Inventory Investment and the Rate of Interest

One of the most powerful factors in the business cycle is business investment in inventory. Although the annual amount of inventory investment is normally a small fraction of fixed investment, it is so volatile that changes from one year to the next in the rate of investment in inventory tend to be as great as changes in the rate of fixed investment. Over shorter time periods, inventory investment has much greater variability than fixed investment and in fact is considered the major factor in the short business cycle.

Although there has been some support for the idea that inventory investment is highly sensitive to interest rates, most observers have held that speculative and other factors are dominant and that the interest rate is ignored. It is also argued that large firms rely little on short-term bank credit and therefore tend to escape the influence of credit tightness, leaving the smaller firms to suffer the effects — cost or availability — of thight money.

This article will show, following a resume of findings on fixed investment, that some of the assumptions underlying economists' skepticism of the existence of appreciable interest elasticity of demand for inventories are not justified. It will be shown that some businessmen do take interest rate levels into consideration when fixing inventory targets, so that the idea of such behavior cannot any longer be considered farfetched. Finally, some evidence that high interest rates did restrain inventory investment in Great Britain and in the United States in the late 1950's when rates finally got back to their pre-great depression levels is presented. That evidence is not conclusive — especially in view of the coincidence with high rates in 1957 of growing excess capacity and declining new orders — but it does seem sufficient to justify the recall of economists' serious attention to investigation of the possibilities for valuable anti-inflationary contributions from short-term interest rate policy.

I. Fixed Investment and Interest Rates - A Resume

Whatever smoothing of the inventory cycle that could be achieved by interest rate policy might not be sufficient by itself to justify confident use of that policy. Some findings on the influence of interest rates on the fixed capital part of business investment are reached in a larger study from which this article is drawn; a brief description of these can provide a useful introduction to the inventory question by disposing of any presumption that effects on inventory would have to be the only effects achieved (1).

Present skepticism about the power of interest rate policy to influence fixed investment is grounded on several major considerations: surveys of business officers have been thought to prove business disregard of the cost of money; and statistical evidence is thought to show that manufacturers are relatively independent of the capital market in the financing of their investment. This empirical evidence has been reinforced by a number of *a priori* reasons: the risk and uncertainty associated with the longer-lived fixed investments make the required rates of return so high that plausible changes in interest rates are negligible by comparison; fixed technical coefficients preclude appreciable changes in the capital intensity of a productive process when interest rates change within the plausible range; since the cost of capital is a small part of product selling prices — and changes in that cost smaller still — fixed investment in expansion is likewise beyond the reach of interest rate policy; shorter-lived investments are little influenced because their discounted present ("capitalized") values are little affected by interest rate movements. Finally, it is thought that monetary measures act too slowly to have effects at the times when they are needed.

As has been described elsewhere (2), the various "classical" surveys of businessmen made in the later 1930's and in the late

(1) A study the writer is preparing for the Brookings Institution of Washington on the influence of interest rates on business investment. It will be understood that considerations of space require that the findings on fixed investment be presented in oversimplified terms, and that discussion of apparently countervailing factors must be foregone.

(2) W. H. White, "Interest Inelasticity of Investment Demand - the Case from Business Attitude Surveys Re-examined", *American Economic Review*, September 1956, pp. 565-587. A complete discussion of this subject will be found in the study cited in the preceeding footnote.

1940's represented periods of depression psychosis in which firms were unwilling to go into debt unless profits on investment were to be extremely high, and investors were unwilling to buy common stocks except at prices that made the "cost" of equity capital much too high. Moreover, both periods saw very low interest rates and the later one saw the intense postwar need for capital equipment, long delays in equipment delivery, high business liquidity and shortages of the management and engineering personnel needed for higher rates of investment. The consequent distortions of evidence on the role of the interest rate were compounded by the sampling procedure used in many of the surveys wich over-represented the small firms who relied much more on self-financing, are more vulnerable to risk and uncertainty because they lack the large variety of independent investment projects that the large firm carries out at one time, make much less use of scientific management, and are comparatively unimportant in total capital spending.

Although various deficiencies or obscurities have prevented the results from being conclusive, survey evidence in Britain and the United States since the mid 1950's has shown increasing indications that fixed investment may be sensitive to the cost-of-capital effects of interest rate policy. These indications are particularly striking because they coincided with the generalization of belief in continuous (gradual) inflation. The appearance of evidence of interest sensitivity is explained by the rapid spread of quantitative techniques for evaluating new investment projects among the larger firms, by restoration of confidence in the economy which permitted marked reductions in the larger firm's minimum acceptable expected rate of return on investment projects and return to reliance on borrowed funds, by the related increase in the part played by the capital market in company finance. and the appearance for the first time in over twenty years of interest rates high enough to be expected to attract the business man's attention. Finally, the recent surveys have permitted concentration on the behavior of the larger firms that dominate business investment and that, for reasons given above, can be assumed to be more open to the influence of the cost of capital.

Evidence from a large-scale survey of the larger British manufacturing companies (3) indicates that a majority require rates of

(3) See below, p. 167.

return on new investment that are below 10% net of taxes and that two-fifths vary their "judgment of the profitability of new investment... from time to time according to the rate of interest". This survey also provided evidence that larger manufacturers' inventories are affectable by the interest rate (discussed below) and that evidence is paralleled by similar findings on fixed investment, findings which are perhaps still more persuasive because the long term interest rate change involved was smaller than the change in short term rates pertinent to the inventory decision. A partial explanation for the Radcliffe Committee's contrary interpretation of this evidence is given below in connection with the inventory discussion; with regard to fixed investment the Committee also seems to have been strongly swayed by the testimony of officers of eight giant British firms, all of whom denied their investment could be restricted by a high cost of money (they can switch borrowing among countries, raise large surplus funds while money is cheap and can borrow short term as much as is needed if those funds are exhausted before money is cheap again; their investments projects are all "necessary" ones). However, one of the eight firms was insensitive because fixed investment was self financed, but was vulnerable to the cost of money ar far as inventory investment was concerned; two more reluctantly conceded that if they were obliged to borrow long term at a time when they considered the interest rate abnormally high — the position in which less gigantic firms may often find themselves — they might postpone even "necessary" projects. And a fourth, who emphasized that capital goods prices rose 1% per month, also said that only interest rates as high as 12% could be a deterrent, but was not asked what its reactions would be if the pace of inflation were slower (4).

Indications that a sizable minority of large American manufacturers take the market rate of interest into account (formalistically, at least) in the evaluation of their *self*-financed investment projects is presented in an article containing some of the material which will appear in the complete study (5). That article also gives a portion of the evidence of the rapid spread of quantitative

(4) Radcliffe Committee, *Minutes of Evidence*, p. 797 (Boots Pure Drug), p. 773 (Vickers), p. 793 (Tube Investments), p. 799 (Associated Electric).

(5) W. H. White, "The Rate of Interest, the Marginal Efficiency of Capital and Investment Programming", *Economic Journal*, March 1958, pp. 51-59.

evaluation of investment projects during the 1950's and of the accompanying reduction in risk aversion and lengthening of economic horizons. It further shows that restrictive monetary policy in the United States can be applied on the basis that manufacturers desire to obtain on average one fourth of their total long term funds (of retained profits, depreciation charges and external funds) from the capital market in prosperous years. That degree of contact with capital market conditions can be considered sufficient because anti-cyclical policy would not be intended to cut back business' planned fixed investments by any more than, say, one fifth and because, in a first approximation, the lowest ranking fifth of investment projects will have to justify payment of an increased cost of capital regardless of whether the next-higher-ranking fifth of planned investment is to be self-financed or not. The total of external financing appears to be concentrated among a minority of the larger firms in any year, but this does not mean that a one-fifth cut in total investment would require a 50% cut in the investment, of external-financing firms; a very large proportion of the larger American firms plan low, self-financeable rates of investment even in prosperous years, and it can be assumed that the concentration of external financing among relatively few companies tends to be accompanied by a parallel concentration of total investment.

The question of overconcentration of the higher external financing ratios found for British manufacturing industry is disposed of by the known correlation between rate of growth and frequency of resort to the capital market and by evidence that the capital market plays a major part for half the firms (6).

The *a priori* argument that plausible changes in cost of capital cannot appreciably shift the choice between more and less capital-intensive methods of performing a given production task is shown to be exaggerated: the assumption that in the case of United Kingdom and United States it is the halved, net-of-tax interest cost that is relevant is largely incorrect; and the change in the total annual costs of the more capitalistic method relative to the less capitalistic is shown to be large enough to rule out the *a priori* working pre-

(6) Over a three-year period nearly half of the 1,800 largest stock-exchange quoted manufacturing (plus some trade) firms were using the capital market (and a little bank credit) to finance at least 50% of the growth in their net assets (derived from *Board of Trade Journal*, December 16, 1960, p. 1416).

sumption of fixed " technical coefficients of production ". The rapid adoption of sophisticated investment selection techniques (" engineering economics ") by the industrial engineers suggests the existence of significant freedom of choice among degrees of mechanization and degrees of durability. Moreover, there can be no *a priori* presumption at all of interest insensitivity in the large portion of fixed investment that is made for replacement-modernization purposes. As expounded by Duesenberry and Terborgh, this investment decision takes the form of choice between the replacement of a machine or process now and postponing replacement for one more year. It is plausible that the balance of advantage in this kind of " voluntary ", purely-technical investment decision could be easily shifted by those changes in the cost of capital that the authorities could create.

The argument that expansion investments cannot be appreciably influenced by changes in capital costs that would cause the necessary sales price of the product to rise only, e.g., ½ per cent is mistaken on three counts: 1) It overlooks the fact that the cost of money inclusive of that part borne by the country's tax authorities must be counted, just as in the case of labor, in its entirety as a cost of production when the selling price is set. 2) It has lost sight (as have the other arguments against interest sensitivity) of the authorities' ability to raise the long term rate to levels that business will consider abnormally high; a delay of only perhaps one year until rates come down will save the firm extra interest payments, not for just a year but for 5-10 years. 3) Most important, while a 1% rise in the price of the product to be made with newly-built productive capacity would not restrict demand for the product very much, expansion investments commonly add 5%-10% per annum to the capacity to produce products already being made. Even if the 1% price rise cut demand for the product by just 0.33%, it would still produce the worthwhile reduction in total expansion investments of 5%.

