

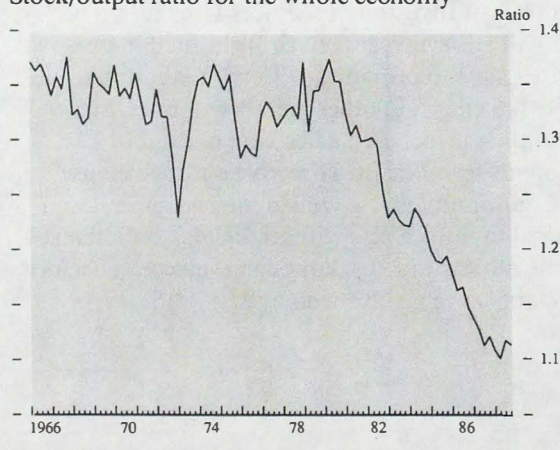
Stockbuilding behaviour in the United Kingdom

The stock/output ratio in the UK economy has declined sharply in the 1980s. This article⁽¹⁾ analyses the decline and discusses the reasons why firms hold different types of stocks and what influences these holdings. The article argues that changes in the financial environment facing firms and in particular the effects of the tax system and the behaviour of real interest rates have been an important determinant of stocks. An empirical model for the manufacturers' finished goods and work in progress category which includes these financial effects is summarised in an appendix.

Introduction

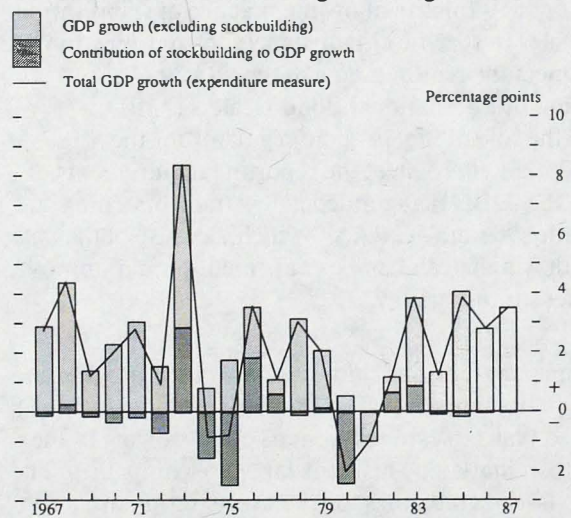
During much of the 1960s and 1970s the ratio of stocks to output in the economy was fairly constant as higher stock levels were held to support the growing volume of output and demand. Nevertheless, there is some evidence to suggest that in general the ratio moved slightly countercyclically—ie during economic downturns, stocks fell by less than output, while in the upswings they rose by less than output (this was particularly apparent in the manufacturing sector). During the 1980s, however, there has been a dramatic and uninterrupted decline in the stock/output ratio (see Chart 1) initially because there was a large fall in stock levels and subsequently, from around 1983 when stock levels stabilised, because output growth was increasing.

Chart 1
Stock/output ratio for the whole economy



The behaviour of stocks and stockbuilding is particularly interesting for two main reasons: the importance of stockbuilding in economic fluctuations and as part of an understanding of the financial decision-making process of companies. An understanding of how financial influences affect stockbuilding is part of the more general question of how financial considerations impinge on real company expenditures. Despite the small contribution stocks make to GDP, their impact on changes in GDP can be very substantial. Recent major recessions have been associated

Chart 2
Contribution of stockbuilding to GDP growth



with large and rapid destocking by UK industry. Chart 2, giving the contribution of stockbuilding to the annual percentage change in GDP, shows that in three of the four recent years in which GDP growth has been negative (in 1974 and 1975 in the wake of the oil price rise and in 1980) the contribution of stockbuilding has more than accounted for the fall in GDP.

