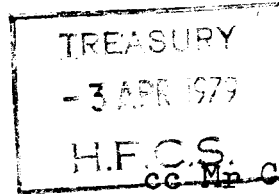


1)

**MONETARY TARGETS – PART A:
22 JUNE 1976 - 21ST OCTOBER 1977**

351
6

35/08



1A

Mr Bridgeman

cc Mr Cassell
Mr Britton
Mr Gray
Mr Hudson
Mr Coleby)
Mr Goodhart) B/Eng
Mr Price)

MONETARY TARGETS

I attach a draft which is based on work by Mr Gray. I hope it goes some way to setting out our conclusions on the first part of the terms of reference. There is room for explanation in many places but we have tried to keep the exposition as short as possible and in a form which might be suitable for submission to Ministers.

EA. Clarke

PP

P E MIDDLETON
22 June 1976

Enc

[REDACTED]

DRAFT

THE IMPLEMENTATION OF AN INTERNAL MONETARY TARGET

A BASIC CRITERIA

1. The setting of a monetary target cannot be approached in isolation from other aspects of macro-economic management aimed at achieving overall policy objectives. At worst it should ensure that the growth of the money supply does not frustrate these objectives. Preferably it should positively support them.
2. The starting point is the financial forecasts which show the broad magnitude of the monetary flows associated with the underlying national income and external forecasts. These forecasts are the means of relating the various policy choices to monetary variables. But the choice of policies is not an exact process. Even if it was, the great uncertainties about the relationship between money supply and other economic objectives would mean that it would be impossible to formulate precise rules to determine a target. It must inevitably be a fairly broad brush operation.
3. It follows that a setting of any single money supply target cannot be a wholly satisfactory guide to the conduct even of monetary policy, let alone macro-economic policy more generally. Other countries have found it necessary to go through a learning process

[REDACTED]

before deciding on the eventual form of a monetary target to suit their circumstances. We have concluded that it would be best for internal purposes to start with a relatively simple form of target rather than construct a multiplicity of targets for different aggregates. But this does not mean that we would not wish to look at other measures of the money supply in appraising the thrust of monetary policy.

4. This note is directed towards a target for internal use. If it was proposed to publish a target, factors which we have not fully explored would need to be considered and these would affect both the form of the target and the level at which it was set. Some of these points are referred to in subsequent paragraphs but we have not attempted to construct an internal version of a published target.

B THE FORM OF THE TARGET

5. What Monetary Aggregate? Treasury and Bank officials have considered on various occasions which of the monetary aggregates would be best suited to be used for target purposes. We have concluded that the wider measure, M3 would be most appropriate. M3 has among its advantages that it has been for some time the main focus of policy attention, it is generally accepted by outside observers, it is the aggregate which seems to attract greatest attention in most other

[REDACTED]

European countries and, of great practical importance, it can be most easily related to the major counterparts of money supply such as the CGBR, debt sales and bank lending to the private sector. On the other hand there is no evidence that M3 is any more stably related to nominal incomes than say the narrower M1. It is sensitive to interest differentials that can shift funds between interest-bearing liquid assets within or outside M3. So though we think that the balance of advantage lies with M3, it would remain necessary to keep a close watch on movements in M1 and a range of wider liquidity measures, to ensure that the movement of M3 alone was not giving a misleading guide to the rate of monetary expansion.

6. For internal purposes we also see considerable advantage in having an accompanying target for the rate of domestic credit expansion (DCE). DCE is larger than M3 to the extent that banks increase their non-deposit liabilities and external finance accrues to the public and banking sectors.. External finance is the critical point; a given M3 target could be achieved by more external finance - a larger current account deficit. So the greater the importance of achieving a given balance of payments position, the stronger is the case for basing policy on the rate of DCE as well as money supply growth. This is the

[REDACTED]

reason why the IMF attach such importance to DCE. And there is much to be said in present circumstances for formalising the rate of DCE which is consistent both with the chosen M3 figure and an acceptable external position.

7. A Fixed or Rolling Target? Two main countries presently publish monetary targets. Germany has a target for a fixed twelve month period whereas the Americans operate a rolling target for twelve months which is updated quarterly. With a published target a rolling basis has the great advantage that it enables the authorities to avoid becoming "boxed-in". They might otherwise be faced, at the final stage of a fixed period target, with either abandoning the target or having to conduct open market operations in a pre-determined direction which could well produce perverse market reactions. With a rolling target this final stage is never actually reached.