The final *a priori* argument against interest sensitivity that requires rectification is the popular reasoning that short-lived investment projects cannot be much affected, despite the smallness of the risk charges added to their required rates of return. That this view has survived and become prevalent is due to uncritical acceptance of earlier work by the advocates of low interest elasticity. Without the rigor of a mathematical or geometric exposition, the reality of the situation can be briefly illustrated by reference to the effects of interest rate changes on the present values — and hence on the

price the market is willing to pay — of short term and long term debentures. As is well known, the price of the short lived asset (in this case, a security) varies much less for any given interest rate change than that of the long lived asset. But the critical question is the effect on the relationship between the " cost of producing " the debenture — its issue price of 100 — and its expected " rate of return " — the rate of interest to be paid on that 100. For example, a fall in interest rate from 6% to 5% which transforms long term debentures offering 5% returns from unprofitable investments not worth the price of 100 to profitable ones worth acquiring at a price of 100, must do exactly the same for short term debentures. That wider price movements are involved for the long than for the short debentures is (almost) irrelevant. Similarly, given equal frequency distributions by rate of return for long-lived and short-lived investment projects in a " state of nature " — i.e., given equality in the interest elasticities of demand for capital equipment when the equipment prices are fixed — an assumption which underlies the differential discounted present value variability argument, then the same proportions of short as long-livel projects are made worth paying for by a given interest rate reduction. This conclusion holds only when capital goods prices are constant. When their supply curves are rather inelastic, a little of the supposed differential interest sensitivity does exist; but it can be shown that over all this only *increases* the total sensitivity of fixed investment to the cost of capital.

It would be argued by many (e.g. W. L. Baumol, M. Friedman, A. W. Phillips) that demonstrations of usefully high interest elasticity would be irrelevant because anticyclical monetary and public spending measures are too slowly adjusted to the requirements of business conditions. The reasons why the various policy adjustment and capital-spending lags for American business should be sufficiently short to permit important smoothing of the " 40 month " business cycle have been published elsewhere and need not be repeated here (7). These reasons are valid insofar as the cycle process is not purely an accelerator process (e.g., the backlog of fixed investment projects is worked off and a major segment of fixed investment demand falls to, and moves along, a lower level regardless of smaller

(7) W. White, " The Flexibility of Anticyclical Monetary Policy ", *Review of Economics and Statistics*, May 1961, pp. 142-147.

short-term changes in income). Monetary policy is sufficiently nimble in sofar as this is so or to the extent that such autonomous " shocks " provide the necessary priming for the accelerator process. And a pure " anti-accelerator " policy (the current effects on investment of recent-past changes in national income being accompanied by the opposite effects of measures taken in response to the same income changes) also appears feasible for monetary policy, even if it is beyond the reach of fiscal policy: Recent-past changes in income affect (a portion of) today's investment decisions and, hence, the investments of the next year and a half. But monetary policy appears sufficiently quick-moving so that the monetary measures that are affecting the current " multiplier " period's investment decisions can have been introduced in response to the *same* recent-past income change (the change from the second preceding to the preceding multiplier period); and the distribution of the monetary measures' effects among investments of different gestation periods may be sufficiently close to the distribution of the effects that the recent-past income change itself had.

Moderate susceptibility to the influence of the cost of money that was restricted to the inventory portion of business investment could be insufficient to justify aggressive use of interest rate policy. With any presumption of such a restriction shown untenable (and very likely in conflict with the facts), it now becomes worth while to investigate the possibilities that interest rate policy can influence inventory investment.

II. Inconclusiveness of *a priori* and Econometric Evidence on Inventory Investment

The possibilities for useful restriction of inventory investment by means of increases in interest rates might be thought especially good because of the ease with which a single firm's inventories could be sold off to consumer purchasers in time of full employment (in contrast with gross fixed investment which can only rarely be converted into a negative quantity for a single firm and never can be for business as a whole). Even if the inventory investment of most large firms could not be restricted at all through interest rate increases, the likelihood exists — in the case of inventory uniquely — that the investments of the interest-sensitive minority may be not only diminished as a positive value but in some cases actually converted to a negative value. This means that worth while effects may be secured even if firms responsible for most of aggregate inventory cannot be affected.

The use of interest rate policy has been strongly advocated by Sir Ralph Hawtrey on the ground that the inventories held by the wholesale trader must be very sensitive to changes in interest rates because the trader's cost of doing business is made up in very large part of interest on the money invested in inventory. Manufacturers and others for whom interest charges on inventory are relatively less important should also be somewhat responsive to interest-rate changes because adjustments in their inventories of raw and semi-finished materials are made without having any effect on the volume or efficiency of production: the average size of inventory can be reduced, in response to a rise in interest rates, simply by an increase in the frequency with which materials are purchased and an appropriate reduction in the size of the average purchase (8).

Most observers have denied the validity of Hawtrey's position, however, on the ground that the amount of inventory needed is rather closely linked to the volume of sales expected with little scope being left for variation in response to other, secondary conditions. Where inventory has been intentionally varied relative to expected sales, the variation has been attributed to the much more powerful factor of speculation on price movements; plausible increases in interest rates cannot nullify the stimulus to commodity hoarding when the expectation is created that prices will rise by, say, 5 per cent in the coming 6 months. It may be added that, even if the wholesale trader is relatively sensitive to changes in interest, his share in total inventory had declined in Britain to only one sixth that of manufacturers.

The author of a basic American work on inventories, Moses Abramovitz, pointed out that during the fraction of a year in which funds are invested in given units of inventory, the cost of (changes in) the interest charge is very small relative to the profit expected from the sale of the given inventory units or relative to the expected price increase when speculative inventories are concerned (9).

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(8) See, for example, R. G. Hawtrey, *Capital and Employment*, 2nd ed., London, 1952, pp. 46-47, 77.

(9) *Inventories and Business Cycles*, National Bureau of Economic Research, New York, 1950, pp. 125-126, 130-131. Abramovitz concluded that there existed " a strong presumption that variations in interest rates do not influence inventory movements greatly ", although, in

It will be shown below, however, that interest costs enter rational inventory planning formulas in terms of maximum efficiency of operations (i.e., of a quantified form of what Hawtrey was actually indicating) and do not require direct reference to expected profit rates.

Recently, a few students of inventory investment have begun to argue that inventory's insensitivity to interest rates has not been convincingly established. The econometrician L. R. Klein, for example, believes that some interest elesticity of inventory demand could be demonstrated for the United States (10).

Franco Modigliani, who has helped establish inventory controls for a number of large American manufacturers, holds that " ... variations in the cost of money — or in the availability of funds — ... affect the optimum amount of inventories through the (opportunity) cost of holding inventories. While this factor may have been overstressed [' in traditional economics '] its significance cannot be dismissed, at least pending further evidence " (11).

A writer who has been influential in the revival of business interest in rational inventory formulas, although indicating that rational behaviour would leave the interest elasticity somewhat low, still believes that:

> How much effect interest rate variations actually have on inventories is an empirical question. Enough data have not yet been compiled to provide an answer which will either prove or disprove Hawtrey's theory. The analysis... indicates that changes in the interest rate should influence the rational entrepreneur to change his lot size, but two factors are present that help reduce the effects of changes in the interest rate. The first of these is the economic purchase quantity which varies inversely with the square root of carrying charges. The second factor is the set of components

the absence of usable statistical evidence, he said he was obliged to rely on the 1938 Oxford survey of 37 businessmen's views on interest rates (Abramovitz, p. 126). The validity of that survey and of his interpretation of it are examined below (pp. 163-165). The availability of new evidence and the increase in the amplitude of interest-rate variation beyond the 1.2 percentage points he assumed (Abramovitz, p. 125) might have caused him to reach the opposite conclusion. In fact, he now appears to believe that the interest elasticity of *fixed* investment is significantly high (*Employment, Growth and Price Levels, Hearings before the Joint Economic Committee*, Pt.2 Washington, 1959, pp. 464-465).

(10) L. R. Klein and A. S. Goldberger, *An Econometric Model of the United States, 1927-1952*, North-Holland Publishing Co., Amsterdam, 1955, pp. 67-68.

(11) Franco Modigliani, " Business Reasons for Holding Inventories and their Macro-Economic Implications ", *Problems of Capital Formation, Studies in Income and Wealth*, vol. 19, National Bureau of Economic Research, Princeton, 1957, pp. 504-505.

other than interest included in the carrying charge. In order to avoid this difficulty Hawtrey assumed that carrying charges other than interest were small and constant, an assumption that is ordinarily not realistic (12).

In their simplest formulation, the economic purchase quantity (" lot size ") formulas referred to determine the optimum frequency of ordering the raw materials and other components to be consumed during the year. Frequent ordering implies small quantities per order and a low average level of inventory and therefore low costs for carrying inventory (interest, storage charges, etc.); on the other hand, infrequent ordering, which requires larger quantitites per order and therefore higher average levels of inventory holding over the year, implies lower annual costs for placing orders and processing deliveries (and lower purchase prices because of the discounts obtainable on large-quantity orders). The economic purchase quantity or " lot size " is the size of order for which the sum of these two kinds of inventory cost is a minimum. The minimum-cost size of order is reduced by any rise in carrying costs and thus the optimum size of average inventory holding falls when interest rates rise. (Somewhat similar reasoning applies to the holding of goods in process and finished goods, although the influence of interest costs must be weaker) (13).

The attenuation of the influence of interest rates by the factors presented in the quotation above may be illustrated numerically. Twenty per cent per annum of the value of the inventory is a typical figure for marginal inventory carrying costs (interest, handling, taxes, insurance, deterioration, etc.) (14). A two percentage-point rise in interest rates would raise the carrying costs to 22 per cent — only a 10 per cent increase — and would raise the square root of the carrying costs by only 4½ per cent, thus indicating only a 4½ per cent reduction in inventories (according to the formula

(12) T. M. Whitin, *Theory of Inventory Management*, Princeton, 1953, p. 81. Hawtrey assumed that the major carrying cost other than interest was storage and that (marginal) storage costs would be low because business tended to own ample warehousing capacity (Hawtrey, *op. cit.*, p. 51). The latter assumption seems justified at least for times of under-employment when interest rates are cut for the purpose of inducing enlargement of inventories.

