Mowl (1978)]. The amount of funds obtained through retail deposits, after adjustment for the reserve assets and special deposits which must be held against them, are reconciled with the quantity of loans demanded by changing other portfolio items. Historically, imbalances between changes in deposits and loans were financed by changes in marketable securities, gilt-edged stocks and local authority debt. Since the late 1960s, the development of an active market in certificates of deposit (CDs) has enabled banks to place large quantities of these liabilities at their own initiative. This liability management has enabled banks to run down their precautionary reserves, and rely on 'liability-side liquidity' to meet demands for funds. As a result they are better able to accommodate to changes in the demand for loans.

25 Recent work on UK bank lending has usually proceeded as if an equation can be estimated with a specification similar to that used in demand-for-money equations. The dependent variable is deflated by the price level, and the explanatory variables are some measure of real income, interest rates, and dummies to represent structural changes in monetary control [see, for example, Spencer and Mowl (1978), and Coghlan (1979)]. Frequently no significant role has been found for interest rates, and a dummy to represent the reforms embodied in competition and credit control [see Bank of England (1971)] does most of the work in explaining the rapid growth of lending from 1971-74.

26 The approach in this paper stems essentially from the simple recognition that time must be taken seriously. Production takes

time.[1] In modern economies, production costs are normally incurred and paid prior to receipt of sales proceeds. Such costs represent a working capital investment by the firm for which it must find finance. Administered prices tend to be based on the historic costs of producing the goods sold. If production costs in the current period duplicate those in the preceding production period, as would occur in a steady state, the proceeds from current sales of past production will exactly finance current working capital costs. However, whenever wage or raw material price increases raise current production costs, unchanged production flows will require more working capital, unless product prices are raised simultaneously. Accordingly, in the absence of instantaneous replacement-cost pricing, firms will increase their working capital typically by increasing their borrowings from banks, or by running down their liquid assets.[2]

27 In this manner additional bank credit is demanded to finance increases in the value of stocks and work in progress, throughout the time interval between the payment for inputs and the receipt of sales revenues. Increases in money wage rates, the single most important factor cost, or in raw material costs, will thus lead to an increase in the quantity of bank credit demanded and, in a closed economy, in the money stock.[3] Increases in the volume of output will similarly require an increase in bank loans to finance the larger value of stocks and work in progress.

28 There is now considerable evidence that over large sectors of the economy, prices are determined as some fairly stable mark-up over historic, actual or normal, unit costs [Coutts et al.(1978) and Nordhaus (1972)]. To the extent that prices are based on some stable mark-up on historic unit costs, increases in labour or materials

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[1] This obvious point, though central to the classical wages fund, is unfortunately obscured by the modern production function literature which characteristically proceeds implicitly in its mathematical formulation as if inputs and outputs are related contemporaneously.

[2] Working capital may also be increased by non-bank borrowing, by raising new equity, or by realising non-liquid assets. But these sources of funds usually take longer to tap.

[3] If the raw materials are imported, the domestic money supply need not increase.

costs, or in output, will raise the current cost value of stocks and work-in-progress, and so the net demand for additional working capital finance, until larger sales receipts, from prices based on the higher historic unit costs, cover the additional working capital finance. If costs stabilise at the new higher level, the level of bank borrowing, if that is the only source of extra working capital, will also stabilise at a new higher level.

29 The amount of extra working capital required will clearly vary among firms, and will depend on the length of time before output prices are raised in response to higher costs. The length of the production period - defined as from the point of cost input to the point of sales receipt - will set a plausible upper limit to the time lag [Coutts et al. (1978), page 41]. While workers and other factor suppliers do provide companies with interest-free finance, depending on factor payment period and trade credit conventions, this is ordinarily very short compared with the total production period over which such working capital expenditure must be recouped with a profit if the company is to remain in business.

30 As shown in Table A, bank lending to ICCs is by far the largest component (about two thirds) of changes in total bank lending in the last decade. The present section attempts to develop a single equation for bank lending to ICCs. The single equation approach to such an important element of company sector behaviour is fraught with difficulties. A fully simultaneous model of company behaviour is required to obtain unbiased results. Such an exercise is beyond the scope of this paper, which merely seeks to indicate some of the important proximate influences on bank lending.

31 The assumption underlying the present study is that banks set their base rate and attempt to meet the demand that results.[1] If the resulting demand exceeds the banks' available supply, they will

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[1] Some studies of UK bank lending have used disequilibrium models as developed by Fair and Jaffee (1972) and Laffont and Garcia (1977) which equate the observed quantity with the minimum or some weighted average of notional supply and demand. Spencer and Mowl (1978) found for bank lending to ICCs that the weights were independent of the 'excess demand', and their resulting ordinary least square model is dominated by demand factors.

Table A

Money supply and bank lending

£ millions

Cumulative flows	(1) M3	(2) £M3	(3) DCE[a]	(4) Bank lending to private sector[b] All currencies	(5) Bank lending to private sector[b] In sterling	(6) (4) as percentage of (1)	(7) (5) as percentage of (2)
1964-1968	4,567	4,294	7,036	2,907	2,472	64	58
1969-1973	16,986	16,003	16,422	17,030	14,065	100	88
1974-1978	23,518	20,052	28,034	18,696	14,708	80	73

Cumulative flows	(8) Bank lending to ICCs	(9) (8) as percentage of (1)	(10) (8) as percentage of (4)	(11) Bank lending to persons	(12) (11) as percentage of (4)	(13) Bank lending to OFIs	(14) (13) as percentage of (4)
1964-1968	..	..	..	..	..	..	..
1969-1973	10,414	61	61	4,237	25	2,379	14
1974-1978	13,108	56	70	3,511	19	2,077	11

.. not available.

[a] As defined at present, for all periods shown. Different definitions were in use before 1976.

[b] Excluding Bank of England Issue Department's holdings of commercial bills.

either change base rate or change the degree to which they ration credit.[1] The equation attempts to capture changes in the degree of credit rationing induced by central bank policy by the use of proxy dummies to reflect changes in quantitative and qualitative controls imposed on the banking system.

32 In most studies of bank lending the dependent variable is deflated by the price level. This implies both that an x% increase in prices raises bank lending by x% in nominal terms, and that the adjustment is instantaneous, in the sense that it is completed within the current period. These assumptions are not supported by the data [see Bell(1978), pages 10-11]. In this study the dependent variable, the quarterly change in bank borrowing by ICCs, is measured in nominal terms.

33 The procedure followed was first to establish a basic equation making ICCs bank borrowing a function of increases in their working capital needs and then to test for the significance of additional variables. Because of the different ways various costs enter the production and pricing process [see Coutts et al. (1978), pages 36-59], working capital demands for any given level of activity were broken down into the following three components:[2]

(i) employment costs;
(ii) cost of raw materials, proxied by the cost of imports of industrial materials; and
(iii) corporate payments of UK tax.