8. If the target was to be published, the advantage would rest with rolling forward. But in the case of an internal target the balance is less clear. A rolling target might be said to remove some of the discipline of having a target in the first place. Though, against this, quarterly rolling-forward could be said to force the authorities regularly to re-appraise policy in all fields in relation to monetary movements. An internal target is however likely to

[REDACTED]

[REDACTED]

become public knowledge. The existence of a target would need to be known fairly generally within Government if the Chancellor was to be in a position to respond to deviations from the target by non-monetary measures. We might also wish to mention its existence to other Governments and bodies such as the IMF. Given the possibility that some of its features might become public we think the balance of advantage, even for an internal target, rests with a rolling basis.

9. What Period? The natural period to which a target would apply is a twelve month one. This is the period most common for decisions and actions in other macro-economic policy areas, and it has been the period which both the Germans and Americans have adopted. In the case of a rolling target there is a further question: how much of the year should relate to the past and how much to the future? There seems much to be said for a system similar to that used by the Americans. It is essential in setting the target to have a reasonably reliable base period. A single month's figure is inadequate and this points to using the average of the latest three months. A one year target set at the end of June 1976 would on this basis relate to the change in money stock from average March/May 1976 to average March/May 1977. This target period would

[REDACTED]

remain in existence until the end of September when it would shift to the June /August averages.

10. It is implicit in the last paragraph that the banking month series for M3 and DCE would be used for the target rather than the end-quarter series. This preference is on mainly statistical grounds; the end-quarter series is not used operationally, suffers from day of the week, end-year and other disturbances, and cannot be easily related to the more frequently observed banking month figures.

11. A single figure or a range? Given the uncertainties in the relationships there is not much to be said for basing the target on single figures for M3 and DCE. The choice seems to lie between setting a range with upper and lower limits, or selecting a single figure with an x% tolerance margin on either side. In theory there may be little between these two approaches and it probably makes little difference which is adopted, so it may be best to opt for giving a range with upper and lower limits 2% - 3% on either side of our most preferred figure.

C MONITORING AND ROLLING-FORWARD

12. It seems unrealistic to try to set one exact rule which would in all circumstances determine when M3 and DCE were moving off target. But it would be

[REDACTED]

helpful to have some rule as a general guide. We consider that it would be undesirable to base any rule on less than six observations, and the most satisfactory measure might be the growth rate shown by the average of the latest three months over the average of the previous three months. Whenever this measure moved outside the target range it could be taken as a signal for policy discussions.

13. If a target is to be introduced, there seems a strong case for seeking to improve the flow of information on monetary developments so that we have more observations, and to have at least some figures on a weekly basis. To give one example, at present, although we know the level of total gilt-edged sales on an hour-to-hour basis, we only know the figure for sales to the non-bank public on a monthly basis. So we recommend that consideration should be given to obtaining money and banking figures on a weekly basis, some of which the banks must already have available for their own internal use. The sooner we get this information the sooner we will develop the necessary experience to use it in monitoring operations.

14. It was suggested in paragraph 9 that the target might be rolled-forward on a quarterly basis. This updating can only be carried out against the background of the macro-economic forecasts. While for internal

13

[REDACTED]

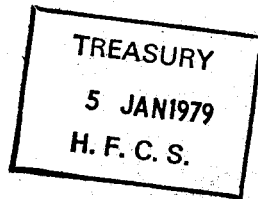
purposes a precise timetable for the updating is not necessary, the present timing of the forecasts points to quarterly revisions say in July, November, February and before the Budget.

D IMPLEMENTATION AND USE OF THE TARGET

15. Operation of a target will involve regular administrative arrangements for deciding on appropriate action. If the target was updated each quarter in the context of the revised forecasts this would be a regular opportunity for a general review of policy action, embracing the possibility of non-monetary as well as monetary action.

16. The existing arrangements for consultation between the Treasury and the Bank could easily be adapted for monitoring between reviews and for deciding in the light of the target on the appropriate monetary response to developments.