(13) A European source providing an exhaustive discussion of the optimum inventory formulas is S. Micha, " Problèmes de gestion opérationnelle des stocks ", *Annales de Sciences Economiques Appliquées* (Belgium), October, 1959, pp. 395-458.

(14) Inventory carrying costs are said to run from 10 to 25 per cent in the United States (*Purchasing*, May 1956, p. 41).

cited above). It will be noted, however, that with actual inventories (excluding goods in process) at $74 milliard as of January 1959, the rational 4½ per cent reduction would be an appreciable factor in the United States business cycle. A $3 milliard reduction in these inventories concentrated in a 6 month period would be equivalent to a one-sixth reduction in gross fixed business investment.

The operation of the optimum inventory formulas for goods-in-process inventory investment is illustrated by data on the "machine setup" costs for non-continuous process ("batch" production) plants. In such plants the equipment is used at different times to make different products or different components of a given product; the more frequently the machines are switched to different products, the smaller is the average inventory of processed goods that must be held. With inventory carrying costs of over 20 per cent, the machine setup costs (as suggested in an industrial engineering textbook) (15) lead to a 4 per cent reduction in optimum goods-in-process and finished goods inventory in response to a two percentage point increase in the interest rate. As above, this is large enough to provide an important anti-inflationary effect.

Of course, the holders of most inventory may not be using the rational formulas or not adjusting the formulas' interest factors in step with market rates of interest, or they may find that the optimum inventory size is unaffected by such an adjustment because of a discontinuity in the rational inventory demand curve (16). Nevertheless, the above calculation does show the possibilities for significant rationally-based variations of inventory in response to changes in the rate of interest; and other, less sophisticated reasons for a business to economize on borrowing at high interest rates may also be operative.

The considerations just presented make it necessary to revise the accepted view about the part of inventory investment that is motivated by expectation of price increases. It is true that plausible interest rate increases could not prevent inventory investment where

(15) D. T. Canfield and J. H. Bowman, *Business, Legal and Ethical Phases of Engineering*, 2nd ed., New York, 1954, p. 87.

(16) Among the sources of discontinuity are discounts for purchases in quantities above a certain amount and full utilization of storage capacity. The latter will reduce the interest sensitivity in times of full employment but not in times of low employment when excess storage capacity should be available, so that only the comparatively small short-run variable costs of storage need be included with interest in the figure for inventory carrying costs.

a 7½ per cent price rise was expected in 6 months if inventory carrying costs were zero or 1 or 2 per cent over that period. But with business aware that annual carrying costs are 10% to 25% of the value of the inventory, expected price rises have greatly diminished significance. Thus, a 15% annual carrying cost would almost be sufficient to nullify the benefits from a 7½% price rise expected over the next 6 months. This indicates (a) that speculative additions to inventory should not be so important as commonly thought and (b) that plausible interest rate increases should be able to cause significant reductions in whatever speculative investments there are.

That inventory carrying costs have in fact minimized speculative inventory investments is indicated by a late 1956 *Fortune* magazine report that "These costs are very well known to treasurers, controllers and financial vice presidents, and these men are now getting more say in corporate decision making" (17).

The fact that econometric studies have not so far demonstrated any valid interest-inventory relationship need not be serious evidence against the relationship. In the first place, the limited periods of time over which useful inventory data have been available in most countries have generally been periods of low or stable interest rates (18); interest rates have been so low and their variations so small as to be below the threshold of perception in an activity in which they obviously could never be a major focus of attention. In the few instances in which interest changes have been large, fluctuations in price expectations (which affect the *real* rate of interest) have been greater than — and generally counteracting to — variations in nominal (money) rates of interest. In the United States it is only in 1957 and late 1959 that interest rates have increased enough to establish even the potentiality of significant influence upon inventories. Finally, there is the statistical problem of allocating causal responsibility between two factors such as the interest rate and sales volume which tend to move in the same direction at the same time.

A recent multiple regression study of total trade and manufacturing inventory investment during 1948-1960 found a very high

(17) See below, p. 177.

(18) The data actually needed for effective analysis would have to be provided on a constant-price basis, with a more than annual frequency, and classified by stage of fabrication — raw materials, goods in process, finished materials (Abramovitz, *op. cit.*, pp. 30-31).

correlation between the forecast series (based on pre-existing inventory-sales, new orders-sales, and order backlogs-sales ratios) and quarterly or semi-annual inventory changes. This high correlation was found even though the short term interest rate (the average prime commercial paper rate in the first half of the semester for which the inventory movement was being computed) had to be rejected as an independent variable. But the statistical ground for rejection of the interest rate " obviously does not exclude interest rates as a variable influencing inventory policy, and perhaps a quite important variable " (19). Presumably it is the considerations presented above which led the investigator to find the statistical rejection of interest rates inconclusive.

Belief in the possibility of finding a causal interest-inventory relationship today when none might have been found in the past is justified not only by the appearance of high interest rates but also by the rapid spread of scientific management in the last few years among the large business firms (see above page 144), the group which is responsible for most of business investment (20).

III. Dependence of Inventory Investment on Short-Term Credit

Although large firms hold a major part of total business inventory and the greater part of all manufacturing inventory, recent studies in Britain and the United States have reached the conclusion that these groups rely comparatively little on bank credit to finance their inventory investment. Insofar as this is the case, at least one of the links in the causal chain running from restrictive monetary policy to restraint of inventory investment is broken. Moreover, if large firms' inventory holdings are self-financed, restrictive monetary measures must discriminate against the small firms, whose inventories are considered to be particularly dependent on bank credit.

(19) N. E. Terleckyj, *Measures of Inventory Conditions*, National Industrial Conference Board, New York, 1960, pp. 22, 25-27.

(20) The domination of inventory investment by large firms in the United States is indicated by the fact that in 1953 two-thirds of all manufacturing inventories were held by firms having $50 million or more of assets and one-half by firms with at least $100 million of assets (U.S. Internal Revenue Service, *Statistics of Income for 1953*, Pt. 2, pp. 71, 75). In Great Britain 170 of the larger manufacturing companies are known to hold one third of total manufacturing inventory (one fourth of all business inventory). See *Board of Trade Journal*, January 14, 1956, p. 47 and April 21, 1961, p. 932.

With more recently available data and the introduction of further considerations, it is easily shown that the bank-financing link in the chain of causation between monetary policy and inventories is actually still intact.

Inventories and Bank Credit in Great Britain.

The impression has been created that British companies are extremely independent of bank credit (" overdrafts " or " advances ") and perforce would have little reason to reduce plans to enlarge inventory (" stock ") holdings when credit tightened. An investigation of the accounts of some 2,500 British companies (mostly manufacturers) having shares quoted on any of the U.K. stock exchanges (who represent roughly half of the output and employment of all private business) criticized the concentration of monetary policy measures in the mid 1950's on bank credit restriction. A 10% reduction in outstanding advances to the 2,500 quoted companies would have constituted a reduction of less than ½% of their capital plus long term debt (their " net assets "); and the real effect would have been much smaller, since cash holdings could have been drawn on to meet part of the loan repayments (21). The low ratio of outstanding debt to banks implied — 3½% to 5% of net assets for all but the smallest company size groups in 1953 — is confirmed by the ratio of change in bank debt to change in net assets, which was at the same low levels for the period end-financial year 1948 to end-financial year 1953 (22). Even when compared with the smaller figure of inventories, the ratio of bank credit change to asset change was merely 9% over the period (23). Moreover, the marginal loan-inventory ratio diminished with rapidity of growth in assets over the period (24). Finally, 46% of the 2,500

(21) *Studies in Company Finance*, B. Tew and R. F. Henderson, ed., National Institute of Economic and Social Research, London, 1960, p. 77. Previously, R. S. Sayers had concluded that the larger firms used relatively little bank credit. His reasoning was that they were in a stronger position than the smaller firms to indulge the businessman's instinctive abhorrance of bankers, and that the statistics available (referring to U.S. business during the 1930's) showed decreasing use of bank credit with size of firm (*Modern Banking*, 3rd edition, 1951, pp. 241-242). However, events in 1955-58 have caused Sayers to reverse that conclusion (*Modern Banking*, 4th edition, 1958, p. 208, note 1).

(22) Tew and Henderson, p. 80.

(23) *Op. cit.*, p. 276.

(24) *Op. cit.*, p. 84. The data appear to explain this by the rapid grower's having *started* the period with extremely *high* bank credits, however.

firms had *never* shown an outstanding bank credit in any of the six successive balance sheets. Only 22% (one third among the larger units) showed an increase in borrowing over the 5 year period (25).

The role of bank credit in Britain ought not be so inconsequential as these data suggest. It is proposed that they reflect the need to rely on company reports referring to one date per year (26). It will also be indicated that changes in bank credit during cyclical expansions — the kind that monetary policy normally seeks to restrain — should be much larger than the average change observed over a period of years. Together, allowance for these two points restores the presumption that British inventory investment is greatly dependent on short term credit conditions. Developments shown by the data most recently available, as well as allowance for the fact that the 1950's were a period of credit restriction, confirm this dependence on bank credit in "normal" conditions.

A strong presumption that the evidence on use of bank credit shown by the data from British companies' end-financial-year balance sheets severely understates the role of the banks is easily demonstrated in terms of choice of the "natural business year" for the balance sheet date and the reinforcement of the resulting bias introduced by "window dressing".

British law requires quoted companies to publish only 1 balance sheet per year and it permits free choice of the date used. The financial year-end dates chosen are in fact dispersed throughout the calendar year. Where the firm's business is seasonal, the choice of financial year end tends to fall naturally at a point just after the end of the main selling (or trade payment) season. But that is also just the time when the firm's cash holdings should be highest and its debt lowest. And the need for high cash holding (and/or large unused overdraft lines) at that time is accentuated by the fact that taxes, interest and dividends are commonly paid by large firms shortly after the balance sheet date (27).

Thus there is a very strong presumption that the only data on companies' use of bank credit available, the sum of the firms'

(25) *Op. cit.*, p. 18.

(26) That this might be a defect was noted, *op. cit.*, p. 77, but any such defect was ruled unimportant (p. 91).