34 Changes in working capital resulting from variations in the level of activity are captured in two ways; first, by defining the employment costs and raw material costs terms to include the effect of changes in employment and the volume of raw materials respectively, and second, by including the current price value of stockbuilding (excluding stock appreciation) as an additional explanatory variable. It is only

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[1] Banks will also bid for deposits, but this is likely to increase the pressure to change base rate.

[2] See Appendix 1 for detailed data definitions. Later tests showed that an equation with only stockbuilding and stock appreciation as explanatory variables did not perform as well as this more disaggregated approach.

increases in costs which must be financed by additional credit, since existing levels will be fully financed out of current sales proceeds. In consequence, all the explanatory variables except the stockbuilding term are entered as first differences. The lags were specified a priori on the basis of analysis suggested by the price mark-up literature. It was expected that for wage costs the period for which extra working capital would be required would not last more than two quarters, while for materials costs the lag might be longer. Since such prices are both more variable and reversible than labour costs, they would not be expected to be passed on in higher prices with the same rapidity. In addition, firms have greater control over their wages bill. Administrative increases in wages would be expected to be reflected more rapidly in higher prices than exogenously given raw material cost changes. Accordingly, all variables were entered for the current and preceding quarters; in the case of imports an additional lag was included.

35 The initial equation to be tested, which is essentially a short-run disequilibrium model and omits any terms to ensure sensible a priori long-run equilibrium properties[1] is as follows:

$$LDI = a_o + a_1 \Delta WB_t + a_2 \Delta WB_{t-1} + a_3 \Delta MBM_t + a_4 \Delta MBM_{t-1}$$
$$+ a_5 \Delta MBM_{t-2} + a_6 IIC£_t + a_7 IIC£_{t-1} + a_8 \Delta TYC_t + a_9 \Delta TYC_{t-1}$$

where

LDI = the quarterly flow of bank borrowing by ICCs

WB = a proxy for the wages bill of ICCs

MBM = the import bill for industrial materials

IIC£ = current price stockbuilding (ICCs)

TYC = corporate payments of UK tax

Δ = quarterly change.

Seasonally-adjusted data are used where appropriate.[2]

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[1] It is not essential that a single equation for bank lending has sensible long-run properties. The feedbacks may be through other influences on companies particularly on working capital requirements.

[2] The independent seasonal adjustment of the various independent variables and the dependent variable creates potential problems in identifying the lag distributions. These have been ignored.

The results of fitting this equation are presented as equation 1 of Table B.[1] It succeeds in explaining about two thirds of the total variation in the flow of company borrowing. The one-quarter lagged changes in the wage bill and in stockbuilding are not significant. In the case of raw materials, the one-quarter lagged value is significant while the current value is not.[2] Equation 1 of Table B significantly underpredicts the rapid growth in bank borrowing that occurred in 1973 and 1974, when short-term market interest rates rose above the banks' base rate. A 'round-tripping' variable, defined as the excess of the three-month CD rate over the lending rate to prime companies (taken to be banks' base rate plus 1%)[3] is thus entered as an additional explanatory variable. As shown in equation 2 of Table B, it is highly significant, and the fit of the equation is improved substantially.

36 On dropping all insignificant variables, a basic equation (equation 3, Table B) was selected. The equation succeeds in explaining three quarters of the variation in ICCs total bank borrowing, and the Durbin-Watson statistic indicates that the degree of serial correlation is acceptable.

37 Each variable is highly significant, and the magnitude of the coefficient on each of the components of working capital needs falls between zero and unity as hypothesised; the coefficients on the wages bill, the import bill and tax payments terms are not significantly different from unity, while that on stockbuilding is about 0.6. These results imply that bank borrowing by ICCs increases substantially in line with the requirement for additional working capital.

38 Further details of attempts to introduce interest rate terms are reported on later in the paper, but the fit was further improved by

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[1] The linear specification is arbitrary. It might be expected that, in so far as bank borrowing is a residual source of funds, the relationship between working capital variables and bank borrowing would be non-linear with small changes in working capital needs being met from other sources (e.g. liquid assets) but with larger changes being met predominantly by bank borrowing.

[2] Attempts to incorporate a separate variable representing fuel prices yielded very insignificant results.

[3] The margin over base rate is applicable to the larger and more credit-worthy ICCs.

Table B

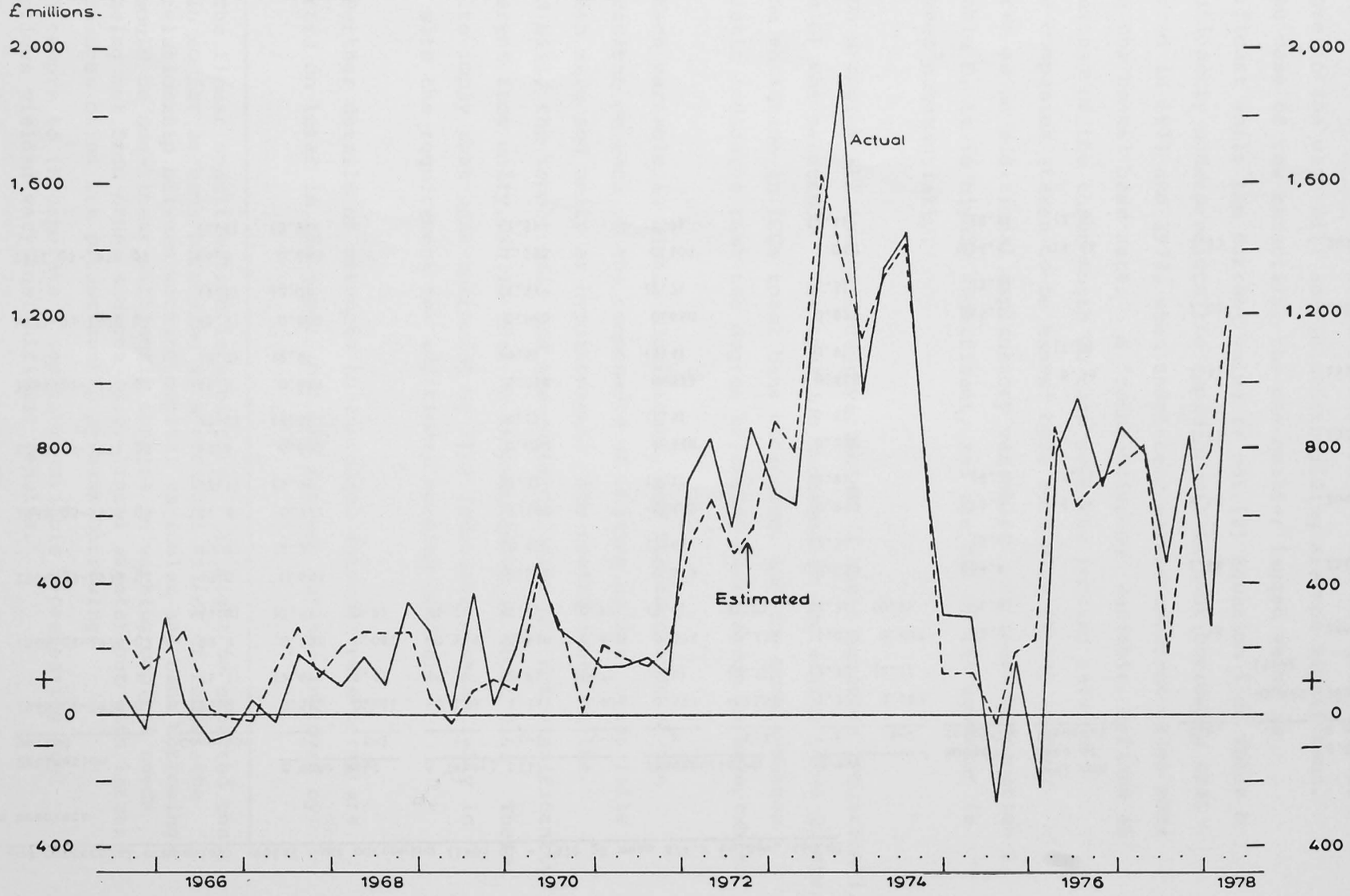
Industrial and commercial companies: total bank borrowing (1965 Q1 - 1978 Q2 mean 424.9 st.dev. 460.0)