Mr Barratt



Mr Gray
Mr Mowle
Miss Boden

cc Mr Couzens
Mr Maynard
Miss Brown
Mr Cassell
Mr Isaac Mr Bridgeman
Mr Littler Mrs Hedley-
Mr Dixon Miller
Mr Wiggins ✓

"ROLLING FORWARD" MONETARY LIMITS

1. You asked for my comments on the suggestion in Mr Bridgeman's minute of 21 April that it might be possible to negotiate some roll forward of the monetary guideline accompanying the DCE ceiling.
2. I believe that it would be misguided in present circumstances to attempt an upward revision in the M3 range for 1977-78 set out so recently in the Budget Speech. Even if we could persuade the IMF of the desirability of such a step (as Mr Bridgeman points out we have no formal commitment to an M3 target) it would reflect adversely on the Government's determination to keep control of the rate of inflation.
3. My reasons are as follows:
 - a. We accepted a DCE ceiling in the IMF discussions because it was in their interests and ours to bring about a rapid improvement in the balance of payments. This did not however mean that we doubted that the money supply was the more relevant aggregate so far as inflation was concerned. Academic literature concentrates on the money supply. And it is abundantly clear that the press and the markets give pre-eminence to this aggregate as the major monetary influence on the future rate of inflation. So as the balance of payments moves into a more satisfactory position it becomes more important to take up a firm position in respect of M3. The Governor has already been making suggestions to this effect in his speeches and this is why he asked for - and received - permission to describe the present range for M3 in 1977-78 as a target. The movement into balance of payments surplus will of course enable us to repay debt and this will be good for confidence in a general way. But the prospect of such repayments is unlikely to compensate for the effect on inflationary

expectations of an excessive money supply, and debt repayments themselves have no direct effect on the growth of M3.

b. Inflationary expectations are moreover still in a volatile state. We have experienced one period leading to the IMF application when they were at an incredibly low ebb. This has been followed by another in the first quarter of 1977 when - to judge from the flows - there was a swing of equally unparalleled size in the opposite direction. Against this background, at a time when the inflation rate has ceased to fall and when there are widespread uncertainties about the effect of the next pay agreement, a good deal of opinion is worried about the possibility of a re-acceleration of price increases. Relaxation of the M3 guideline - with all its great advantage of being the same as that for the previous year - would remove an important element of stability in the present situation and would be taken to mean that the Government had chosen to play down - or even given up - the present policy of bringing down the inflation rate.

c. The long term effects are potentially the most worrying. Sticking to the announced guidelines will play an important part in reassuring both external and domestic opinion about the continuing priority to bringing down inflation. To be seen to be making adjustments at the first signs of an improvement in the current account or to allow for more reflation in the context of the pay negotiations, would make it so much more difficult to use the need for tight monetary guidelines as a credible stopping point should we wish to so use it in the future.

d. I rather doubt whether the line of argument suggested in paragraph 6 of Mr Bridgeman's minute would carry conviction - though I am sure it is the best available. We can just about get away with our present stated position with M3 forecast to be at the top end of the announced range in 1977-78. But it is difficult to believe that either the press or the markets would accept that an even greater acceleration in the growth of the money stock is justified between 1976-77 and 1977-78 than that already in the pipeline.. Most market operators now seem to have moved to the view that interest rates have fallen far enough to move M3 into the announced range in the near future.

e. As Mr Bridgeman suggests, manipulating the M3 guideline in this way implies either that the PSBR ceiling is to be broken or that the PSBR is to be reduced by optical measures. I have doubts about whether optical adjustments on the required scale are in fact available given what seems to be happening to the underlying growth in fixed rate export credit. If they are, they certainly would not fool either the Fund or the markets; such devices would only add to the general implication of lack of determination in dealing with inflation.

4. The above arguments are not, of course, conclusive. Much depends on the Chancellor's reasons in wanting further scope for manoeuvre. If the pay policy came to depend on the relaxation of monetary control, it would be a fine point which would most affect expectations and the movement of prices. And Mr Bridgeman is not of course advocating rolling forward the target; he is responding to a remit from the Chancellor to explore the possibilities. I confess I should like to see the potential disadvantages given a lot of weight because I do not believe that it will be possible to use monetary targets in the way suggested. There is likely to be sufficient obscurity about the next pay round to make it virtually impossible to convince the market that the suggested roll-over is not a device both to accommodate higher wage settlements and relax the fight against inflation and edge round our IMF commitments at the first opportunity.