The national accounts identify the stockbuilding behaviour of four main industrial sectors: manufacturing, wholesaling, retailing and 'other'.⁽²⁾ Manufacturing stocks, which can be further decomposed into raw materials and fuels, work in progress and finished goods, now account for just under one half of the total stocks held in the economy. Charts 3 and 4 show the stock/output ratios for manufacturers' stocks of work in progress and finished goods (as one category) and stocks of raw materials and fuels. Again, both stock/output ratios have fallen substantially in the 1980s but the behaviour of the finished goods and work in progress category in the 1970s is somewhat different. While in the 1960s and early 1970s the ratio appears to have moved countercyclically, there was a significant rise between 1974 and 1981. The ratio in the distribution sector (defined as wholesaling and

(1) Written by T S Callen in the Bank's Economics Division.

(2) 'Other' as here defined includes energy and water supply and other industries.

Chart 3
Stock/output ratio : manufacturers' work in progress and finished goods

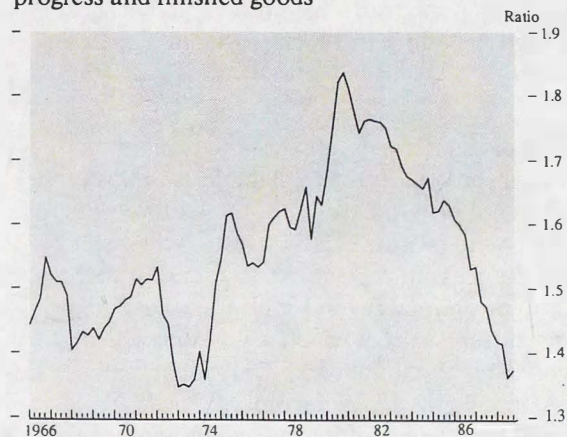


Chart 4
Stock/output ratio : manufacturers' raw materials



retailing) exhibits a similar pattern to that of finished goods and work in progress, although the decline in the 1980s is not as sharp (see Chart 5). The behaviour of the 'other' category (Chart 6) is more erratic and, although a trend decline in the ratio is apparent throughout the period, this has accelerated in the 1980s.

Chart 5
Stock/output ratio in the distribution sector

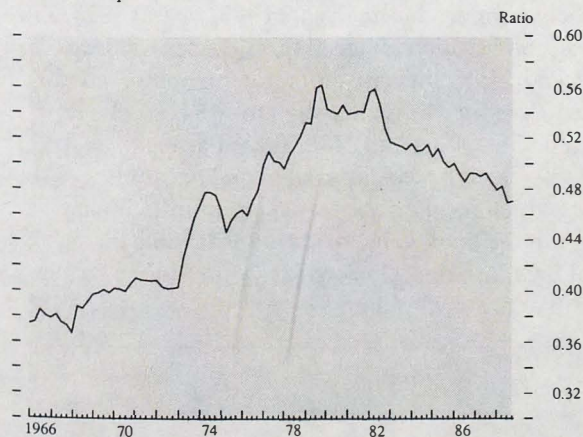
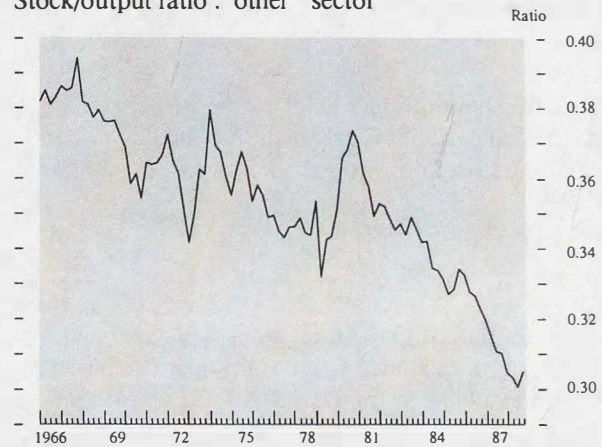


Chart 6
Stock/output ratio : 'other' sector



Reasons for stockholding

Firms hold stocks for a variety of reasons. Deliveries of raw materials and components are made at discrete intervals in time whereas production is occurring continuously, so stocks of raw materials are held in order to ensure the smooth and continuous running of the production process. They may also be held to speculate on price changes. Demand for finished goods also takes place at discrete time intervals so stocks will accumulate as the production process is continuous. Stocks will be held to help the firm to meet demand if output cannot be increased sufficiently, but they may also be held involuntarily if demand is less than expected and not all output can be sold. It is also possible that firms hold stocks of finished goods as an asset on which they hope to make a capital gain.