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill		Δ Import bill			Stockbuilding		Δ Tax		Round-tripping	Real own rate of interest	D.W.	.ρ	S.E. £ mn	$\bar{R}^2$
			t	t-1	t	t-1	t-2	t	t-1	t	t-1						
1	1965 Q1-1978 Q2	135.2	0.595	0.111	-0.138	1.341	0.401	0.177	-0.182	1.390	0.982				-0.563	268.8	0.66
		(1.1)	(2.6)	(0.4)	(0.3)	(2.8)	(0.7)	(0.6)	(0.7)	(3.3)	(2.3)				(4.2)		
2	1965 Q1-1978 Q2	58.9	0.792	0.061	-0.534	0.919	0.430	0.675	-0.234	1.052	0.407	713.3		1.76		245.2	0.72
		(1.0)	(3.5)	(0.2)	(1.2)	(2.1)	(0.9)	(2.6)	(1.0)	(2.3)	(0.9)	(4.8)					
3	1964 Q3-1978 Q2	45.5	0.853			0.950		0.619		0.833		658.9		1.86		234.3	0.74
		(0.9)	(6.2)			(2.4)		(3.6)		(2.3)		(5.4)					
4	1965 Q3-1978 Q2	131.6	0.727			1.162		0.472		0.932		475.4	-16.58	2.16		204.1	0.81
		(2.7)	(5.9)			(3.3)		(3.1)		(2.9)		(4.2)	(2.7)				
5	1964 Q3-1971 Q2	11.8	0.899			0.092		0.546		0.232				2.81		130.8	0.15
		(0.2)	(2.5)			(0.1)		(1.5)		(0.5)							
6	1965 Q3-1971 Q2	45.7	0.838			0.336		0.573		0.416			- 6.34	2.42		132.1	0.15
		(0.7)	(2.2)			(0.5)		(1.4)		(0.9)			(1.0)				
7	1971 Q3-1978 Q2	268.3	0.502			0.840		0.660		0.827		545.1		2.03		298.0	0.65
		(2.1)	(2.0)			(1.5)		(2.7)		(1.5)		(3.3)					
8	1971 Q3-1978 Q2	166.9	0.660			1.298		0.403		1.044		436.6	-18.46	2.23		261.5	0.73
		(1.4)	(2.9)			(2.5)		(1.7)		(2.1)		(2.9)	(2.8)				

Chart B

Industrial and commercial companies: total bank borrowing 1965Q3-1978Q2, actual and estimated using equation 4, Table B



including the real own rate of interest in the current period as an extra explanatory variable (equation 4, Table B). The coefficient is right-signed and significant at the 5% level.

39 To test for the robustness of the coefficient estimates, the data were divided into two sub-periods, and equations 3 and 4, Table B were re-estimated independently for each. As is shown in Table B, the results are somewhat mixed, and there is some evidence of heteroscedasticity over the whole sample period. The magnitudes of most coefficients vary quite significantly between sub-periods. The coefficient on the wages bill is larger for the first sub-period, while the opposite is the case for the coefficients on imports and taxes. Nevertheless, Chow tests indicated that the equations were not unstable, reflecting no doubt the dominance of the latter period in the total variation in bank borrowing over the whole period.[1] Stability tests were not performed on individual variables. With the exception of the import bill terms, every estimated coefficient[2] contains the value of the other estimates within two standard errors - a non-rigorous but compelling test.[3]

40 The basic model outlined above even modified for real interest rate effects, needs to be adjusted to allow for the possibility that working capital needs can be met other than through bank borrowing. Also bank borrowing is only part of companies' liability portfolio and substitution can take place within the portfolio for reasons both connected and unconnected with changing working capital needs. Various possibilities suggest themselves:

(i) bank borrowing and other forms of net liquid liabilities may be treated as close substitutes by ICCs managements;

(ii) borrowing from banks in foreign currency may be largely unrelated to changes in domestic UK costs; foreign currency borrowing being matched by the acquisition of foreign currency real and financial assets;

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[1] Time dependent heteroscedastistic errors bias the Chow test in favour of not rejecting stability.

[2] Ignoring the constant term.

[3] Attempts to remove the heteroscedasticity by dividing through the equation (including the constant) by a price index were not wholly successful. The main effects of this were to reduce the coefficients on the imports bill and on the real interest rate.

(iii) the relative reliance on bank borrowing may be a stronger function of relative interest rates, and particularly of the level of the own nominal or real interest rate, than indicated above;

(iv) monetary controls may have affected the degree of recourse to the banks by ICCs; and

(v) bank borrowing may be used to finance other capital needs of companies, such as fixed investment.

Substitutability

41 Since the theory does not specify the extent to which companies will increase their bank loans or draw down their bank deposits or other liquid assets to meet increases in their working capital requirements, the dependent variable was defined in two additional ways:

(i) change in ICCs net borrowing from banks: total bank borrowing net of total domestic bank deposits; and

(ii) change in ICCs net liquid liabilities: total short-term borrowing from banks and non-banks net of identified holdings of liquid assets.

42 The results are shown in Table C.[1] Somewhat surprisingly, gross bank borrowing was more closely determined by changes in company working capital needs than either of the net definitions. The evidence suggests that ICCs total bank borrowing is directly determined by working capital needs, while changes in ICCs bank deposits and net liquid assets are governed at least in part by additional factors.

43 Another possibility is that working capital needs are replenished by new equity issues, and other sources of finance, particularly inflows from abroad. Various additional explanatory variables were included in the ICCs bank borrowing equations with, in the case of perfect substitutability, an expected coefficient of minus unity.

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[1] Equations including the real rate of interest on bank borrowing were omitted because this variable was usually wrong-signed and insignificant. Where, however, sterling bank borrowing was used to calculate the 'net' variables, the real own interest rate was significant (see Table H on page 43).