P E MIDDLETON
25 April 1977

NB It was interesting to hear the Chancellor saying on the radio this morning in the aftermath of the USDAW conference that the monetary targets were not negotiable.

35 108 A

Mr Gray ✓
Mr Malt ✓

cc: Mr Couzens
Mr Middleton
Miss Brown
Mr Cassell
Mrs H edley-Miller
Mr Bridgeman
Mr Littler
Mr Dixon
Mr Wiggins ✓

Miss Boden

MR BARRATT

TREASURY
5 JAN 1978
H. F. C. S.

"ROLLING FORWARD" MONETARY LIMITS

I agree with Mr Middleton's argument about the need to keep to the stated M3 range, but we should bear in mind the implications for other targets and policies.

2. If external flows remain favourable, then the danger arises that M3 will press up against the upper limit of the stated range. It may be possible to counter this by lowering interest rates, but then there is the danger that the DCE target will not be met. But if there is a reluctance to let the exchange rate rise, something must give. What shall it be?

3. The DCE ceiling cannot be allowed to give, since this is imposed on us by the IMF. If, despite Mr Middleton's warnings, the upper limit of the M3 range is significantly exceeded, then there is the distinct possibility that external sentiment will reverse itself, leading to substantial external outflows. If the exchange rate then has to fall as a consequence, the chance of reaching our inflation objective will be greatly diminished. In other words, our present exchange rate policy may well run counter, in this as well as other respects, to our inflation policy.

G W

G W MAYNARD
25 April 1977

55/08

10



CH/EXCHEQUER	
REC.	12 JUL ...
ACTION	Mr Wainwright 2
COPIES TO	PS/ST
	PS/FT
	PS/YST
Sir D. Cass	

DR. JEREMY BRAY M.P.
HOUSE OF COMMONS
LONDON SW1A 0AA

01-219 4057 (direct line)
01-219 3000 (switchboard)

11th July, 1977.

Mr Ainey
Mr Coyne

Mr Shepherd
Mr Middleton
Mr Bridgman

TREASURY
20 APR 1978
H. F. C. S.

Dear Denis,

The Economic Commentary in the June Bank of England Quarterly Bulletin, and the article on financial forecasts, put questions regarding the use of targets in monetary policy, suggesting they deserve public discussion. I enclose a note suggesting how these questions might be answered. I understand that the Treasury do have a copy of Gregory Chow's programme for the optimal control of non-linear systems, if not in its latest form. If they don't have copies of the memoranda referred to in my note, I would be glad to send copies.

The technical analysis needed does not seem to me to conflict with the confidence issues. A very impressive range of simulations could be given of how the method would in fact cope with a far wider range of exigency than the market has ever considered, and with plausible but impressive smoothness. It would be an interesting exercise, educating foreign exchange dealers in the UK and abroad, but not the least benefit would be educating ourselves.

I have also sent a copy of the enclosed note to Christopher Dow at the Bank of England.

If it has been felt in the Treasury that the applications of control theory is a rather remote technical question, then I hope the enclosed note would help to persuade the doubters that immediate help is available on urgent practical problems, which seem to have little rational basis as they are at present formulated.

Jeremy

Rt. Hon. Denis Healey, M.P.,
Chancellor of the Exchequer,
HM Treasury,
Parliament Street,
S.W.1.

The Pursuit of Monetary Targets

Jeremy Bray

The Bank of England Quarterly Bulletin (June 1977) has put questions regarding the use of targets in monetary policy, suggesting they deserve public discussion. My suggestion is that both in the clearer formulation of the questions, and in their practical solution, newly available stochastic control theory methods have a role to play, not in some distant future when credible complete econometric models are available, but now.

First the questions. The Bulletin commentary points out that over the past four years M_3 grew on average 10% a year and GNP at current prices about 20% and for the past six years, the velocity of circulation of both M_1 and M_3 has been far from stable. Even an elaborate lag structure does not produce a very good relation between money supply and money GDP. The proportionate errors are an order of magnitude greater than those usual in national income forecasting. This does not offer a very promising justification or basis for monetary policy.