(27) Among quoted companies, the greater part of net cash assets reported in 1953 was to be paid out in these forms shortly after the balance sheet date (S. J. Prais, "The Financial Experience of Giant Corporations", *Economic Journal*, June 1957, p. 255).

balance sheet data on loans from banks, show the position when the need for credit is abnormally low, and other short term obligations are abnormally high, so that they drastically understate the use of bank credit by individual firms. This conclusion is corroborated by other evidence on the prevalence of use of bank advances in British industry. In contrast with the 46% of quoted companies who had never shown an outstanding overdraft (loan), and the 10% who had shown it only in one of the 6 balance sheets checked, and with the half or more of all large companies who showed zero overdrafts in their 1953 reports (28), the National Institute of Economic and Social Research interpreted one of the surveys made for the Radcliffe Committee as indicating that bank credit had been used by between one half and three-quarters of the firms, and by three-quarters of the better-represented large firms with over 1,000 employees, in just one 6 month period (the period of credit squeeze that began in September 1957) (29).

A 1956 interview survey found that 70% of manufacturers with 200-500 employees had used overdrafts during a one year period (30). This compares with balance-sheet appearance frequencies of only 46% among 690 very small quoted companies (net assets under £250,000) or 29% if those showing overdrafts in oly 1 or 2 of the 6 balance sheets checked are excluded. (Among quoted companies with assets of £250,000-500,000, these percentages rise to 59 and 38 respectively) (31).

In addition to the underestimate caused by the necessity of relying on balance sheet overdraft figures, for some purposes there is a further underestimate that is due to combination of results for a succession of years. Normally, it is to be expected that over the long run short-term bank credit will bear a stable, fairly small ratio to net assets or to inventory holdings. With the gradual expansion of capacity, inventory investment occurs that is complementary to fixed investment, and represents "permanent" capital in the same way as does the fixed plant. Relatively little of this part

(28) Tew and Henderson, p. 284.

(29) Radcliffe Committee, *Memoranda* 2, pp. 89, 92, 94.

(30) H. F. Lydall, "The Impact of the Credit Squeeze on Small and Medium Sized Manufacturing Firms", *Economic Journal*, September 1957, pp. 429-430; and details for the larger firms kindly supplied by Lydall.

(31) Tew and Henderson, p. 286.

of total inventory investment should be financed by bank credits. But in cyclical expansions plant is operated more fully than is normal, and the ratio of necessary inventory to fixed plant increases abruptly. Fear of slowed raw material deliveries and speculative actions cause further non-permanent increases in the ratio of inventory to plant. These marginal inventory movements over the business cycle are the ones that should depend most on bank credit. And, in normal times, it is only when these very same additions to inventory are taking place that restraint of inventory investment becomes important. (Henderson's reference to an average of years over which cyclical growth was unimportant is not entirely unjustified: during the 1950's Britain had to try to restrain non-productive investments even before cyclical excesses were developing; and in these conditions the marginal bank credit/investment ratio need not have been much above the lower average ratio).

TABLE I

BANK CREDIT AND INVENTORY INVESTMENT
OF BRITISH QUOTED COMPANIES (a)

Rise in Value of Inventories (£ *million*)		Rise in Reported Bank Credit÷Rise in Inventories (*percentage*)
1949–53	1087	7 (b)
1949	134	10
1950	286	12 (c)
1951	655	17 (c)
1952	23	(— 150)
1953	— 12	(+ 360)
1954	225	10
1955	364	16
1956	343	21
1957	232	20
1958	1	(1400)

(a) Tew and Henderson provide only the aggregate figures for 1949-53. Separate yearly figures are found in NIESR, *Company Income and Finance 1949-53*, London, 1956, p. 15.

(b) This 7% marginal ratio for 1949-53 compares with a 9% ratio for the slightly different data of TEW and HENDERSON, p. 276.

(c) The 1950 and 1951 ratios rise to 26% and 22% if half the part of the rise in value of inventory that represents price inflation (rather than a physical increase) is eliminated on the ground that it is automatically self-financed — a nominal rise financed by nominal profits associated with it (cf., W. H. WHITE, "The Rate of Interest, the Marginal Efficiency of Capital, and Investment Programming", *loc. cit.*, note 3, page 52-53).

Separation of the National Institute's 1949-53 data by years shows these points clearly, and the continuation of the data after 1953 shows an even stronger statistical "dependence" of inventory on bank credit in years of high inventory growth.

Table 1 shows that the ratio of rise in bank credit to rise in value of inventory in years of rapid inventory expansion is two to three times the long term average ratio. In the years of low inventory investment, total inventory moves closer to its normal relationship with fixed plant (and bankers demand that temporarily over-borrowed positions be corrected), so that outstanding bank credit falls relative to inventory holdings.

With the marginal balance-sheet ratios of expansion years thus shown to be substantial ones, it is clear that elimination of the downward bias created by use of balance sheet data would make cyclical inventory expansions greatly "dependent" on bank credit. And further enlargement of the statistical ratio is required to eliminate the abnormal depressing effects of the credit squeeze exerted during the 1950's and to account for large companies' return to use of bills of exchange in the mid-1950's (32). The latter alone might double the credit-inventory ratios of Table I (33).

In sum, to the extent that statistical evidence can be relevant, the evidence now indicates that anticyclical monetary policy should not henceforth be frustrated by isolation of inventories from conditions on the money market.

Inventories and Bank Credit in the United States.

As in the case of Great Britain, it is often said that control of the cost or availability of bank credit cannot have much effect on American inventory investment because the companies who dominate total inventory changes are very little dependent on short term bank credit (34). This view is not the reflection of any downward bias from annual balance sheet data. Aggregate balance sheet figures are

(32) RADCLIFFE COMMITTEE, *Report*, pp. 67-68; *Minutes of Evidence*, pp. 379-380, 575-576. See also the additional adjustment to exclude the automatically self-financed part of the nominal (price-level) rise in unchanged physical stocks of inventory, note (c) to Table 1.

(33) H. B. ROSE, *The Economic Background to Investment*, Cambridge, 1960, p. 241.

(34) This is the view, for example, of the recent influential report, *Employment, Growth and Price Levels*, by the staff of the Joint Economic Committee of the U.S. Congress (Washington, December 1959, pp. 391-392).

available for all except the small manufacturing companies at the ends of the calendar quarters. That frequency of report should eliminate most of the seasonal and window-dressing distortions.

The opinion that large companies are little dependent on bank credit is again explained by concentration of attention on the low average ratio of short term bank loans to inventory holdings. It is also the result of the fact that, until recently, the data on the 20-odd giant manufacturers having assets over $1,000 million could not be separated from those of other large firms. These giants use very little short term bank credit. They can be properly set aside from the other large firms because (a) since separate data have become available the giants have played a comparatively small part in inventory investment and (b) they actually carry out very large amounts of short term borrowing through wholly-owned financing subsidiaries who take over the large firm's normal function of giving trade credit to customers but whose debt-ridden accounts are

TABLE 2

SHORT TERM BANK LOANS AND U.S. MANUFACTURERS' INVENTORY INVESTMENT

Asset size ($ *million*)	Average loan/inventory ratio, June 1956 (%)	Marginal loan/inventory ratio: March 1956-57 Actual	March 1956-57 Adjusted (a)	June 1956-57 Actual	June 1956-57 Adjusted (a)	Share of total inventory change, June 1956-57 (%)
up to 10	20	28	(25)	25	(17)	11
10–50	17	48	?	45	?	6
50–100	11	48	32	45	25	8
100–250	15	54	31	51	16	8
250–1000	9	35	30	36	25	46
1000–up	1	−15	−13	−4	−4	21
All companies	13	31		29		100

Source: Derived from Federal Trade Commission-Securities and Exchange Commission, *Quarterly Financial Report for Manufacturing Corporations*, first and second quarters, 1957.

(a) The adjusted figures make allowance for the fact that in times of tight credit American commercial banks require that 20% of outstanding loans be kept permanently on deposit. This proportion of outstanding short term bank loans was eliminated from the 1957 loan totals and 12% of the 1956 loan totals was eliminated from the 1956 loans totals, as tentative information suggests would be justified. The smallest class of companies is assumed to have had no blocked deposits at the start of the period and only a 1% blockage at the end; no assumption could be safely formulated about the broad next-to-smallest size class.

intentionally left unconsolidated with the parent company's accounts, for window-dressing reasons (35).

The marginal ratios of short-term bank credit to inventories for all manufacturing corporations during the most recent major cyclical expansion are presented below along with the average ratios usually relied on (36). To show that the ratios are very high for most of the large firms (even if not for the 23 giants), so that it cannot be claimed that small firms' inventories must bear the brunt of short term restrictions, these ratios are shown by size of company assets (Table 2). The role of each size group in the total inventory expansion is also indicated.

In contrast with an average loan inventory ratio of 13%, Table 2 shows a marginal ratio of 31% for all manufacturing corporations in the period of fastest inventory expansion. And while the average ratios decline consistently with size of firm, the relevant, marginal ratios rise with size of firm except for the two largest size classes, and in all cases remain higher for the next to largest size class than for " small " manufacturers (assets under $10 million). Since these are *ex post* figures that reflect the operation of restrictive monetary policy, they understate the scope for monetary policy influence on inventory investment. Even so, the adjusted 30% ratio found for the period of more rapid inventory rise among firms with assets of $50 million to $1,000 million should be adequately high for ample monetary effects on inventory (37).

(35) " Credit from Large to Small Business ", in *Financing Small Business, Report to the Committees on Banking and Currency... U.S. Congress*, Federal Reserve System, Washington, 1958, pp. 489-490.

(36) The main source for evidence that large firms' inventory investment is little dependent on bank credit is D. M. EISEMANN, " Manufacturers' Inventory Cycles and Monetary Policy ", *Journal American Statistical Association*, September 1958, pp. 680-690. Although that study did give some attention to the marginal loan inventory ratios, the chief evidence (which was the source of the comparison by size of firm) was either vitiated by the need to include the few giant companies which give the appearance of being little dependent on short term credit or else was based on the meaningless average loan/inventory ratios. (That study contained a number of secondary arguments against using monetary policy to influence inventories which will be taken up in the fuller presentation of the writer's study).