Table C

Industrial and commercial companies

t values in brackets

1 Net bank position[a] (1964 Q3 - 1978 Q2 mean 218.6 st.dev. 424.9)

Equation number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stock-building t	Δ Tax t	Round-tripping	D.W.	S.E. £ mn	$\bar{R}^2$
1	1964 Q3-1978 Q2	- 8.6	0.365	1.169	0.500	0.413	442.3	1.73	324.0	0.42
		(0.1)	(1.9)	(2.2)	(2.1)	(0.8)	(2.6)			
2	1964 Q3-1971 Q2	- 52.3	0.464	0.006	1.224	0.426		2.54	124.5	0.29
		(1.0)	(1.3)	(0.0)	(3.6)	(1.0)				
3	1971 Q3-1978 Q2	- 99.0	0.483	1.471	0.358	0.610	477.6	1.72	461.7	0.33
		(0.5)	(1.2)	(1.7)	(1.0)	(0.7)	(1.9)			

2 Bank borrowing less liquid assets[a] (1964 Q3 - 1978 Q2 mean 174.1 st.dev. 455.4)

4	1964 Q3-1978 Q2	- 24.2	0.197	1.176	0.674	0.109	493.3	1.50	352.0	0.40
		(0.3)	(1.0)	(2.0)	(2.6)	(0.2)	(2.7)			
5	1964 Q3-1971 Q2	- 14.6	0.244	-0.065	1.242	0.598		2.26	143.1	0.19
		(0.2)	(0.6)	(0.1)	(3.2)	(1.2)				
6	1971 Q3-1978 Q2	-280.6	0.565	1.644	0.520	0.201	605.8	1.63	483.0	0.40
		(1.3)	(1.4)	(1.8)	(1.3)	(0.2)	(2.3)			

[a] Net borrowing is positive.

The detailed results are not reported because all of the coefficients were insignificant and/or wrong-signed. The variables tried were new equity issues, net lending by the public sector to the private sector, public sector lending to ICCs, total net capital inflows and ICCs net capital transfers. All of these variables suffer, to a greater or lesser degree, from the possibility of simultaneous determination with bank borrowing. This is particularly likely in the case of foreign inflows; accordingly, the relative rate of return on foreign assets, proxied by the difference between the three-month euro-dollar rate (adjusted for cost of forward cover) and the three-month CD rate was entered. It did not add significantly to the explanatory power of the basic equation.

Sterling bank borrowing

44 A further aspect of substitutability is the question of ICCs borrowing in foreign currency from UK-registered banks: the substitutability of this form of borrowing for sterling bank borrowing may be more limited than for foreign currency borrowing from UK-registered banks and from foreign banks. Data on foreign currency borrowing from foreign banks are not available. It seemed prudent therefore to run the equation on ICCs bank borrowing in sterling as well as on total bank borrowing from UK-registered banks. The results of the sterling bank borrowing equations are shown in Table H on page 43. The results suggest that it makes little difference whether ICCs total bank borrowing or sterling borrowing is used as the dependent variable. The coefficients on the wage variable and on stockbuilding are both larger for total borrowing, relecting roughly the larger magnitude of total vis a vis sterling borrowing. The equations for total bank borrowing perform marginally better statistically in terms of slightly higher $\bar{R}^2$ and lower standard errors relative to the mean and standard deviation of the dependent variable. In view of the importance of sterling bank borrowing as a counterpart of sterling M3, both variants were kept for subsequent tests: the results for sterling bank borrowing are presented in Appendix 3.

Interest rate effects

45 In an attempt to capture stronger interest rate effects than those already reported, various interest rate terms were tried. For

example, banks' base rate plus 2% in nominal terms was entered in the current and lagged quarters.[1] As shown in Table D and Table K, (equations 2) the coefficients in all but one case have the hypothesised negative sign but are not significant. Lending rates in real terms were then entered, defined as the banks' base rate (plus 2%) minus a proxy for the expected inflation rate (equations 3).[2] The coefficient on the current real rate is clearly significant, and the magnitude and significance of the coefficient on the wage variable decreases. When the expected rate of inflation and the nominal banks' base rate are entered independently, only the expected rate of inflation has the correct and significant sign (equations 5).

46 In view of the importance of correctly isolating interest rate effects, and the plausibility that the adjustment of company borrowing to changes in the cost of borrowing will be distributed over time, an Almon lag was run on the real borrowing rate, using a second order polynomial, a four-quarter lag, and no end-point constraints. As shown in equations 6, the real borrowing rate is correctly signed, but the total coefficient is less significant than that on the current value on its own.

47 The value of the coefficient on the real own rate (shown in equations 7) implies that a one percentage point rise in the real borrowing rate will reduce bank lending by approximately £17 million (or 4% of the mean quarterly flow value) in the current and each succeeding quarter. The long-run elasticity is infinite, because of the incompletely specified model (see below), but the response after, say, three years implies an elasticity at the median of the stock of loans outstanding of less than -0.1.[3] To the extent that ICCs bank borrowing is primarily for short-term purposes, a low estimated

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[1] Prior to 1971, Bank Rate was used as a proxy for the clearing banks' base rate. The margin over base rate is assumed to be that charged on average to ICCs.

[2] The proxy for expected inflation is based on past movements in monetary aggregates. See Bank of England (1979) for definition.

[3] The average real base rate plus 2% over the estimation period is about 2.275%. The stock of bank advances to ICCs at the end of 1971 (the mid-point of the estimation period) was about £7,000 million.

Table D

Industrial and commercial companies: total bank borrowing and interest rate effects

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stockbuilding t	Δ Tax t	Round-tripping	Nominal own rate of interest		Expected inflation	Real own rate of interest		Four quarters Almon: total coefficient	D.W.	S.E. £ mn	$\bar{R}^2$
								t	t-1		t	t-1				
1	Basic equation 1964 Q3-1978 Q2	45.5	0.853	0.950	0.619	0.833	658.9							1.86	234.3	0.74
		(0.9)	(6.2)	(2.4)	(3.6)	(2.3)	(5.4)									
2	1964 Q3-1978 Q2	292.3	1.002	1.149	0.583	0.882	720.3	- 2.78	-26.93					2.00	233.6	0.74
		(1.5)	(5.9)	(2.5)	(3.3)	(2.4)	(5.2)	(0.1)	(0.8)							
3	1965 Q4-1978 Q2	140.6	0.716	1.151	0.475	0.923	462.8				-15.26	- 1.98		2.21	206.9	0.81
		(2.8)	(5.7)	(3.3)	(3.0)	(2.8)	(3.9)				(2.6)	(0.3)				
4	1964 Q3-1978 Q2	283.1	0.969	1.237	0.568	0.902	736.7	-28.15						1.95	232.9	0.74
		(1.5)	(5.9)	(2.7)	(3.3)	(2.4)	(5.4)	(1.3)								
5	1965 Q3-1978 Q2	- 86.8	0.591	0.914	0.493	0.879	366.2	7.86		19.82				2.20	203.3	0.81
		(0.5)	(3.5)	(2.2)	(3.2)	(2.7)	(2.5)	(0.4)		(4.3)						
6	1967 Q1-1978 Q2	150.3	0.722	0.900	0.521	0.952	505.0						-10.41	1.97	237.5	0.75
		(1.9)	(4.1)	(2.2)	(2.9)	(2.4)	(3.2)						(1.6)			
7	1965 Q3-1978 Q2	131.6	0.727	1.162	0.472	0.932	475.4				-16.58			2.16	204.1	0.81
		(2.7)	(5.9)	(3.3)	(3.1)	(2.9)	(4.2)				(2.7)					

elasticity is not surprising.[1] Taken at face value, these econometric results would imply that the monetary authorities' ability to restrain directly the volume of ICCs advances, by varying interest rates, may be limited in the short to medium run. However, it is possible that the cost of borrowing may have an effect on the magnitude of ICCs borrowing which is not caught directly by the real interest rate term. If high borrowing costs induce companies to lower their demands for working capital, they may cut back directly on their wages or raw materials bills by reducing their volume of employment, production and stocks. Such an effect could be caught best in a simultaneous equation system in which interest rates were allowed to affect the various sources of working capital needs.