The production smoothing/buffer stock model⁽¹⁾ suggests that stocks of finished goods serve primarily to smooth production levels in the face of variable sales and rising marginal costs of production. A steeply rising marginal cost curve provides a strong motive to smooth production, while high storage costs act as a disincentive to such behaviour. Two types of production smoothing can be defined.⁽²⁾ Long-run production smoothing occurs if the variance of production is less than the variance of sales, whereas short-run smoothing occurs if production responds less to a sales shock than it would if a firm could not hold stocks. The model does not require sales to be uncertain for firms to find it optimal to smooth production relative to sales. If sales are variable and random then a buffer stock role for stocks is also introduced whereby firms hold inventories against the contingency that demand will be greater than production in any period. If stocks are to perform a production smoothing/buffer stock role, the variance of sales should exceed the variance of production, so that any transitory shock to demand is met out of stocks, with stock levels being gradually brought back to their desired level over time. A permanent change in demand will initially be met

(1) See Holt, C, Modigliani, F, Muth, J and Herbert, S, *Planning production, inventories and work force*, Englewood Cliffs, N J: Prentice-Hall, 1960.

(2) See Blinder, A, 'Can the production smoothing model of inventories be saved?', *The Quarterly Journal of Economics*, Vol CI, Issue 3, August 1986, pages 431-54.

out of stocks, with production gradually adjusting to the new level of demand and stocks being returned to their new desired level.

The production smoothing model can be written as follows. In each period it is assumed that the representative firm minimises the following cost function:

$$\min C = a_0 (\Delta Y_t + u_{1t})^2 + a_1 (Y_t + u_{2t})^2 + a_2 (I_t - a_3 E_t S_{t+1} + u_{3t})^2 \quad (1)$$

where Y_t is output, S_t sales and I_t stocks. U_{it} are cost shocks and $a_i > 0$. E_t is the expectations operator based on information available at time t and Δ represents the one-period change in the variable. The relationship between the three variables is given by $Y_t = S_t + \Delta I_t$ (ie output equals sales plus the change in stocks). The three terms in (1) capture the costs of changing output, the costs of producing output and the costs of having stocks deviate from some target (here taken to be proportional to expected sales). For the basic production smoothing model to hold it requires that $a_2 a_3$ be small relative to a_0 and a_1 (ie the targeting of stocks is not important) and that the cost shocks (U_{it}) have small effects.

Empirical evidence (mainly from the United States⁽¹⁾) has cast severe doubt on the notion of production smoothing, with the variance of production consistently having been found to exceed that of sales in a variety of sectors of the US economy and even in the economy as a whole. Also, the covariance between sales and stock changes is not negative, implying that as sales rise so do stocks.

There have been two main responses to the failure of the basic production smoothing model to explain the observed data. The first has been to modify the model to allow for a target stock to sales ratio which arises because it is costly for firms to allow stocks to deviate from some fraction of actual or expected sales. Kahn⁽²⁾ formally demonstrates that this behaviour can be justified in terms of the firm not wanting to be unable to meet demand. This effect is given by the third term in equation (1) and once it is embedded in the model there is no reason to expect the variance of sales to exceed the variance of production.⁽³⁾ The second approach⁽⁴⁾ introduces cost shocks into the model so that a producer will build up stocks in periods when production costs are relatively low and run them down in periods when production costs are high. So, rather than smoothing the level of production, firms smooth the cost of production. It has been argued⁽⁵⁾ that cost shocks play at least as important a role as demand shocks in determining the time series properties of stockbuilding behaviour. The variance of sales is less

than the variance of production because one of the primary functions of stocks is to allow firms to shift production from periods in which production costs are relatively high to periods in which production costs are relatively low.