However accepting that there may be more complex relationships between money supply, or components of money supply and other monetary variables, and components of GDP and their deflators; and accepting that monetary targets are being set, the Bulletin commentary asks what variables should be used, how should they be measured, and how should the targets affect the evolution of policy? Should it be M_3 , or M_3 and M_1 , or DCE, or DCE and PSBR, or DCE, PSBR and M_3 ? Should targets be set for successive years, or "rolling targets" for the year ahead? Can one month's figures indicate a trend? Will weekly figures reduce the lag? Will the effect of short term fluctuations be smoothed out, and so can they be ignored?

Other/

Other relevant questions are: what actions should then be taken? What are the penalties for delaying action? Is the action very sensitive to the choice and treatment of the target?

The framework within which these questions can be formulated systematically is to define the objectives to be sought, and then to find the use to be made of available instruments in seeking these objectives.

Taking the very simplest of monetarist models, suppose it is argued that M_3 should be allowed to grow at the rate at which GDP can grow without inflation, or with very little inflation. Suppose furthermore that this is defined to be the rate at which GDP, or productive potential or a full employment GDP, has in fact grown over a past period, and the period has been chosen, a growth rate calculated, a base point fixed, and so a trajectory defined. Suppose furthermore it is possible to control M_3 to follow closely the desired trajectory. A monetarist accepting the model may expect that after a period, the balance of payments, unemployment and inflation will settle down to acceptable levels. But more realistically he will expect that there would be long term deviations from acceptable levels, and the desired trajectory for M_3 would have to be modified in the light of experience. There was after all nothing ultimate in the original choice of trajectory. The questions then is how should the trajectory be adjusted?

It should be adjusted so as to bring the balance of payments, unemployment, and inflation down to the most acceptable available levels.

The relation between the number of instruments and the number of objectives does not make this a nonsensical objective, since in a stochastic system there is no question of the exact achievement of objectives in any case. It is a matter of having/

having a preference to move a variable in one direction rather than another, and the monetarist will argue the system will help to move all or most variables to the best available levels.

The objective function therefore combines a money supply target and balance of payments, unemployment and inflation targets, the latter, for the monetarist, being essentially a trim of the former. If the monetarist can supply a model showing how the balance of payments, unemployment and inflation are affected by money supply, then that would be sufficient for him. But no such empirical model of the UK is available, which could be made the basis of such a control method. If we worked with a single equation monetarist model alone, forecasting only money GDP from money supply, then there would be no trim to correct drifts above or below productive potential.

It would however be possible to work with the Treasury model which still gives scant treatment of monetary variables, with the money supply being controlled to a trajectory chosen on monetarist arguments, and the whole battery of fiscal instruments being used to trim to correct drifts of the balance of payments, unemployment, and inflation, compatible with the money supply target.

The form of such an objective function might be to minimise

$$Q = \sum_{t=1}^{16} a_0 (M_t - M_t^0)^2 + a_1 (B_t)^2 + a_2 (U_t - U_0)^2 + a_3 (\Delta P_t)^2$$

where M_t = money supply M_3
 M_t^0 = money supply target
 B_t = current balance of payments
 U_t = unemployment
 U_0 = target unemployment

P_t = consumer price index

a_i = weighting coefficients

t = time suffix for successive future quarters.

The weakness of such an objective function used with the Treasury model is that there is no relation between the money supply target and the state of the system, or its expected state, nor any coordination between fiscal and monetary policy. Money supply is determined by the objective function, effectively alone, and fiscal policy by the non-monetary objectives and the Treasury model.

A way round these objections can be found using the best relationship between money supply $M_t = M_3$ and money GDP $= Y_t$ that can be found, however poor this may be. It will be of the form

$$y(t) = \frac{D(L)}{E(L)} m(t) + k + \frac{F(L)}{G(L)} \xi(t)$$

where D, E, F, G are polynomials in the displacement operator L , with $L m(t) = m(t-1)$,

$$y(t) = \frac{Y(t) - Y(t-1)}{Y(t-1)} \quad \text{and } m(t) \text{ similarly}$$

k = constant

$\xi(t)$ = uncorrelated (0,1) random variable

expressing changes in money GDP as an ARIMA lag of changes in M_3 , plus an ARIMA correlated residual.

The Treasury model produces forecasts $y'(t)$ of changes in money GDP by other means, with a more roundabout argument, which will gradually begin to incorporate monetary variables, but which will not reduce to the above single equation monetarist model. The term $a_0(y(t) - y'(t))$ is then substituted for the money supply term $a_0(M_t - M_0)^2$ in the above objective function.