(37) The problem of whether the marginal dollar of credit was used to finance inventories rather than some other assets reduces the significance of the statistical loan/inventory ratios. Partial correction of possible biases can be made by use of the ratio of change in bank loans to change in net short term assets (short assets net of short liabilities other than bank loans). When this is done for the adjusted figures, the marginal loan ratio of mid 1956 to mid 1957 is found to be 25% for the under-$10 million firms and 26% for all firms with assets over $50 million. This corroborates the results found for the loan/inventory ratios.

The present discussion is concerned with the possibilities for influencing inventory investment by changing the *cost* of money (rather than its availability). In that context, the scope for monetary policy is not determined simply by the size of the bank-financed share of inventory expansions. A rise in the cost of money would take its effect even if inventory expansions were not accompanied by any increases in use of short term bank credit. The large firms' financial officers would be aware of an alternative to paying increased interest rates on the unchanged amount of debt outstanding, *viz*: reduction of the planned inventory expansion and repayment of a part of the existing debt with the funds thereby conserved.

The several considerations just presented seem sufficient to overrule the popular opinion on short-term interest rate policy in the United States: the inventory investment of larger American companies is *not* so independent of bank financing as to preclude significant achievements by anti-cyclical monetary policy.

IV. Evidence on the Potency of the Interest Rate

The preceding discussion has shown that the deductive and inductive reasons for denial of interest rate effects on inventory are at least far from conclusive and at worst erroneous. However, it has not been possible to establish that plausible variations in the interest rate must have an important influence on inventory investment. That is a matter which can be determined only by empirical evidence on business behavior. No truly satisfactory empirical evidence is available. Nevertheless, after careful consideration of its possible defects, the evidence that can be found does permit the investigator to conclude that the short-term interest rate may significantly influence inventory investment.

British Evidence on the Interest-Inventory Relationship.

If short-term borrowing is to be significantly affected by interest rate changes, Great Britain should provide a good test. With somewhat higher and perhaps more volatile bank interest rates than those of the United States and with somewhat lower rates of business taxation in the last few years, absence of an appreciable interest-inventory causal relationship might approach being fairly conclusive evidence that the relationship would not exist in any country (38).

(a) *The Prewar Oxford Surveys.*

With almost no other formal surveys of interest rate influences on inventory investment available, it may be worth while to go back to the pre-World War II Oxford surveys. As discussed elsewhere (39), various characteristics seem to cause these surveys to understate the possible role of interest rates in fixed investment decision-making. With interest costs presumably less significant in inventory than fixed investment decisions, these surveys must be so biased that negative findings could not constitute very useful evidence against an interest-inventory relationship. Consequently, if the surveys could be shown to record any appreciable amount of interest effect, the results would have to be read at the least as consistent with usefully high interest elasticity of inventory demand.

Abramovitz relied for empirical substantiation of his 1951 conclusions on his finding that "none" of the 37 businessmen interviewed for the 1938 Oxford survey "said that the cost of borrowed funds affected his calculations about the volume of stocks (inventories) he should hold" (40). However, the surveyors did report — in, it is true, a grudging way — indications of interest rate sensitivity by 2 of the 37 respondents: A consumer goods manufacturer "says that bank rate would affect the carrying of stocks, but admits that stocks would not be increased solely because of a fall in bank rate" (41). The qualification with which this case was dismissed acquires significance in the light of the wording of the inventory query in the questionnaire distributed for the interviewed businessmen's guidance: "Have you ever increased your stocks of raw material on account of a fall in bank rate?" (42). Now bank rate tended to be reduced in times when business was

(38) The creeping inflation in Britain during the mid-1950's may disqualify any such evidence. However, by late 1957 fears of inflation had abated.

(39) W. H. White, "Interest Inelasticity...", *op. cit.*, pp. 572-573.

(40) Abramovitz, *op. cit.*, p. 126.

(41) *Oxford Studies in the Price Mechanism*, T. Wilson and P. W. S. Andrews, eds., Oxford, 1951, pp. 28-29. The other case was a merchant who said that only merchants carrying inventories for speculation on "small price changes would be affected, but that the volume of stocks of this type was not heavy".

(42) *Op. cit.*, p. 27.

getting worse, and there would therefore be a tendency at least for business to *reduce* inventories at times of rate reduction. It remains possible that the respondent would have been led to reduce stocks by a *smaller* amount because of a rate reduction, or at least that bank rate *increases* would have definite effects on desired stockholdings. (While they might be inadequate to convert a desired increase into a decrease, they presumably could reduce the size of planned increases or cause a reduction in otherwise unchanged stockholdings). In short, if, as the quotations above make likely, the discussion was primarily in terms of bank rate reductions (it is stated, however, that the guiding questionnaire was generalized in the course of discussion), then the inquiry obviously tended to exclude the conditions under which the interest-inventory relationship would be most likely to be discovered.

Certain additional considerations must be introduced in the evaluation of the fact that all but two of the 37 firms covered were insensitive to interest rate changes. " The reason usually given for this is either that the business does not borrow from the bank or else that the effect of changes in the rate is too small in comparison with the profit margin to make any difference " (43). The first of these two reasons may have been important to the conservative, depression-bound businessmen of prewar England, but little insulation of larger business from credit market conditions should exist for that reason in current conditions (see evidence presented earlier). As for the second reason, required rates of profit may have been abnormally high because of the high risk allowances of depression times, but evidence presented below shows that desired net-of-tax rates of return on new investment are now below 10% for a majority of the larger manufacturers. The effect of this decline in net profit rates is at least partly counteracted by the accompanying rise in income tax rates. But, in any case, the height of profit margins becomes less of a barrier to interest sensitivity as the Hawtreian optimum inventory formulas become popularized.

A third consideration with respect to the 35 out of 37 firms found to have reported complete insensitivity of inventory to interest rates is that these include 3 cases of slight sensitivity: " very little ", " practically no ", or " very small " effects (44). If the impression that

(43) *Op. cit.*, p. 28.
(44) See *Oxford Economic Papers* No. 1, 1938, p. 15.

these replies were primarily about bank rate reductions (excluding consideration of rate *increases*) is correct, then it is fair to assume that somewhat stronger reactions would have been reported to a more meaningful formulation of the interest-inventory question.

This assumption gets support from the results of the *second Oxford survey*, made in 1939, which did inquire about interest rate changes in general, and referred specifically to interest rates charged borrowers by the banks. As tabulated by the surveyors, this investigation found a much larger proportion of the desired inventory holdings of respondents being influenced (at one time or another) by interest rates, *viz*; 14 per cent of the 294 who answered the question (45). As described in White, *op. cit.*, at least half the respondents to the second Oxford survey who were unaffected by interest rates were self-financers or were small or weak firms. With a sample chosen to give proper weight to the holders of most of the country's total inventory, it is possible that very much more than 14 per cent would have reported some interest-inventory relationship. And even the 14 per cent figure could connote useful results from short-term interest rate adjustments; as described above, where inventory is involved, affected firms not only reduce their investment but can convert it to a *negative* figure, so that useful results can well be obtained from interest rate policy when only a quite small proportion of firms is sensitive to interest rates.

In summary, the prewar Oxford surveys should not be taken as evidence against a usefully strong interest-inventory relationship and they probably can serve as evidence in support of such a relationship.

(a) *Recent British Evidence.*

There is no consensus on the value of interest rates among British observers; and, when endorsements are given to interest rate policy, they generally refer to long-term interest rates as a determinant of long-term investment.

The most influential modern source of information on the role of interest rates in British inventory investment is the report and the

(45) Derived from the table in *Oxford Studies*, pp. 56-60. Only 8% checked credit and capital *availability* as factors in the inventory investment decision, although this may be due to most of the period for which respondents answered being one of recession or worse, with easy money prevailing.

evidence of the Committee on the Working of the Monetary System (Radcliffe Committee). This expert body is completely unequivocal in rejecting the idea that interest rate variations can affect inventory holdings. "If the wide fluctuations [a range of 4 or 5 percentage points!] could usefully be confined to the short rates, the case might be strong. But we have found that stocks of commodities are extremely insensitive to interest rates" (46).

A contributing factor to this conclusion was probably the balance sheet evidence interpreted as showing that little use was made of bank loans by British companies (discussed above), for the Committee's *Report* cited the balance sheet data as evidence of the extent of companies' independence of the banks, even noting that cash holdings in 1953 were several times the amount of outstanding bank loans (47).

A necessary condition for the Committee's negative finding on short term interest rates was what seems to be serious misinterpretation of two large-scale surveys of British business that were made for the Committee's use. In both instances the Committee appears to have greatly underestimated the strength of the sensitivity to interest rates that was indicated, and in both cases they were able to dismiss whatever indications of interest sensitivity they did discern on the dubious ground of "non-response bias": so small a proportion of the respondents returned their questionnaires that it could be assumed that what responses were received over-represented those business that were anxious to complain about the effects of tight money (48).

Because of the complexity of the problem of interpreting the results of the Committee's voluminous but poorly-designed surveys, extracting the true meaning of the survey results would necessitate a thorough examination. But because they constitute the most comprehensive and up-to-date evidence available, that effort is justified.

(46) Radcliffe Committee, *Report*, p. 174.

(47) *Report*, p. 109.

(48) The interpretation the Committee gave the evidence on inventory investment provided by the 8 giant firms is uncertain. The testimony shows that only 2 of the 8 believed that money costs influenced inventory. One said the high rates following 7% Bank rate caused the firm to restrict inventories (see above, p. 144), and the Chairman of Ford — a firm which was unaffected because it used no outside financing and held the technological minimum of inventories — volunteered the opinion that the credit-using members of the British automobile industry would be led to cut inventories by the high borrowing cost (*Minutes*, p. 780).