A second theory sometimes advanced to explain stockholding behaviour is the (S,s) model.⁽⁶⁾ In this model, the firm does not place an order until stock levels fall to some lower bound (s) at which they restore their stock holdings to the maximum level (S). In order for this behaviour to be optimal several conditions need to be met, the most important of which is that the cost of an order involves a substantial fixed component, ie there are economies of scale when placing orders. The (S,s) policy was designed for retailers of finished goods where these restrictions are thought to be more applicable than in the manufacturing sector. It can be shown that S and s will depend upon the interest rate, the storage cost of inventories, the penalty associated with being unable to meet demand, the distribution function of sales and the fixed and variable costs of production. Some of the obvious problems with the production smoothing model are eliminated in the (S,s) model. These are primarily that more account is taken of the costs and benefits of holding stocks. Pursuit of (S,s) policies by retailers will lead to the variance of orders exceeding the variance of sales and therefore the theory rejects the idea that retail stocks act as a buffer to protect manufacturers from fluctuating sales. However, if retailers behave in this manner, then manufacturers may use stocks to smooth production. Despite these apparent advantages, the results of estimating such a model have not been encouraging and the restrictiveness of the underlying assumptions are also not particularly appealing.

The tax system and the cost of stockholding

When measuring the cost of holding stocks it is necessary to allow for the various forms of stock relief that have been present in the tax system. The UK tax system has operated two main systems of stock relief: the first was introduced by the 1975 Finance Act (but was made retrospective for accounting years 1973/74 and 1974/75), and the second (which replaced the 1975 scheme) was introduced in 1981. Several amendments were made to the scheme before it was abolished in 1984. Stock relief was initially introduced to offset the inflationary distortion created by the tax system and accounting practices which result in the treatment of inflationary increases in the book value of stocks as taxable income. In times of high inflation, this obviously provides a strong disincentive to stockholding.

(1) But see West, K, 'Evidence from seven countries on whether inventories smooth aggregate output', *National Bureau of Economic Research Working Paper No 2664*, 1988, for a study of the G7 countries.

(2) Kahn, J, 'Inventories and the volatility of production', *American Economic Review*, Vol 77, No 4, 1987, pages 667-79.

(3) If firms aim to maintain a fixed stock to sales ratio, then a change in sales causes the firm to adjust its level of stocks. This introduces the accelerator principle into the model where now a change in sales leads to greater changes in output as firms readjust their stock levels to the new target.

(4) Eichenbaum, M, 'Rational expectations and the smoothing properties of inventories of finished goods', *Journal of Monetary Economics*, Vol 14, 1984, pages 71-96.

(5) Eichenbaum, M, 'Some empirical evidence on the production level and the production cost smoothing models of inventory investment', *National Bureau of Economic Research Working Paper No 2523*, 1988.

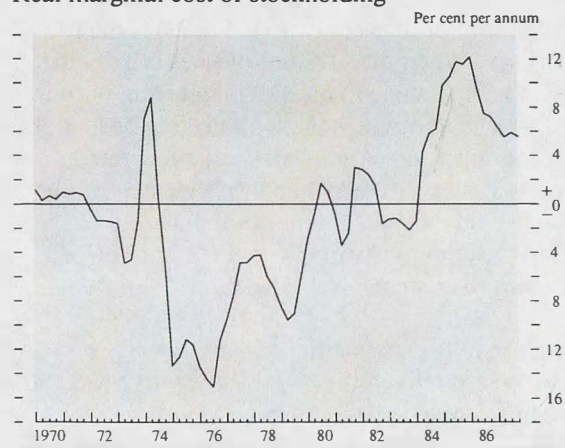
(6) See Blinder, A, 'Retail inventory investment and business fluctuations', *Brookings Papers on Economic Activity*, Vol 2, 1981, pages 443-505.