The effect of this argument is that the Treasury model produces forecasts of

money GDP. Although the argument by which it does so may be dismissed by a monetarist, the "with policy change" numbers for money GDP will (by definition) be the best available. The money supply is then adjusted by the money supply term in the objective function to match the expected future money GDP; the monetarist would say, to produce the expected money GDP. Full allowance is made for the lag in the effect of money supply on money GDP.

Provided the model satisfies certain conditions, both the monetarist and the Treasury modeller should be satisfied. Monetary policy will follow, not slavishly but broadly and on average, correcting for past excursions by future adjustments, the path required for the smooth non-inflationary growth of money GDP to which the Treasury's "with policy change" forecasts always try to converge. And the Treasury modeller should be satisfied because while he may place no great reliance on the efficacy of monetary policy, he will be allowed a set of fiscal adjustments compatible with the monetary policy, which on their own and according to the Treasury model, should take the economy along the desired course.

To achieve this happy end the conditions to be satisfied are that the model (and the system it represents) should be sufficiently rich in available policy instruments. Whether it is, is not a simple question. It can however be answered. The monetarist will be happy: his instrument of the money supply will be nicely tuned to his objective. To satisfy the Treasury modeller, the combined policy should be compared with the policy indicated by an objective function identical but with the monetary term omitted. The two policies should be compared both in the values of corresponding parts of the objective functions, and in the detailed evolution of policy and the forecast outturn. Experience suggests they will be very similar, but the combined policy will show a more firmly controlled (not necessarily tighter) monetary policy.

To decide which monetary objectives are relevant, at this stage of development of monetary policy an empirical test is to see whether M_1 alone or M_3 alone, or M_1 and M_3 together offer the best control of money GDP Y , using single equation general ARIMA lagged predicting relationships. If it turned out that M_1 and M_3 together provided the best control, then it would be necessary to see whether the relative movements of M_1 and M_3 would be compatible. If constraints on relative movements had to be imposed they would become either a part of the model, or of the objective function, with some deterioration of performance which would have to be taken into account in considering whether any advantages remained over using M_1 or M_3 alone.

The positions of DCE and PSBR are somewhat different. DCE was introduced to provide a monetary instrument for correcting a balance of payments deficit. Although the rationale has been used by the IMF in many loan operations, the original rationale (Polak, 1958) was a rough improvisation for simple economies ignoring price and exchange rate effects, and neither originally nor subsequently has it had a sound empirical basis. However the need to consider the interaction of the money supply and the balance of payments is valid, and is provided for in the proposed argument.

Similarly PSBR, if not as a single variable, then in its component parts also plays a part in the proposed argument.

To achieve satisfactory control it is helpful to include not only the rates of change but also levels in the objective function, with the balance between rate and level affecting the emphasis on smoothness or tightness of control.

The/

The control algorithm needed

The above method is practicable now, if use is made of Chow's non-linear optimal control programme. Chow (1977) suggests how his algorithm might be used in macroeconomic policy formulation. Butters & Chow (1977) gives a User's Guide to an available Fortran program implementing the algorithm. Chow and Megdal (1977) gives results from the use of the program on the large scale Michigan Quarterly Econometric Model of the US.

Chow (1977) gives 12 steps in a suggested procedure. The application I have suggested makes modifications relating to the setting of the objective function, which in any case must be a process of iteration, not only between policy makers and modellers, but between policymakers and modellers with different points of view - in our case represented by monetarists and Treasury modellers.

Chow suggests setting target values for important economic variables which are somewhat more desirable than those given by current policy proposals, and weighting according to the relative importance of variables. These two however interact. For example a variable given high weighting which is near its target may be improved less than a variable which is given low weighting but is a long way from its target. I have suggested (Bray, 1975) that a convenient way of setting both target values and weighting is to ask what is the priority of a marginal improvement in each important variable at different levels of that variable (and if desired at different levels of other variables too). The resulting priority line (or surface) is given by equating to zero the partial derivative of the objective function Q with respect to the variable. Conversely the priority line determines both the target (by its intercept with the axis) and the weighting (by its slope) in the objective function.