F.B.I. Inquiry

In the summer of 1957, the Federation of British Industries received 1,600 responses from manufacturing firms to a mail survey covering various monetary policy issues that were of interest to the Radcliffe Committee. The Committee minimized the findings on the ground that the 30% rate of response achieved was too low; it created a presumption that a disproportionately large segment of those firms that had suffered from the restrictive monetary measures took the trouble to answer and hence were overrepresented in the responses (49). Such overrepresentation may exist for the "small people" among those queried, for the F.B.I. reported that their response rate was "very bad". On the other hand, "the rate of return was better amongst the larger firms than the smaller firms" (50). This suggests that the rate of response was much higher than 30% among the large manufacturers — the ones who are of chief interest because they dominate inventory investment. After allowance for other, non-biasing explanations of the high overall rate of non-response offered by the F.B.I. (the discouraging length, complexity, and obscurity of the questionnaire form and the absence of many of the business officers on summer vacation) (51), the *large firm* response rate can be assumed sufficiently high to be free of "non-response bias". The fact that there were as many as 555 replies from "large" manufacturing firms (firms with more than 700 employees, exclusive of those whose financial decisions were controlled by a parent company) is further corroboration of this inference. The total number of such companies in Britain should not be much over, say, 1,000, and many are not members of the F.B.I.

Only one of the survey questions bore directly (and with sufficient clarity to permit analysis) on inventory investment. This asked if the Bank rate increases of January-February 1955 were:

A *major* factor in taking your business decisions. If so, did it cause you to:

(a) modify the market expectations for your product?

(b) .....

(49) Radcliffe Committee, *Report*, p. 160.

(50) *Minutes of Evidence*, p. 371.

(51) *Op. cit.*, p. 372.

(d) reduce or defer raising your stocks of purchased goods because of its effect on costs?

(e) reduce or defer raising your stocks of purchased goods because you considered it to be a danger signal?

(f) take any other action? (52).

Only 9% of the 545 large manufacturers answering said that the 1955 Bank rate rise was a major factor in business decisions, and a mere 4% — 20 firms — said their inventory investment was restricted by the *cost* aspect of the Bank-rate rise.

The true significance of this small rate of reaction to a borrowing cost increase can be evaluated only after consideration of the circumstances. Three aspects must be examined: The consequence of allowing answers only from those for whom the bank rate rise was "a *major* factor in taking your business decisions"; the proportion of the respondents then using bank loans and thereby exposed to the influence of bank rate changes; the size of the borrowing cost increase experienced.

The restriction of the question to firms for whom the Bank rate increase was a major factor in business decisions probably excluded the larger part of the respondents who were vulnerable to interest rate changes. Even accepting the 4% figure as fully representing the frequency of major effects on inventories, it is plausible that twice as many firms experienced "moderate" effects on their desired inventory holdings from the rise in borrowing costs but could not call this a major factor in their business decisions (53). This much enlargement of the frequency of interest rate effects on inventory should suffice to establish a strong case for interest rate measures. The considerations presented below will make the case stronger still.

As described earlier, perhaps a quarter to a third of the larger companies never used bank credit. The replies to one of the F.B.I. questions on the "credit squeeze" are fully consistent with such a figure. Moreover, these replies show that only 209 of the 550 large-

(52) Radcliffe Committee, *Memoranda 2*, p. 120. Items (b) and (c) contained the same queries as (d) and (e) in respect to fixed investment.

(53) This point was made by the FBI in discussing the survey results with the Committee, *Minutes*, p. 374. As stated, the question appears to include only those firms that reduced or stopped increasing inventories; moderate effects would embrace those cases in which inventory growth was reduced but remained above zero.

firm respondents were able to borrow *as much* from the banks as they desired during the year 1955 (54). This suggests that the 20 firms who reduced their inventory investment because of the early 1955 rise in interest rates should have been compared, not with the 545 respondents to the Bank rate question but with the 209 firms for whom credit rationing did not constitute a limitation on investment that was stricter than the borrowing cost limitation. Firms that report that they are affected by credit rationing are not in position to respond to a rise in the cost of credit; at pre-existing cost levels they would have wanted to borrow more, and hence a rise in borrowing costs can not have a major affect on the amount of borrowed funds they use — especially so when the rise in cost is accompanied by tightened rationing.

Evaluating the 20 interest-rate sensitive respondents against the perhaps 250 non-rationed users of bank credit raises the proportion whose inventory experienced a major effect from 4% to 8%. After, say, trebling this figure to allow for the more numerous group that experienced only moderate effects, quite important results are indicated for those "normal" times in which rationing pressures imposed by the authorities would not be applied to the large firms (55).

The significance of the indicated inventory restrictions must be evaluated in the light of the *size* of the interest rate increase which produced them. The Radcliffe Committee was probably helped in reaching its skeptical conclusion by the fact that the Bank rate increase concerned was the very large figure of 1½% points (from 3% to 4½%). However, the accompanying change in the interest rates charged by banks was in most cases a mere half per cent. "The normal rate to customers is 1 per cent over Bank Rate with a minimum of 5 per cent". This means that only the part of the Bank rate rise that was between 4% and 4½% was accompanied by a parallel rise in the bank's lending charges (56). (Some of the

(54) *Memoranda 2, loc. cit.* The introduction of tighter credit rationing after mid 1955 may mean that this figure somewhat understates the number of non-rationed bank customers.

(55) This remains true even if the percentage found is reduced to allow for those firms that could not be affected simply because they did not need bank credit and for those cases in which credit rationing had restricted other, less urgent activities than inventory investment. Those firms that did not need bank credit during 1955 should have included a disproportionately large share of low investors. Hence they detract less from the scope for interest rate effects on inventory than their numerical importance would suggest.

(56) *Report*, p. 143. The minutes of the Committee's inquiry into the survey contain frequent references to the 1.5% rise in Bank rate (*e.g.*, pp. 374-376), but no references to the

very large companies may have been able, like the nationalized industries, whose borrowings bore the government's guarantee, to push their borrowing rates down to 4% when bank rate fell to 3%, and any such firms would have experienced a 1% rise in 1955. It may be that such firms account for a disproportionately large share of the large firms' affirmative replies on money costs).

There is a strong presumption that one-half percentage point increases in short term borrowing charges are below the threshold of perception for a major portion of borrowers, and for most of the rest would not be sufficient to overleap the threshold by enough to produce "major" effects. Therefore, the much larger rate movements that are frequently produced in the U.K. can be plausibly expected to elicit much higher frequencies of report of effects on inventory.

These successive adjustments of the published figures to eliminate biases may suggest an impossibly inflated role for interest rate changes — e.g. 40% of the large companies being affected by a 1 or 1½% rise in banks' loan rates at a time of fairly stable prices and little reliance on the rationing form of restrictive monetary policy. The plausibility of so high a percentage of interest-sensitive large firms is, however, confirmed by the response to another of the survey's questions that touched on interest rates. The question:

> Does your judgment of the profitability of new investment vary from time to time according to the prevailing rate of interest?

was answered affirmatively by 41% of the large companies (57). This widespread attention to the market rate of interest is made reasonable, in turn, by the lowness of the "rate of... return on new investment" firms apparently required. Two-thirds checked 10% or lower net-of-tax rates of return for what they "considered as being reasonable at the present time" (58).

In sum, the Federation of British Industries survey of about 550 large manufacturing firms is strong evidence that interest rate policy should affect inventory holdings significantly. The case developed is so strong that more conservative adjustments for obvious biases

size of the accompanying rise in borrowing costs. This suggests that, at the time it made up its mind about the FBI findings, the Committee was unaware of the smallness of the borrowing cost changes that were at issue.

(57) *Memoranda* 2, p. 120.

(58) *Ibid.*

than those made above could not change this finding. The finding is corroborated by the results of another large-scale survey made in early 1958 after Bank rate had been raised to the "crisis" level of 7 per cent.

Chambers of Commerce Survey

In the Spring of 1958, the Association of British Chambers of Commerce sent a "representative sample" of 16,000 of its "manufacturing and merchanting" members a survey prepared for the use of the Radcliffe Committe (59). This survey inquired about declines, following the raising of Bank rate to 7% in September 1957 and related emergency measures, in sales, or fixed or inventory investment. A check list, from which one principal explanation could be selected, was provided: "a general slackening of business", related unfavourable business conditions, and the various restrictive measures of September 1957. Questions were also asked about the effects of these various measures on bank credit, on long-term financing, etc. 3,600 replies were received — a 22% rate of response. Large firms (in this case, firms with over *1,000* employees) were represented by replies from 291 manufacturers and 24 non-manufacturing firms.

At least three-eighths of the firms with over 1,000 employees that had bank loans outstanding during the period said they reduced or paid off the loans because of the two-percentage point rise in bank borrowing costs of September 1957. Exclusion of the quarter of the credit-using firms whose demands were being restricted by the (intensified) credit *rationing* of the period would raise the three-eighths figure to one half. Since the survey did not ask directly about the causes of inventory investment reductions, these borrowing reactions can not be causally linked to inventory reductions: fixed investment reductions (and, in a few cases, liquid asset cuts, etc.) must account for a portion of the reduced borrowings, although it seems reasonable that a major portion would be reflected in inventory investment reductions (60).

(59) *Memoranda* 2, p. 88.

(60) See W. H. White, "Bank Rate Vindicated? - Evidence before the Radcliffe Committee", *The Bankers' Magazine* (London), August 1959, pp. 98-104.

Only 21% of all the larger respondents reduced their inventory investment to a negative figure. But many more must have reduced it less drastically; consequently, ample scope for

The reported rate of borrowing-cost sensitivity is very much higher for the wholesalers plus a few retailers surveyed (most of whom had under 100 employees). Apart from a few borrowers not answering about rationing or borrowing-cost reactions, practically all of the non-rationed borrowers said they had cut borrowings because of the rise in borrowing costs. And a somewhat larger of wholesalers reported doing negative inventory investment.

When the Radcliffe Committee considered this strong evidence of the influence of short term interest rates, it was unfortunately misled by reliance on a summary table into which the query:

> Since September 1957 have you... taken steps (a) to reduce or (b) pay off bank borrowing because of the [1½-2 percentage points] increase in costs?

was fitted by Procrustean means to read:

> Taken steps to reduce overdraft (61).

In its final Report, the Radcliffe Committee depreciated this survey on the ground that only a small proportion of the questionnaires mailed out were returned, which justified the suspiscion that the list of responding companies was overweighted with firms who wished to complain about tight money. That may be the case for the smaller respondents, but it seems unlikely to apply to the 315 respondents with over 1,000 employees, including 291 manufacturing respondents. Although statistics are lacking, it can be shown that there probably were not much more than 1,000 manufacturing companies in Britain that had over 1,000 employees (62). And the

inventory reactions by the interest-rate sensitive 28% of all large firms (*i.e.*, three-eighths of all large firms that were borrowing from banks) should exist.