48 Attempts to capture any early unwinding from round-tripping proved unsuccessful (Table E, equation 1). It has been suggested that fears of the tighter imposition of controls on bank lending encouraged firms to maintain their borrowing and deposits at higher levels at little post-tax cost [see Artis (1978)].

49 An alternative and complementary explanation may be that the round-tripping variable is catching some delayed once-and-for-all effects on borrowing brought about by the introduction of competition and credit control (CCC) in September 1971.

Monetary controls

50 Any statistical attempt to model bank lending in the United Kingdom must be capable of explaining the extremely rapid growth that occurred from 1971 to 1974, when the stock of total private sector bank borrowing tripled in nominal terms, and doubled in real terms. As previously stated most researchers have attempted to catch this by a CCC or 'pressure release' dummy which provides much of the explanatory power for their equation. Both CCC and 'pressure release' dummies were entered sequentially to catch any behavioural

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[1] Concern that the current period rate coefficient may be being biased by the inclusion in bank borrowing of interest debited to accounts led to the inclusion of the latter as a separate independent variable with an expected coefficient of unity. The real own interest rate coefficient was virtually unaffected by the inclusion of this extra item, which was itself not significant.

Table E

Industrial and commercial companies: total bank borrowing and quantitative controls and other variables

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stock-building t	ΔTax t	Round-tripping	Round-tripping unwinding	Real own rate of interest t	Income gearing proxy t-1	Corset dummy	Lending controls dummy	Pressure release dummy	1972 dummy	CCC dummy	D.W.	S.E. £ mn	$\bar{R}^2$
1	1964 Q3-1978 Q2	50.9	0.798	0.995	0.632	0.821	657.3	85.5								1.84	236.0	0.73
		(1.0)	(4.7)	(2.5)	(3.6)	(2.2)	(5.3)	(0.5)										
2	1964 Q3-1978 Q2	27.6	0.510	0.733	0.699	0.661	548.7								249.6	2.21	221.5	0.76
		(0.6)	(2.8)	(1.9)	(4.3)	(1.9)	(4.5)								(2.6)			
3	1965 Q3-1978 Q2	116.4	0.640	1.085	0.507	0.876	461.7		-15.08						73.0	2.22	205.2	0.81
		(2.2)	(3.7)	(3.0)	(3.1)	(2.6)	(4.0)		(3.3)						(0.7)			
4	1964 Q3-1978 Q2	28.1	0.924	0.944	0.692	0.809	691.2				-107.0	-35.4	48.7			2.21	228.2	0.75
		(0.3)	(4.7)	(2.4)	(4.0)	(2.2)	(5.3)				(0.9)	(0.4)	(1.6)					
5	1965 Q3-1978 Q2	126.5	0.677	1.167	0.417	0.975	441.3		-18.32		106.3	22.7	5.5			2.28	209.4	0.80
		(1.1)	(3.1)	(3.1)	(2.3)	(2.8)	(3.1)		(3.4)		(0.8)	(0.2)	(0.2)					
6	1964 Q3-1978 Q2	- 1.6	0.856	1.008	0.688	0.747	680.5							522.0		2.61	189.2	0.83
		(0.0)	(7.8)	(3.2)	(5.0)	(2.5)	(6.9)							(5.3)				
7	1965 Q3-1978 Q2	43.6	0.804	1.119	0.595	0.829	595.2		- 7.28					387.1		2.48	189.9	0.84
		(0.8)	(6.8)	(3.5)	(4.0)	(2.7)	(5.2)		(1.5)					(2.8)				
8	1964 Q3-1978 Q2	431.8	1.049	1.115	0.551	0.937	712.5			-127.6						1.96	233.0	0.74
		(1.4)	(5.1)	(2.7)	(3.1)	(2.5)	(5.5)			(1.3)								
9	1965 Q3-1978 Q2	-27.0	0.640	1.109	0.488	0.897	442.7		-17.78	53.5						2.17	205.8	0.81
		(0.1)	(3.0)	(3.0)	(3.1)	(2.7)	(3.4)		(4.1)	(0.5)								

changes resulting from the abandonment of quantitative limits on advances in September 1971 as a result of the introduction of the new credit control arrangements.

51 As may be seen in Tables E and L, (equations 2 to 5) neither dummy improves the explanatory power of an equation including the real own interest rate. Separate dummies were also included with the pressure release variable to catch any effects of quantitative controls on bank lending and the corset (equations 4 and 5). None of these contributed to the explanatory power of the equation. As the various controls were directed primarily at bank lending to persons and to financial companies, these results are perhaps not too surprising.

52 However, inspection of the residuals of the basic equation including the real own interest rate (Table B, equation 4) for total bank borrowing shown in Chart B (on page 22) indicates positive residuals throughout 1972. These residuals were not captured adequately by the a priori definition of the pressure release dummy which took values of zero, except for 4 in 1967 Q2 and Q3 and 1971 Q4-1972 Q3 inclusive. A variable (1972 dummy) defined with the advantage of hindsight - which could be rationalised as a pressure release variable - taking values of one in 1972 and zero otherwise improved the fit of the equation quite substantially. (There is little improvement in the sterling borrowing case.) The only other major effect is to reduce the size and significance of the real interest rate coefficient (Table E, equation 7).

Fixed investment spending

53 Anecdotal evidence suggests that at least some smaller ICCs borrow from banks to finance fixed investment as well as working capital needs. The inclusion of a term representing the change in current price fixed investment for all companies (predominantly ICCs) was either very insignificant and/or wrong-signed. The results are not reported, as the inclusion of this variable had virtually no effect on the other coefficients. Indeed, to the extent that investment goods are purchased from other ICCs, fixed investment has no net effect on demand for funds by the sector, and the result is as expected.