It/

3

It is perfectly acceptable (and indeed probably realistic and desirable) to set the target well beyond the range of the attainable. The model will see that it is not attained, but the priority will be maintained in balance with other priorities, and not upsettingly reversed if a variable exceeds an arbitrarily set target.

The full argument can therefore be implemented now, with models in their present state. Clearly the argument will be improved if the model is improved, but the method is not dependent on having a perfect model.

The proposed method also gives a coherent answer to the real problems raised in the Bank of England Quarterly Bulletin.

References

Bank of England Quarterly Bulletin, June 1977.

Gregory C. Chow, "Effective Use of Econometric Models in Macroeconomic Policy Formulation", Princeton Econometric Memorandum No.206, February 1977.

Ettie H. Butters & Gregory C. Chow, "Optimal Control of Non-Linear Systems Program Users Guide", Princeton Econometric Memorandum No.209, April 1977.

Gregory C. Chow & Sharon Megdal, "The Control of Large Scale Non-Linear Econometric Systems", Princeton Econometric Memorandum No.207, March 1977.

Jeremy Bray, "Optimal Control of a Noisy Economy", Jour. Roy. Stat. Soc. (A, General) 1975 (III).

J.J. Polak, "Monetary Analysis of Income Formation and Payments Problems", IMF Staff Papers, April 1957.

35/04

4

TREASURY
- 6 JUL 1978
H.F.C.S.

15.9.77

MR. GOODHART
MR. PRICE

Copies to: Mr. Hewitt
Mr. Ash
Mr. Patterson
Group 7/2

A Preliminary Note on the Demand for M3

The first step in our attempt to identify a stable demand function for M3 balances has been to estimate single equations of the type estimated in the late 1960s, early 1970s. In addition we have also included an own rate on bank deposits and a measure of risk on bonds. None of these variations produced an equation that remained stable over the 1970s.

The simplest equation estimated included a constant, a single long rate of interest, nominal income, and the lagged money stock. The coefficient estimates derived from running this equation are given in Table 1. Up to 1970 the equation appeared to be extremely stable, particularly bearing in mind the limited degrees of freedom available. However, once the period is extended to 1972 and beyond, the apparent stability is destroyed, and the coefficient estimates cease to be economically meaningful.

The next step was to include a short rate (LA rate) and an own rate (CD rate from 1971 and LA rate before that). The coefficients all have the right sign up to 1972, without being particularly significant or stable. Stability should however not be expected given the collinearity of the independent variables and the limited degrees of freedom available. As before the coefficient estimates cease to be justifiable economically after 1971; in particular the coefficient on the lagged dependent variable is unacceptably high. This is a finding which is repeated for all demand equations regardless of detailed specification.

The inclusion of bond variability (the standard deviation of the daily consol rate over the quarter) did nothing to improve the situation. This variable did have the correct (positive) sign except for the 1964-70 period but was never significant. The interest rates were next entered in differential form. This resulted in a

persistent negative coefficient on bond variability, so the estimates given, Table 3, exclude this variable. As can be seen the results are clearly unacceptable. The income coefficient is not significant and generally negative, the coefficient on the consol-CD differential is incorrectly signed, and the coefficient on the lagged dependent was much too high to be acceptable. There is no improvement if the five-year bond rate is employed in place of the consol rate, see Table 4.

Finally we tried including the stock of money lagged twice as explanatory variables. This made absolutely no difference to the conclusions derived from the simpler single-lag form. The "best" equation of this type is reported in Table 5 which yields estimates very similar to those given in Table 2. Experience with M1 demand equations indicates that the shorter estimation periods are unlikely to contain sufficient independent information to identify a pre-1972 demand function. It is therefore not possible to discriminate between the single versus double lag formulations.

Conclusions

The result of this exercise is the negative conclusion that there is no obvious simple, single equation, demand for M3 balances.

Present research attempts to determine whether the problem stems from the change in banking sector behaviour post-1971, or to the existence of exogenous supply disturbances in response to the new financial conditions originating at that time.

Economic Intelligence Department,
Monetary Policy Group,
15th September 1977.