(61) See White, *loc. cit.*, pp. 99, 101 and Radcliffe Committee, *Minutes of Evidence*, pp. 757-761, wherein numerous queries were put to the A.B.C.C. representatives about the meaning of the small proportions of firms who gave high interest rates as the chief explanation for the reductions they had experienced in sales and/or fixed and/or inventory investment. The fact that a large proportion reduced their overdrafts (loans) because of the high interest rate was completely ignored (as was the fact that most giving a chief reason for the three declines noted above were referring to *sales* declines and of course gave the obvious reason, "slack business", etc.).

(62) For example, it would probably be agreed that British manufacturing firms with over 1,000 employees should be at most no more than half as numerous as the 1,780 American

A.B.C.C. questionnaire was mailed to "representative samples" comprising only 30% of the membership of the various Chambers of Commerce. Even if all large manufacturers belonged to the A.B.C.C., this would suggest that only a few hundred of them received the questionnaire, so that the 291 respondents should represent a large enough proportion of those queried to rule out serious "non-response" bias.

The Committee had one more reason for discarding the A.B.C.C. results: business was worsening in the Autumn of 1957, and business executives tend to rationalize admissions of poor business in terms of factors beyond their control such as high interest rates (63). This explanation would be made dubious merely by the fact that much more persuasive rationalizations were provided by the survey and were predominantly cited ("slack business", "increased competition", "tight money", "hire-purchase restrictions", etc.). The explanation is completely discredited by the form of the A.B.C.C. questionnaire. The question indicating high interest sensitivity was one of a list of innocuous, technical questions on bank credit: changes in certain forms of credit rationing since September 1957 and effect of subsequent rise in cost of credit on use thereof. Emotional blocks might have prevented the executives from giving the true single explanation for sales and/or investment reductions, but they should *not* have also influenced the answers to this question.

In brief, the two large-scale surveys of big manufacturers made for the Radcliffe Committee in 1957-58 must together create a strong presumption that interest rate changes can have a significant effect on British inventory investment.

This conclusion has been reinforced by more recent observations of the National Institute of Economic and Social Research and the Governor of the Bank of England. The Economic Research group, in a discussion of balance of payments developments, mentioned of imported materials inventories:

firms in this category (*Survey of Current Business*, June 1959, p. 19). Direct evidence is provided by reduction of the known labor force of all quoted British manufacturing companies to exclude the known labor force of the 35 largest firms in the group. The average labor force among the rest of the firms is a little over 1,000, but the necessary skewness of the distribution assures that the median firm — which happens to rank about 1,000th — has under 1,000 employees.

(63) *Report*, p. 160.

In the first quarter of 1958, they began to fall probably partly in reaction to the increase in Bank Rate to 7 per cent in the Autumn of 1957 (64).

The central banker, reporting later, had still stronger findings:

It is too early to assess exactly the part played by monetary measures, individually or collectively, in restraining the boom which was gathering force in the spring. But experience since September 1957 suggests that monetary policy in general, and Bank Rate in particular, exercises greater influence now, when there is more underlying stability in the economy, than it could in the early years after the war, when the economy was distorted and inflationary pressures overwhelming. Indeed it may well be the case that, had the Radcliffe Committee taken its evidence two years later, witnesses would have ascribed considerably more force to monetary measures than they did at the time (65).

United States Evidence on the Interest-Inventory Relation

(a) *Recent Reports on Business Inventory Plans*

The likelihood that inventory investment in the United States has been becoming at least potentially sensitive to interest rates is established by the revival of interest in optimum inventory formulas. This is indicated by the number of articles published by business officers in recent years showing that their companies use inventory formulas which include interest rates or other cost of capital (66).

It is possible, of course, that because of approximateness in some of the data used in the formulas and of the subordinate role of interest costs in total inventory carrying costs (or for other reasons such as inertia) the interest rate figure used is commonly left unchanged when the market rate of interest or other form of cost of

(64) *National Institute Economic Review*, January 1959, p. 5.

(65) *Bank of England Quarterly Bulletin*, December 1960, p. 19.

(66) A dozen of those reported to use such inventory formulas are (Companies' 1957 rank by sales shown in parentheses): Allied Chemical (52), American Machine and Foundry (166), American Thread (n. a.), Bucyrus-Erie (396), Clevite Corp. (455), General Electric (5), International Business Machines (37), Johnson and Johnson (169), Minnesota Mining and Mfg. (106), Proctor and Gamble (31), St. Regis Paper (113), Westinghouse Electric (14). Details on the source of this information — magazines such as the *Controller*, *Harward Business Review*, and *Purchasing* — are given in the full version of this study.

capital varies (67). And many large firms no doubt do not use scientific formulas at all for inventory planning. In addition, finished goods inventories may not be easily controlled with such formulas, owing to unpredictability of retail sales. For example, the findings of a study made a few years ago on management of finished-goods inventory by large home laundry equipment manufacturers won for that study the title, " The Theory of Inventory (Mis) Management " (68).

Limited popularity for scientific inventory management is indicated by a large-scale survey published in 1958 which found that only " some " respondents used the rate of return criterion for their inventory investment, with a similarly restricted proportion said to be using the optimum inventory formula in connection with goods-in-process inventories. However, the survey included small as well as large firms and may be dominated by smaller respondents. Consequently, and since tight money is reported to have stimulated the spread of scientific inventory management (cf., later statement by the same organization below), this evidence is not necessarily inconsistent with sufficiently widespread use of the formulas by firms doing a major part of inventory investment (69).

Although, for the reasons given, the evidence on the spread of inventory formulas cannot by itself be taken as showing that

(67) A one percentage-point interest-rate rise in an otherwise unchanged total inventory carrying cost is shown by two successive articles on the inventory procedures of the firm listed second in the preceding footnote.

A clear indication that the interest factor would be varied appears to exist in the case of a manufacturing firm with 1,800 employees; " the treasurer of the company agreed that a figure of 4% would adequately express the cost of money invested in additional inventory " because at the time (1955) the firm had " access to adequate working capital at a short-term loan rate of 3.75% ". The large increase in short-term rates since 1955 must have forced an increase of the interest rate used for planning inventory. Moreover, with total carrying costs for some of the firm's inventory computed at as little as 6% (the cost for " all except the bulkiest items " being " considerably less than the 25% rate previously [prior to the 1955 recomputation] used "), the resulting reduction in desired inventory should have been quite significant (provided fuller use of storage capacity as business expanded had not raised marginal storage cost too much).

See W. G. Briggs, " Calculating Economic Manufacturing Quantities for Better Inventory Controls ", *N.A.A. Bulletin*, October 1957, pp. 57, 59, 62, 64.

An explicit instance of reduction of optimum lot size because of 1957's high interest rates is provided by the case of a 150-employee manufacturer cited as an illustration of a *Wall Street Journal* survey's results (*Wall Street Journal*, June 24, 1957, p. 10).

(68) Rocco Corzo, Jr., " The Theory of Inventory (Mis) Management ", *Business Horizons*, Fall, 1958, pp. 107-110.

(69) See C. G. Baumes, *Inventory Management in Industry*, Studies in Business Policy No. 88, National Industrial Conference Board, New York, pp. 6, 7, 19, 21.

inventory demand is significantly interest elastic, it does make more credible the surprisingly strong claims in 1957 by businessmen themselves that inventory is affected by high interest rates — claims which might otherwise be discounted as business rationalizations for falling sales and as the reflex reactions to any condition which, like high interest rates, raises the cost of doing business. (A number of the reports cited below, having been made within the business fraternity, are in any case not likely to be twisted by public relations considerations or to claim awareness of what the fellow businessman would recognize as impossibly refined financial considerations) (70).

(b) *Informal Inventory Surveys during Tight Money Period*

There seems to be no systematic survey of inventory investment available for the period of high interest rates beginning with late 1956. The sketchy survey results which are available provide at least clues to what survey findings might be.

Fortune magazine has conducted quarterly surveys of the inventory plans of a few hundred companies. The surveys asked, in addition to quantitative information, for a checking of factors responsible for the respondents' intentions. The survey of October 1956 led to a forecast that, despite expectations of an expanding sales volume in 1957, the size of inventories would not be significantly increased — a forecast which proved correct. No tabulation of reasons given for the desired reduction in inventory-sales ratios was published, and the statistics are no longer available. However the interest rate increases of late 1956 appear to have played some part in respondents' decisions to restrict inventory expansion:

> Some executives would like to increase inventories more than this, for they are coming to regard inventories as safer than cash. "We've never gone wrong as far in the postwar holding steel", one executive recently remarked. "The price never declines and I don't think it ever will". But executives must balance the value of holding inventories as an inflationary hedge against the costs. These costs are rising: they range upwards from 4 to 4½ per cent for money, and added to that are the expenses of... storage... and the risk that production specifications may change.

(70) For example: "Tight money is twisting the plans of a growing number of American businessmen. Some are postponing or cancelling carefully-laid expansion plans. Many are keeping a closer eye on inventories so as to limit costly borrowing" (*Wall Street Journal*, June 24, 1957, p. 1).

These costs are very well known to treasurers, controllers, and financial vice presidents, and these men are now getting more say in corporate decision making (71).

The only other factor mentioned was improvement in inventory control — and this was only hinted at (72).

During 1957 two additional factors contributing to the realized reduction in inventory investment appeared; first, the rise in production capacity for goods used in inventories which made it unnecessary to hold surplus inventory as insurance against delivery delays; and, then, the (perhaps consequential) drop in demand for business production which made it desirable to reduce inventories significantly.

These two factors were mentioned in early 1957 by the chief economist of the National Industrial Conference Board, reporting on a late 1956 survey of 200 N.I.C.B. member companies, but he nevertheless listed as a primary influence on inventory investment: "Considerably lower liquidity on the part of corporations and relatively higher borrowing costs, both of which are dissuading business from substantial further net investment in inventory" (73).

In the same vein, in May 1957, the commentary accompanying the monthly poll of the 200-member survey committee of the National Association of Purchasing Agents said: "With money costs high, materials readily available and some production schedules uncertain, the 'heat' remains on to effect inventory reductions whenever possible" (74).