Long-term properties

54 A final concern was to ensure that the single equation had sensible long-run economic properties, by including disequilibrium stock variables. Total desired company bank borrowing is presumably related to some equilibrium balance-sheet position. If the stock of bank loans rises above some desired ratio to total assets or to liquid assets, or alternatively, if interest payments on bank loans rise above some upper limit in relation to current income, companies would be presumed to adjust their borrowing downwards. The expectation is that such variables would enter with a negative sign. An income gearing variable was thus constructed and entered.[1] As shown in Table E (equations 8 and 9), the coefficient tend to be positive, i.e. wrong-signed, when the real own interest rate is also included in the equation.

55 It is possible that companies react asymmetrically to high as opposed to low values for income gearing. This was tested by splitting the income gearing term into two separate variables, depending on whether its quarterly value was above or below its mean value for the total period. The coefficients were correctly signed but not statistically significant when the real own interest rate was included in the equation. The results are not presented.

56 On reflection, it is concluded that the attempt to force equilibrium properties on a single equation is not persuasive, since the feedback effects occur through several different channels. Company response to a high income gearing or high capital gearing burden may come about through the goods markets, by raising prices or reducing stocks, through the factor markets by lowering working capital needs, or by altering dividend or investment policy. One important conclusion of this exercise is that further work on bank borrowing by ICCs should take place within the framework of a simultaneously determined model of company behaviour.

[1] See Appendix 1 for definition.

Summary

57 In conclusion, it appears possible to identify a single equation for bank lending to ICCs based on the components of company working capital needs which has a high degree of explantory power.[1] This work is, however, only an interim stage towards a more comprehensive analysis of both company and banks' behaviour. The implicit assumption in this analysis is that banks set their base rate and meet the ICCs loan demand that results.[2] There is little evidence that changes in the degree to which banks ration credit are important for ICCs borrowing.[3] The monetary authorities' ability to affect ICCs bank borrowing is primarily through their ability to influence interest rates. The low interest elasticity on the real own interest rate terms, and failure of the nominal rate to be significant, suggest *prima facie* that their power to affect the volume of ICCs borrowing directly through this means is slight. However, indirect interest rate effects on working capital needs through their impact on the goods and factor markets may be important. These issues have not been examined in this paper.

58 The historical evidence suggests that in the United Kingdom the authorities ability to control the rate of bank credit expansion, at least to ICCs, has been limited. The components of companies' working capital, particularly money wage rates, appear to be important determinants of bank lending. As central banks, consistent with their paramount supportive role to the financial system, tend to allow the money stock to accommodate to changes in the demand for credit, monetary

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[1] The equation does suffer, however, from problems of heteroscedasticity and perhaps of inconsistent and/or inadequate seasonal adjustments.

[2] Liability management allows banks considerable scope to meet the resulting demand. However, changes in money-market rates as the result of liability management may force changes in banks' base rates.

[3] It is by no means clear that the authorities have ever tried to ration credit to *industrial* companies (as opposed to those engaged in distribution and commerce).

aggregates are properly considered to be endogenous. Monetarists may not be justified, therefore, in regarding the money stock as an exogenous variable simply because it is potentially under the control of the monetary authorities.

Appendix 1

Data definitions[1]

1. Δ Wage bill = Δ[ECM(LE-LEG)]

   where ECM = employment costs per employee (£ million/thousand employees, seasonally adjusted)

   LE = employees in employment (thousands, seasonally adjusted)

   LEG = employment in non-trading public sector (including HM Forces). (Thousands, seasonally adjusted)

2. Δ Import bill = Δ(PMIM.MGIM)

   where PMIM = average value index of imports of industrial materials (1975=1, seasonally adjusted)

   MGIM = imports of industrial materials excluding precious stones (OTS), (1975 prices, seasonally adjusted)

3. Stockbuilding = IIC£ = company sector stockbuilding (£ million, seasonally adjusted)

4. Δ Tax = ΔTYC

   where TYC = corporate payments of UK tax, including ACT (£ million, seasonally adjusted)

5. Round-tripping = RCD-(RCBR+1), when RCD > (RCB+1)

   where RCD = three-month sterling certificate of deposit rate (per cent)

   RCBR = clearing banks' base rate (Bank Rate prior to CCC) (per cent)

6. Own interest rate = RCBR+2

7. Real own interest rate = (RCBR+2)-PEXM

   where PEXM = proxy for expected rate of inflation based upon movements in monetary aggregates (per cent)

[1] Further information on some of these variables is given in Bank of England (1979).

8. Corset dummy = 0 1963 Q1 - 1973 Q3
0.18 1973 Q4
1.0 1974 Q1 - 1974 Q4
0.66 1975 Q1
0 1975 Q2 - 1976 Q3
0.5 1976 Q4
1.0 1977 Q1 - 1977 Q2
0.5 1977 Q3
0 1977 Q4 - 1978 Q2
1.0 1978 Q3 - 1978 Q4

9. Lending controls dummy = 0 1963 Q1 - 1965 Q1
1.0 1965 Q2 - 1967 Q1
0 1967 Q2 - 1967 Q3
1.0 1967 Q4 - 1971 Q3
0 1971 Q4 - 1978 Q4

10. Pressure release dummy = 0 1963 Q1 - 1967 Q1
4.0 1967 Q2 - 1967 Q3
0 1967 Q4 - 1971 Q3
4.0 1971 Q4 - 1972 Q3
0 1972 Q4 - 1978 Q4

11. 'Round-tripping' unwinding dummy = 0 1963 Q1 - 1974 Q2
1.0 1974 Q3 - 1975 Q2
0 1975 Q3 - 1978 Q4

12. Income gearing = $[((RCBR+1).SBKA)/(YCTP+YCNT-YSAC)]_{-1}$

where RCBR = clearing banks' base rate (per cent)

SBKA = stock of ICCs bank advances outstanding (£ million)

YCTP = company gross trading profits (£ million, seasonally adjusted)

YCNT = corporate rent and non-trading income (£ million, seasonally adjusted)

YSAC = company sector stock appreciation (£ million, seasonally adjusted)

13. Foreign interest rate differential = (REUE+RFDS)-(RCBR+2)

where REUE = three-month euro-dollar rate (end-quarter; per cent)

RFDS = forward discount rate on sterling (quarterly average; per cent)

RCBR = clearing banks' base rate (per cent)

Appendix 2

Outside-sample forecasts

59 Forecasts for 1977 Q1 to 1979 Q3 were made for total bank borrowing by ICCs using equations estimated over both 1965 Q3 to 1976 Q4, and 1971 Q3 to 1976 Q4.[1] Table F shows the estimated equations compared with those estimated over the full available sample period up to and including 1978 Q2. Dropping the last six observations from the sample period did not greatly affect the estimated coefficients, with the possible exception of the coefficient on the wages term (and the constant) in the equation estimated for the post 1971 Q3 period: typically estimates are within one standard error of each other.