The stock relief scheme introduced in 1975 treated all increases in the book value of stocks in excess of a threshold level as tax allowable. Thus, under the scheme, both physical and inflationary increases in the value of stocks were tax deductible. The original scheme was altered for two reasons: first, the relief over-compensated for inflation and introduced new distortions and second, if stock values fell, relief was clawed back and tax was payable. The scheme created problems for companies with the onset of recession, and the substantial destocking in 1980–81 led to a sharp increase in tax bills which negated some of the benefits of selling stocks. The 1981 scheme only allowed tax relief on the inflationary increase in the value of stocks. This was calculated by applying an official stock price index to the opening value of stocks less £2,000.⁽¹⁾ It should be noted that while stock relief continued until 1984, the positive incentive to hold stocks ceased when relief on the physical increase was abolished. At the margin (ignoring the 'claw-back' provisions), the system operated between 1975 and the beginning of 1981 allowed 100% first-year allowances on the purchase of stocks, while the system operated between 1981 and 1984 was only sufficient to offset the tax losses due to the inflationary gains on stocks. This scheme should have had a virtually neutral influence on the incentive to hold stocks.

The cost of stockholding

The financial cost of holding stocks consists of two elements: the opportunity cost of the funds and the anticipated rate of nominal capital gains associated with the goods held in stock. It is usual to consider the difference between these two elements as the financial cost of stockholding. There are also, of course, storage costs and the benefits of a reduction in the probability of being unable to meet demand to consider when deriving the cost term. The cost of stockholding term used in the empirical analysis in the appendix to this article is derived in Kelly and Owen⁽²⁾ and is based on the solution to a problem in which the firm equates the marginal financial and storage costs of holding stocks to the marginal decrease in the probability of being unable to meet demand to provide a decision rule for stock levels. The derivation explicitly takes into account tax effects and also the rise in stock prices relative to the general price level. The treatment of stock relief is somewhat simplified as no account is taken of the threshold levels at which tax relief was available. The formulation also makes the simplifying assumption that all firms earn sufficient income to pay tax and can therefore take full advantage of stock relief provisions.⁽³⁾ The path of the real marginal cost of stockholding variable is plotted in Chart 7. The jump in 1974 (when inflation rose sharply) and the effect of the introduction of stock relief are clearly seen. Stockholding costs were negative

Chart 7
Real marginal cost of stockholding



between 1975 and 1980, but rose to be significantly positive in the 1980s as stock relief was removed and real interest rates rose as the government acted to reduce inflation.

Explaining the decline in the stock/output ratio

Five main explanations of the decline in the stock/output ratio in the 1980s have been advanced.

- (1) It is reasonable to assume that firms are forward looking so that their current behaviour is influenced not only by current events but also by their expectations of the future. So a firm's stockbuilding behaviour in the current period is influenced not only by sales in that period, but also by future expected sales. When current stockbuilding decisions are influenced by expectations of the future, an anticipated recession will lead to destocking before the recession actually occurs. This behaviour then contains a degree of self-fulfilment as a decline in stocks will itself reduce GDP. However, while this may explain the initial decline in stocks in 1981 and the consequent fall in the stock/output ratio, it cannot account for the continued decline that has occurred in the ratio since output and sales in the economy have picked up. As firms' expectations of the future improved, this should have led them to increase their stock levels, but no such increase has occurred.⁽⁴⁾
- (2) A potential explanatory variable that is often overlooked in studies of stockbuilding is the expected variance of sales (if stocks of finished goods are being considered) or the expected variance of supply (if stocks of basic materials). Variances are important because one of the reasons for holding stocks is to avoid the possibility of being unable to meet demand and the consequent loss of sales and/or goodwill. In the case of basic materials, when the variance of supply is high, this will encourage the holding of high stock levels as reliance on actual supply to

(1) This is a simplified discussion of the stock relief schemes. For more detail see Devereux, M., 'The IFS Model of the UK Corporation Tax', *Institute of Fiscal Studies Working Paper* No 84, 1986.