There were four fairly significant surveys that touched on the effects of high interest rates on U.S. inventory investment during the period of tightest money, mid-1957 and winter 1959-1960. All suffer from serious deficiencies for the purpose under discussion. But the points at which one survey has deficiencies tend to be strong points in another of the surveys. And the composite result constitutes strong circumstantial evidence that interest rates may significantly influence inventory investment in the United States.

(71) "Business Roundup", *Fortune*, November 1956, p. 44.

(72) *Ibid.*

(73) Testimony of M. R. Gainsburgh, *January 1957 Economic Report of the President, Hearings before the Joint Committee*, 1957, p. 125.

(74) *Bulletin of the National Association of Purchasing Agents*, May 1957, p. 1.

Information on the size distribution of respondents was available only for the first of these surveys, a July 1957 inquiry by the magazine, *Fortune*. The published description of the survey's results concentrated on " tight money, a shortage of working capital, and a consequent improvement in inventory control as the reasons " — cited by " many executives " — for inventory restriction (75). In fact, disregarding the three-eighths of the manufacturers that were expanding their inventories for obviously overriding " important reasons " (expected sales expansion and opening of new factories), one-fifth of the 54 respondents checked the factors " tighter credit " and " tighter financial position generally " as " important reason " for planned reductions of inventory over the following 12 months. Only 2 of the 54 offered high interest rates as explanation for reducing their inventories.

It seems reasonable that a substantial portion of these citing the tight credit explanations could actually have been affected by higher interest rates, and if that is the case these results constitute a good indication that interest rates have sufficient influence on inventory investment. This is so for a number of reasons:

(a) The survey form suggested all the explanations listed above (plus several others) but appears *not* to have included high interest rates in the list. In that situation it is natural for interest sensitive respondents to check tight credit and tight finances as the explanation, since high interest rates are embraced in the concept of tight credit and because unwillingness to pay high interest rates should tend to cause a tightening of the firm's financial position before it led to inventory restrictions. That unavailability of credit is unlikely to claim many of these " tight money " replies is indicated by the fact that most of the firms citing tight money were very large ones and all were earning good profits at the time.

(b) Answers in cases where the high borrowing cost reduced the size of the inventory expansion otherwise planned could not include reference to the interest rate, for high borrowing costs can not be offered as an " important reason " where a *rise* in inventories is to be explained.

(c) Firms for whom pressure to expand inventories was counteracted by the high cost of money could not be represented, since

(75) " Business Roundup ", *Fortune*, August 1957, p. 50.

only those planning to *change* their inventories over the following 12 months were to reply to the question. (One large, profitable firm — assets $175 million — volunteered that despite expectations of a 5% sales rise, high interest rates would cause it to *reduce* inventory 10%) (76).

(d) While no hint of the imminent recession is to be found in this survey's responses, it is possible that many respondents really had the overriding reason of expected sales decline in mind by July 1957, but for public-relations reasons refrained from citing that factor.

(e) Over the 11 months preceding the date of the survey, the sensitive interest rate on prime commercial paper had risen only ¼ percentage point, and the banks' prime loan rate (4%) had not risen at all (although cases of increases in banks' compensating deposit balance requirements may have continued to appear as late as mid-1957). With the relevant interest rate thus comparatively stable, it is unlikely that high rates could have been the explanation for any discrepancy between the actual and the desired level of inventory. If firms were dissatisfied with existing inventory levels and were planning to make a change, some other factor would have to be responsible in most cases.

(f) Finally, to have offered interest rates as an important reason for planning changes in inventory over the next 12 months, most firms would have had to be able not only to forecast interest rate levels over much of that period but also to forecast that a significant change in rates would occur and that other economic changes would be less powerful ones.

In brief, the mid 1957 *Fortune* magazine survey of large and medium-sized manufacturing companies is inconclusive but suggests a likelihood that interest rate policy may have an important influence on inventory investment.

With economic recovery and with interest rates rising to a new peak at the beginning of 1960 (prime loan rate 5%, or 6¼% inclusive of compensating balances), the results of a *Business Week* survey of company executives in February of that year appear to

(76) The other firm volunteering high interest rates as important reason was a $20 million assets manufacturer of clothing — an industry that seems particularly sensitive to interest costs.

have been much more clearly indicative of interest sensitivity for inventory investment. Nearly a quarter of the surveyed firms planned no inventory expansion for 1960, and half of the remaining firms planned self-financeable expansion only. The published results say:

While smaller companies are pinched the hardest, bigger corporations aren't altogether immune from the money squeeze. True, they have had little trouble in borrowing, but they are paying rates that are cutting into profits. Thus, the notion that tight money has no effect on company policy must be taken with a grain of salt.

Inventory Plans - Certainly, the very cost of money explains some of the evident caution about inventory policy. When interest rates were much lower, many companies would take a gamble on inventories... Now, the high cost of money makes such gambles too risky...

Plans of a majority of companies to increase inventories only moderately seem to have been influenced by interest rates. In many cases, their budgeting for inventory appears to be determined by their ability to finance themselves. Many of them plan to build up their inventories without resort to bank credit, and a somewhat smaller group hopes to borrow less than usual (77).

Another survey made under these same conditions of exceptionally high short term interest rates, which also appears to have found a substantial influence on inventory investment, is a National Industrial Conference Board survey of 228 industrial companies on the reactions to tight money. Quantification of results and size distributions are lacking, but the remarks made appear to justify an inference that substantial inventory effects were found. One of the few instances cited of inventory effects (most of the survey apparently being concentrated on the effects of tight money on trade credit policies and speed of payment of trade debts, etc.) concerned a company executive who unequivocally stated that it was the high interest rate securable on money market investments which was restricting the firm's inventory investment — a clear case of the extreme of interest sensitivity in which the opportunity cost of money market investment was considered seriously enough to constitute a deterrent to " real " investment within the business itself (78).

(77) " Where the Credit Pinch Hurts ", *Business Week*, February 27, 1960, pp. 65-66.
(78) " The Consequences of Tight Money ", *Conference Board Business Record*, January 1960, pp. 11-14, 38-46.

These inferences about the survey's results are supported by a subsequent N.I.C.B. evaluation of actual inventory developments which, although listing the end of expectations of commodity price increases first, then said:

A second explanation of the flaccid behaviour of inventory demand may lie in more intensive control of inventory (perhaps assisted in some degree by computer machinery) in a period of high borrowing costs. Over the past year, and particularly in the months from last September to this March [1960], short-term interest rates have been quite substantially above any recent experience. The cost of carrying inventory has risen sharply, and the alternative of holding Treasury Bills has become much more attractive. At the interest rate applying in the first quarter, it would take expectations of an important rise in prices to make inventory holding a preferred alternative to Treasury-bill holding, and such sanguine price expectations have not been very common over the past several months.

A sharp further fall in short-term rates may, other things being equal, stimulate some additional inventory demand (79).

It should be noted that a third explanation for the lowness of inventory holdings, which could be a partial or complete substitute for the first two, was also suggested: The abnormally low inventory/sales ratio might reflect in part the abnormal lowness of current unfilled order backlogs.

A January 1960 survey of the purchasing agents of 86 basic metals and metals products companies of various sizes by *Steel* magazine found that three-eighths to one-half of the firms planned to use loans to finance part or all of their inventory in 1960. One-fourth of the respondents answered " yes " to the question: " If money gets tighter and interest rates higher in 1960 will your inventory plans be adversely affected "? (80). Since only half or fewer of the respondents were planning to finance any inventory in the money market even if credit remained at its existing tightness, for one-quarter would be affectable by further tightening of money conditions constitutes strong evidence of the influence of money measures on inventory. In fact, it is indicated that the high level of interest rates already realized had been having restrictive

(79) " Business Highlights; Inventories Again ", *Conference Board Business Record*, May 1960, pp. 3-4.
(80) *Steel*, January 18, 1960, pp. 54-55, and information provided by the magazine.

effects, and it is likely that some of those unaffectable because they planned no inventory borrowing would have planned to borrow to finance enlarged inventory holdings if rates had not been at such unprecedentedly high levels. Thus the head of the Cleveland Association of Purchasing Agents reported that " his group feels that 6 per cent money is already too expensive. 'If lenders go any higher they are liable to price themselves out of the market' ".

The very few respondents to the *Steel* survey who quantified the effects foreseen reported that inventories would be reduced 15 per cent-25 per cent below planned levels if credit was tightened further. Even if only half these percentage effects should be applicable to the entire fourth of the sample affectable by tighter money (and assuming the sample representative of industry in general), the effects of restrictive monetary measures would thus have been shown to be very powerful: the growth in manufacturers' inventories in 1960 would be reducible by $4-$6 milliard, and that reduction might be concentrated in the first six months of the year.

This apparently strong evidence must be accepted with reservations owing to uncertainty about the representativeness of all manufacturing of the industries surveyed, to some indication that the affectable firms tend to be smaller than those not affectable and to the combining of money cost with money availability in the question asked.

Despite these deficiencies, the *Steel* survey results do constitute circumstantial support for interest rate policy because, at the least, they represent one more instance in which interest rate policy might have been discredited but was not. One firm identified by size — a $100-million sales firm whose inventory level would be cut 15 per cent by tighter money — presumably represents cost rather than availability, and the report from the Cleveland Association of Purchasing Agents clearly indicates strong money-cost effects on inventory.

In summary, the various pieces of evidence of improvement in large business' financial and inventory control procedures coming from the National Industrial Conference Board, *Fortune* magazine, etc., and from the purchasing officers of a number of large companies as well, create a strong presumption that the inventories of large American businesses are, at the least, very much more likely to be influenced by interest rates than was true even 10 years ago. And the evidence from several surveys covering large firms made

after the end of the cheap money era suggests that interest sensitivity may in fact exist among manufacturers who account for an important part of total inventory holdings. Although the institutional evidence is incomplete, and in some degree contradictory — although the surveys are either incompletely reported or improperly designed for determination of the true scope for interest rate policy —, a very persuasive circumstantial case is nevertheless established. In conjunction with the parallel but more nearly conclusive results for Great Britain, these findings require that very serious consideration be given to reviving short-term interest rate policy as an anticyclical measure.

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