60 The forecasting performance of equations 2 and 4 in Tables F and G is not outstanding: the root mean square error as a percentage of the mean actual during the forecast period is 51% and 58% respectively. The dependent variable is, however, the flow of bank borrowing: the root mean square error as a percentage of the stock of bank borrowing at the end of 1977 is 2.0% and 2.3% respectively. The cumulative increases in bank borrowing over the period 1977 Q1 to 1978 Q2 predicted by the two equations were £442 million and £261 million respectively greater than that which actually occurred. There was a large overprediction (£700 million and £850 million, respectively) in the second half of 1978: mirrored by an increase in acceptances of about £600 million by the non-bank sector. Underprediction of 1979 Q1, however, more than compensated for the earlier overprediction. In part the underprediction reflects estimates of a fall in tax payments (seasonally adjusted) in 1979 Q1 of about £140 million and of a positive real interest rate. But even if the effect of these terms are set to zero predicted bank borrowing in 1979 Q1 would have still been only about £1.1 to £1.2 billion compared with an actual of £1.8 billion.

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[1] The actual values shown in Table G differ slightly from those used in estimation, because revisions to the data took place between estimation (in the second half of 1979) and the use of these equations for outside sample forecasts (in early 1980).

61 The behaviour of bank lending in the first half of 1979 took most forecasters by surprise and the Midland Bank comment that 'the first half [of 1979] was marked by an abnormally high demand for bank credit in the private sector, part of which reflected the interruption of normal patterns of receipts and payments due to various industrial disputes, and part was a process of "re-intermediation" or return to the banks by borrowers who had found temporary accommodation elsewhere while the "corset" was being tightened last autumn' [Midland Bank (1979), page 1]. Such a rationalisation of disintermediation in 1978 and reintermediation in early 1979 is consistent with the pattern of forecasting errors. Special factors such as industrial disputes in early 1979 - which would not be fully picked up by the working capital variables in the equations no doubt played a part.

62 Another possibility is that companies were round-tripping into certificates of tax deposit which offered relatively high interest rates over the period: outstanding tax deposits by ICCs increased from practically zero in early 1977 to just over £1/2 billion in 1978 Q3 and to over £1 billion in 1979 Q1 before falling back to just under £1 billion in 1979 Q3. An equation was run over 1965 Q3 to 1978 Q2 with the change in certificates of tax deposit held by ICCs as an extra explanatory variable: its coefficient is 1.4 with a t value of 3.2, that is, not significantly different from unity. In forecasting, the inclusion of this variable led to great overprediction of the second half of 1978, but reduced the underprediction of 1979 Q1, by between £350 million (imposing a unity coefficient) and almost £500 million (using the estimated coefficient).

63 In the middle of 1979, faster wage inflation, higher raw material prices and continued stockbuilding resulted in the equations predicting bank lending (in Q2 and Q3) in excess of £3 billion, while actual bank lending to ICCs was only £2.3 billion. However, increasing pressure from the supplementary special deposits scheme encouraged further disintermediation through acceptances (of over £1 billion for the non-bank sector).

Table F

Industrial and commercial companies: total bank borrowing

t values in brackets

Equation Number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stock-building t	Δ Tax t	Round-tripping	Real own rate of interest t	D.W.	S.E. £ mn	$\bar{R}^2$
1	1965 Q3-1978 Q2	131.6	0.727	1.162	0.472	0.932	475.4	-16.75	2.16	204.1	0.81
		(2.7)	(5.9)	(3.3)	(3.1)	(2.9)	(4.2)	(4.4)			
2	1965 Q3-1976 Q4	130.2	0.801	0.849	0.575	0.985	457.2	-19.43	2.18	190.5	0.84
		(2.8)	(6.0)	(2.3)	(3.6)	(3.0)	(4.3)	(5.2)			
3	1971 Q3-1978 Q2	166.9	0.660	1.298	0.403	1.044	436.6	-18.46	2.23	261.5	0.75
		(1.4)	(2.9)	(2.5)	(1.7)	(2.1)	(2.9)	(2.8)			
4	1971 Q3-1976 Q4	99.8	0.833	1.098	0.440	1.155	425.7	-24.40	2.30	253.0	0.85
		(0.7)	(3.1)	(1.8)	(1.7)	(2.1)	(2.9)	(3.1)			

Table G

Industrial and commercial companies: total bank borrowing: forecasts 1977 Q1-1979 Q3

£ millions

Table F equation number	1977 Q1	1977 Q2	1977 Q3	1977 Q4	1978 Q1	1978 Q2	1978 Q3	1978 Q4	1979 Q1	1979 Q2	1979 Q3	Cumulative change 1977 Q1-1979 Q3	Cumulative change 1978 Q3-1979 Q3	Root mean square error 1977 Q1-1979 Q3	RMSE as percentage of mean actual in forecast period 1977 Q1-1979 Q3
1							827	1,221	920	1,280	1,867		6,115		
2	836	932	256	759	991	1,095	891	1,245	985	1,387	1,823	11,200	6,331	464.2	51.1
3							803	1,244	850	1,253	1,869		6,019		
4	803	861	205	718	979	1,122	877	1,399	798	1,169	1,902	10,833	6,145	529.0	58.3
Actual	893	795	516	749	296	1,178	715	706	1,839	1,339	964	9,990	5,563		
Memorandum item															
Change in non-bank take-up of commercial bills accepted by banks ('the bill leak')							475	126	-95	417	616		1,539		

Appendix 3

Regression results for sterling bank borrowing of industrial and commercial companies

Table H

Industrial and commercial companies: bank borrowing in sterling (1965 Q3 - 1978 Q2 mean 337.0 st.dev.399.1)

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill		ΔImport bill			Stockbuilding		Δ Tax		Round-tripping	Real own rate of interest	D.W	ρ	S.E. £ mn	$\bar{R}^2$
			t	t-1	t	t-1	t-2	t	t-1	t	t-1						
1	1965 Q3-1978 Q2	70.9	0.545	-0.039	-0.178	1.311	0.580	0.145	0.009	1.312	0.534				0.374	259.2	0.59
		(0.8)	(2.5)	(0.2)	(0.4)	(2.9)	(1.1)	(0.5)	(0.0)	(3.0)	(1.2)				(2.5)		
2	1965 Q3-1978 Q2	49.7	0.690	-0.135	-0.454	1.030	0.550	0.385	-0.103	1.098	0.171	533.7		1.93		238.3	0.65
		(0.9)	(3.1)	(0.6)	(1.0)	(2.4)	(1.2)	(1.5)	(0.4)	(2.5)	(0.4)	(3.7)					
3	1965 Q3-1978 Q2	35.4	0.626			0.954		0.494		0.816		488.3		1.96		232.8	0.66
		(0.7)	(4.6)			(2.4)		(2.9)		(2.2)		(4.0)					
4	1965 Q3-1978 Q2	100.8	0.531			1.171		0.346		0.943		330.2	-14.80	2.26		201.6	0.75
		(2.1)	(4.3)			(3.4)		(2.3)		(2.9)		(2.9)	(3.9)				
5	1965 Q3-1971 Q2	- 11.0	0.819			0.397		0.480		0.448				2.54		148.7	0.07
		(0.2)	(2.0)			(0.5)		(1.0)		(0.9)							
6	1965 Q3-1971 Q2	10.2	0.799			0.775		0.541		0.791			- 6.65	2.65		133.2	0.18
		(0.1)	(2.1)			(1.1)		(1.3)		(1.6)			(1.0)				
7	1971 Q3-1978 Q2	191.3	0.376			0.890		0.514		0.812		409.6		2.08		294.7	0.56
		(1.5)	(1.5)			(1.6)		(2.2)		(1.4)		(2.5)					
8	1971 Q3-1978 Q2	94.4	0.527			1.327		0.269		1.019		306.0	-17.63	2.30		261.8	0.65
		(0.8)	(2.3)			(2.6)		(1.2)		(2.0)		(2.0)	(2.6)				