(2) Kelly, C and Owen, D., 'Factor Prices in the Treasury Model', *Government Economic Service Working Paper* No 83, 1985.

(3) Devereux, M., 'Taxation and the Cost of Capital: The UK Experience', *Oxford Review of Economic Policy*, Vol 3, No 4, 1987, provides estimates that suggest 40% of companies were fully tax exhausted in 1980.

(4) See Hall, S., Henry, B and Wren-Lewis, S., 'Manufacturing stocks and forward looking expectations in the UK', *National Institute of Economic and Social Research Discussion Paper*, No 64, 1984, for a discussion of this type of forward-looking model.

meet current need may lead to interruptions in the production process. With regard to stocks of finished goods, the variance of sales (or expected sales) is the relevant variable. When the variance of sales is high, the probability of being unable to meet demand from output is increased and hence more stocks will need to be held. In the 1970s, economic fluctuations may have generated a greater expected sales variance than has been seen more recently. Some evidence was found to support this hypothesis in the empirical work: as the variance of expected output rose, stock levels also rose.⁽¹⁾

(3) The change in the stock relief scheme at the beginning of 1981 removed the positive incentive to build up stocks. Thus, while between 1975 and 1981 the combination of very negative real interest rates and stock relief on the physical increase in stocks made investment in stocks attractive *vis-à-vis* investment in liquid assets, the return to positive real interest rates and the change in stock relief (and its removal in 1984) has made the acquisition of stocks much less attractive since 1981. Hence, there has been a build-up of liquid assets held by companies in the 1980s while stocks have declined.

Recent research at the Bank on manufacturers' stockbuilding of finished goods and work in progress has looked at the significance of financial factors on stockbuilding behaviour.⁽²⁾ A common approach to modelling company sector behaviour suggests that liquid assets as well as stocks play a buffering role for companies as liquid asset holdings are less costly to alter than other company variables. The implication behind such an interpretation is that if liquidity has moved away from its desired level because of some shock to the firm, this will be adjusted over time by changes in other variables. A finding that such 'disequilibrium' liquidity effects are significant when entered into a stocks equation (as well as other company sector equations) then indicates that stocks and liquidity are in some sense 'jointly' determined: one method of improving liquidity in the short term is to reduce stock holdings. The work at the Bank also suggests that there is an important relationship between companies' holdings of stocks of finished goods and liquid assets.⁽³⁾ However, this relationship is not attributed to disequilibrium effects; rather than performing solely a buffer stock role, financial influences are considered important in the stockholding decision. This work takes the form of a model where stocks are one of several alternative investments the firm can hold. Stocks are a fairly liquid form of investment (they can be disposed of relatively easily) and it is probable that stocks and liquid assets can to some extent be thought of as substitutes, despite the fact that one is a real asset and the other is a financial one. As with any allocation decision, the allocation between the alternative assets is based on the relative costs and returns of each. The benefits to

holding stocks are that the probability of being unable to meet current demand is reduced, costly changes in output do not need to be made, interruptions to the production process are reduced, inflationary or holding gains may be realised and the tax system may allow increases in stock values to be offset against taxable profits. There are three major costs of stockholding: physical storage costs, an opportunity cost (ie what could be gained from holding an alternative asset) and, in the absence of stock relief, stock appreciation which leads to an increase in taxable profits. The benefits of holding liquid assets are twofold: the interest that is paid on the asset and the flexibility that it provides to the firm (it makes it easier for a firm to adjust to external shocks and also reduces the probability of bankruptcy). Again, the cost of holding liquidity is the opportunity cost of not holding an alternative asset. If it is assumed that the only two assets a firm can invest in are stocks and liquid assets, the opportunity cost of holding one is the return forgone on the other. The costs and benefits of holding the alternative assets will vary with interest rates, inflation and the tax treatment of the assets. The latter was particularly important in the period 1975-84 because of the tax relief that was then available (in the various forms) on stock appreciation.

(4) A further reason cited for the observed decline in the stock/output ratio is that improvements have been made in stock control techniques, so that, for any given level of sales, a lower stock level needs to be held. The trigger for the improvement in control techniques may have been the abolition of stock relief, which meant the holding of inefficient stock levels became more costly, but the ability to introduce these methods may also be linked to the increased certainty apparent in the 1980s. Two main developments seem to have been made. The first is the introduction of 'just in time' methods, where companies use a smaller base of suppliers, delivery to schedule and quality targets. Stockholding can thus be reduced, with stocks being replenished with frequent high-quality deliveries from dedicated suppliers. Second, the automation of material planning and handling within the factory and the re-organisation of the flows of production have reduced the required level of stockholding. Attempts were made to introduce proxies of technical progress into estimated stock equations; however, these did not meet with any success, which is not particularly surprising given the conceptual and empirical difficulties in identifying technical progress.

(5) There has been a change in the composition of industry. In manufacturing, sectors which had high stock/output ratios have declined relative to other sectors, while in retailing the shift towards large-scale outlets with the introduction of 'out-of-town' developments has achieved marked economies of scale in stockholding. It has been estimated⁽⁴⁾ that this compositional change can

(1) More detail will be given in a forthcoming Bank of England *Technical series paper* by T Callen, S Hall, and B Henry, entitled 'Manufacturing stocks, expectations, risk and co-integration'.

(2) For more detail see a forthcoming Bank of England *Discussion paper* by T Callen and B Henry, entitled 'Stockbuilding and liquidity: some results for a joint model'.

(3) An econometric model for stocks of finished goods and work in progress is described in the appendix.

(4) See Higson, C and Holly, S, 'Why has the stock-output ratio fallen?', *London Business School Economic Outlook*, February 1988.

account for about one third of the decline in the ratio in the manufacturing sector.

Conclusion

The stock/output ratio in the UK economy has declined dramatically in the 1980s. This article has analysed the behaviour of stocks and considered some explanations for the decline. Alternative explanations considered were that there has been a change in the financial environment facing firms in the 1980s; that firms act in a forward-looking manner and it is the expected level of future sales or the expected variance of future sales that influences stockbuilding; that there have been improvements in stock control techniques; and that there has been a change in the structure of industry. Some evidence was found to support both financial influences and the expected variance of output as explanations of

stockbuilding behaviour in the manufacturers' finished goods and work in progress category, although, given the difference in behaviour of the various categories, it cannot be claimed that an explanation has been provided for the behaviour of the aggregate ratio. The finding that financial effects are an important determinant of the behaviour of stocks of finished goods and work in progress is significant as it suggests that financial changes have direct effects on real company expenditure, rather than solely through effects on output, and that companies are responsive to changes in the financial environment they face. Although anecdotal evidence suggests that technical progress in stock control methods has reduced the required stock level, this effect was not significant in the empirical work. This, however, is more likely to be a reflection of the inadequacy of the empirical techniques, rather than the absence of such features.

Appendix

A model of manufacturers' stocks of finished goods and work in progress

The results of estimating the model discussed in the main text are described below. The Granger-Engle two-step method was used in the estimation work.⁽¹⁾ Briefly, this proceeds as follows: in the first stage a relationship between the levels of the dependent and explanatory variables is investigated. If a long-run economic relationship exists between the dependent variable (in this case the stock level) and the explanatory variables then the variables should co-integrate, or move together over time, yielding a stationary error process. Two tests are commonly used on the residuals from the regression to test for this stationarity, the Dickey-Fuller Test (DF) and the Augmented Dickey Fuller Test (ADF). Test statistics of greater than -3 and -3.2 respectively are usually taken as implying stationarity. Assuming that a valid 'co-integrating' vector is found in the first stage, a dynamic regression is then run among the differenced variables and the lagged residuals from the first stage regression.