Table J

Industrial and commercial companies

t values in brackets

Estimation period 1965 Q3-1978 Q2

1 Sterling bank borrowing less bank deposits [a] (mean 553.0 st.dev.619.8)

Equation number	Constant	Δ Wage bill t	Δ Import bill t-1	Stockbuilding t	Δ Tax t	Round-tripping	Real own rate of interest [b]	D.W.	S.E. £ mn	$\bar{R}^2$
1	101.5	1.096	0.704	0.635	1.224	698.4		1.58	442.0	0.48
	(1.1)	(4.2)	(0.9)	(2.0)	(1.8)	(3.0)				
2	262.0	0.867	1.103	0.336	1.438	344.8	-32.90	2.24	366.3	0.65
	(3.0)	(3.9)	(1.8)	(1.2)	(2.5)	(1.7)	(4.8)			

2 Sterling bank borrowing less liquid assets (mean 604.3 st.dev.638.6)

3	122.7	1.254	0.689	0.468	1.523	644.2		1.30	462.1	0.47
	(1.2)	(4.6)	(0.9)	(1.4)	(2.1)	(2.7)				
4	294.5	1.010	1.104	0.154	1.743	268.7	-34.91	1.92	380.6	0.65
	(3.2)	(4.4)	(1.7)	(0.5)	(2.9)	(1.3)	(4.9)			

[a] All currencies.

[b] Rate on bank borrowing.

Table K

Industrial and commercial companies: bank borrowing in sterling and interest rate effects

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stockbuilding t	ΔTax t	Round-tripping	Nominal own rate of interest		Expected inflation	Real own rate of interest			D.W.	S.E. £ mn	$\bar{R}^2$
								t	t-1		t	t-1	Four quarters Almon: total coefficient			
1	1965 Q3-1978 Q2	35.4	0.626	0.954	0.494	0.816	488.3							1.96	232.8	0.66
		(0.7)	(4.6)	(2.4)	(2.9)	(2.2)	(4.0)									
2	1965 Q3-1978 Q2	371.6	0.790	1.335	0.430	0.908	593.9	-35.82	- 3.85					2.10	229.9	0.67
		(1.9)	(4.7)	(2.9)	(2.5)	(2.5)	(4.4)	(0.9)	(0.1)							
3	1965 Q4-1978 Q2	99.5	0.530	1.177	0.348	0.953	340.8				-16.47	2.40		2.27	205.2	0.74
		(2.0)	(4.2)	(3.4)	(2.2)	(2.9)	(2.9)				(2.9)	(0.4)				
4	1965 Q2-1978 Q2	369.9	0.786	1.348	0.428	0.912	596.3	-39.43						2.10	227.4	0.68
		(1.9)	(4.9)	(3.1)	(2.5)	(2.5)	(4.5)	(1.8)								
5	1965 Q3-1978 Q2	81.9	0.519	1.150	0.348	0.938	320.7	-12.67		15.07				2.26	203.8	0.74
		(0.4)	(3.1)	(2.8)	(2.2)	(2.9)	(2.2)	(0.6)		(3.2)						
6	1967 Q1-1978 Q2	133.9	0.473	1.012	0.410	0.905	315.5						-11.49	2.03	233.9	0.67
		(1.8)	(2.7)	(2.5)	(2.3)	(2.4)	(2.0)						(1.7)			
7	1965 Q3-1978 Q2	100.8	0.531	1.171	0.346	0.943	330.2				-14.80			2.26	201.6	0.75
		(2.1)	(4.3)	(3.4)	(2.3)	(2.9)	(2.9)				(3.9)					

Table L

Industrial and commercial companies: bank borrowing in sterling and quantitative controls and other variables

t values in brackets

Equation number	Estimation period	Constant	Δ Wage bill t	Δ Import bill t-1	Stock-building t	Δ Tax t	Round-tripping	Round-tripping unwinding	Real own rate of interest t	Income gearing proxy t-1	Corset dummy	Lending controls dummy	Pressure release dummy	1972 dummy	CCC dummy	D.W.	S.E. £ mn	$\bar{R}^2$
1	1965 Q2-1978 Q2	41.1	0.571	0.997	0.508	0.803	486.4	83.7								1.96	234.6	0.65
		(0.8)	(3.3)	(2.5)	(2.9)	(2.2)	(4.0)	(0.5)										
2	1965 Q3-1978 Q2	21.7	0.408	0.819	0.542	0.708	418.2								161.2	2.14	228.8	0.67
		(0.4)	(2.2)	(2.1)	(3.2)	(1.9)	(3.3)								(1.6)			
3	1965 Q3-1978 Q2	103.3	0.545	1.184	0.340	0.952	332.5		-15.08						-12.3	2.25	203.8	0.74
		(1.9)	(3.1)	(3.2)	(2.1)	(2.8)	(2.9)		(3.4)						(0.1)			
4	1965 Q2-1978 Q2	6.5	0.714	0.958	0.563	0.800	525.8				-106.0	-21.6	48.6			2.23	227.5	0.67
		(0.1)	(3.1)	(2.4)	(3.2)	(2.2)	(3.9)				(0.9)	(0.2)	(1.4)					
5	1965 Q3-1978 Q2	38.8	0.575	1.211	0.303	1.007	335.5		-15.65		78.0	68.0	21.5			2.36	206.4	0.74
		(0.3)	(2.7)	(3.3)	(1.7)	(3.0)	(2.4)		(2.9)		(0.6)	(0.6)	(0.7)					
6	1965 Q2-1978 Q2	- 3.9	0.633	1.005	0.542	0.753	506.5							404.0		2.33	206.3	0.73
		(0.1)	(5.2)	(2.9)	(3.6)	(2.3)	(4.7)							(3.7)				
7	1965 Q3-1978 Q2	45.8	0.579	1.144	0.423	0.878	405.0		- 8.88					241.8		2.35	197.5	0.76
		(0.8)	(4.7)	(3.4)	(2.7)	(2.8)	(3.4)		(1.7)					(1.7)				
8	1965 Q2-1978 Q2	578.6	0.889	1.168	0.411	0.953	559.7			-177.5						2.10	228.2	0.67
		(1.8)	(4.4)	(2.9)	(2.4)	(2.6)	(4.4)			(1.7)								
9	1965 Q3-1978 Q2	133.1	0.548	1.182	0.343	0.950	336.8		-14.59	- 10.9						2.26	203.8	0.74
		(0.4)	(2.6)	(3.3)	(2.2)	(2.9)	(2.6)		(3.4)	(0.1)								

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