It was found that there was evidence in favour of a simple model with the cost of stockholding and the cost of liquidity (measured by the borrowing and lending rates) proving to be significant determinants of the stock level. Manufacturers' output and retained earnings were also found to be important determinants. The preferred long-run equation is set out below:

$$K = 17454 + 0.13M - 0.55CS + 0.15R + 0.96B - 0.77L$$

$$R^2 = 0.77, DF = -3.4, ADF = -3.1^{(2)}$$

Sample period: 1970:1-1985:4

where K is the stock level of manufacturers' finished goods and work in progress, M is manufacturing output, CS is the Kelly and Owen cost of stockholding variable, R is retained earnings, B is the borrowing rate and L is the lending rate.⁽³⁾ This has the obvious interpretation that while financial influences are important, there are other motives behind stockholding. As the cost of stockholding rises, stock levels fall as firms switch into liquid assets (the cost of stockholding term enters with a positive coefficient in an equation for liquid assets). As borrowing rates rise stockbuilding increases, whereas as lending rates rise stockbuilding falls—ie, as the cost of liquidity, measured by the net internal rate ($B-L$), rises, liquidity falls and stocks rise. Retained earnings are an important determinant as they indicate the amount of finance that is internally available to the firm to allocate to the

acquisition of assets. The inclusion of inflation in the regression (implying, in an unrestricted way, that relative real interest rates influence stock levels) led to a deterioration in the test statistics, although the tests were still passed. Output may not be the appropriate variable when considering stocks of finished goods, so a proxy for manufacturers' demand was tried instead of output. However, the DF and ADF tests were failed when this proxy was included. The preferred dynamic equation based on the second stage of the Granger-Engle procedure is given below:

$$I = -14.42 + 0.44 I(-1) + 0.15 I(-2) + 0.15 \Delta B$$

(0.54) (3.64) (1.4) (2.18)

$$-0.11 \Delta B(-1) - 0.1 \Delta L + 0.11 \Delta L(-1) + 0.24 \Delta M - 0.24 \Delta CS$$

(1.55) (1.86) (1.62) (2.64) (2.21)

$$+ 0.25 \Delta CS(-2) + 0.08 \Delta R(-1) + 0.08 \Delta R(-2) - 0.01 e(-1)$$

(2.24) (2.18) (2.14) (1.74)

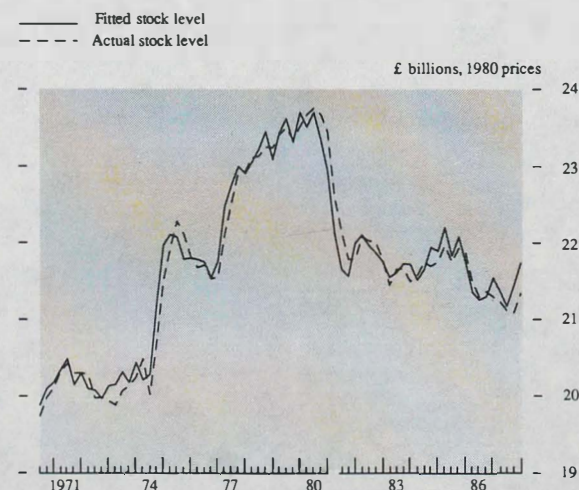
$$R^2 = 0.57, SE = 200.25, LM(4) = 2.44, BJ(2) = 0.17,$$

$$ARCH(1) = 0.7, \chi^2(8) = 14.5$$

Sample period: 1970:2-1985:4

where I is stockbuilding of finished goods and work in progress, $e(-1)$ are the lagged residuals from the first stage regression and the other variables are as previously defined. The fit of this equation (after being reparameterised in terms of the stock level (K)) is given in Chart 8.

Chart 8
Fitted values of the dynamic equation



(1) Engle, R and Granger, C, 'Co-integration and error correction: representation, estimation and testing', *Econometrica*, Vol 55, 1987, pages 251-76.

(2) The ADF test is marginally failed, but this appears to be owing to problems induced by the extra differencing used in the ADF test. Inspection of the correlogram indicates stationarity of the residuals.

(3) The borrowing rate is approximated by the banks' base rate and the lending rate by the three-month interbank rate.