R.T.Coghlan/Miss L.M.Smith (4332)

Table 1

	<u>Constant</u>	<u>y</u>	<u>Consol. rate</u>	<u>M-1</u>	<u>R²</u>	<u>DW</u>	<u>SE</u>
1964-70	-.458 (1.47)	.315 (3.81)	-.119 (3.15)	.763 (9.19)	.995	2.319	.009
1964-71	-.449 (1.93)	.309 (4.30)	-.116 (4.16)	.767 (9.46)	.997	2.288	.009
1965-71	-.342 (1.25)	.337 (4.15)	-.120 (4.11)	.729 (7.66)	.995	2.357	.009
1964-72	-1.120 (7.38)	.195 (2.97)	-.149 (5.11)	.957 (15.55)	.997	2.027	.010
1964-73	-1.122 (7.98)	.118 (2.35)	-.126 (4.48)	1.029 (24.64)	.998	1.990	.011
1964-74	-1.185 (8.25)	.184 (4.22)	-.155 (6.47)	.976 (25.75)	.999	1.860	.012
1964-75	-.752 (4.02)	.064 (1.11)	-.112 (3.34)	1.041 (19.65)	.998	1.293	.017
1964-76	-.491 (2.90)	-.038 (0.83)	-.074 (2.30)	1.106 (22.03)	.998	1.218	.018

t-statistics shown in brackets

Table 2

Estimation Price	Constant	Y	own R		SR		LR		M3 -1	\bar{R}^2	DW	SE
			CD	IA	Consol.	Consol.						
- 70(4)	- .428 (1.47)	.118 (1.05)	.104 (1.94)	- .123 (2.28)	- .058 (1.37)	.946 (9.77)	.936	2.369	.008			
- 71(4)	- .311 (1.30)	.187 (1.97)	.042 (1.17)	- .059 (1.64)	- .063 (1.59)	.866 (9.14)	.977	2.318	.009			
- 72(4)	- .898 (4.45)	.092 (0.89)	.008 (0.24)	- .034 (0.94)	- .085 (1.81)	1.028 (10.94)	.998	2.034	.010			
- 73(4)	- .990 (5.62)	.065 (0.84)	-.010 (0.46)	- .007 (0.28)	- .087 (1.98)	1.063 (17.38)	.998	2.032	.011			
- 74(4)	-1.054 (6.28)	.166 (2.89)	-.028 (1.92)	- .027 (1.29)	- .125 (3.62)	.976 (20.88)	.999	2.050	.011			
- 75(4)	- .536 (2.44)	-.004 (0.06)	-.038 (1.34)	.007 (0.26)	- .051 (1.05)	1.079 (16.91)	.998	1.348	.017			
- 75(4)	- .320 (1.82)	-.097 (2.01)	-.043 (1.66)	- .004 (0.17)	- .004 (0.10)	1.142 (22.60)	.998	1.396	.017			

Table 3

	<u>Constant</u>	<u>y</u>	<u>LA-CD</u>	<u>Consol.-CD</u>	<u>M3</u> <u>-1</u>	<u>R²</u>	<u>DW</u>	<u>SE</u>
- 70(4)	.003 (0.01)	-.034 (0.39)	-.173 (3.40)	.021 (1.39)	1.035 (9.92)	.995	2.040	.009
- 71(4)	.081 (0.42)	.042 (0.53)	-.102 (3.01)	.028 (2.11)	.951 (9.95)	.996	2.003	.009
- 72(4)	-.453 (2.94)	-.141 (1.82)	-.087 (2.44)	.051 (3.78)	1.188 (13.68)	.997	1.727	.012
- 73(4)	-.509 (6.12)	-.107 (1.29)	-.034 (1.34)	.040 (3.15)	1.161 (20.15)	.998	1.789	.012
- 74(4)	-.242 (3.33)	.002 (0.02)	.026 (1.00)	.042 (2.69)	1.026 (17.37)	.998	1.456	.015
- 75(4)	-.081 (1.12)	-.085 (1.24)	.011 (0.39)	.047 (2.60)	1.094 (16.52)	.998	1.242	.017
- 76(4)	-.061 (0.94)	-.112 (2.32)	.003 (0.15)	.052 (3.15)	1.119 (22.78)	.998	1.364	.017

Table 4

	<u>Constant</u>	<u>y</u>	<u>LA-CD</u>	<u>5-year-CD</u>	<u>M3-1</u>	<u>R²</u>	<u>DW</u>	<u>SE</u>
- 70(4)	.101 (0.53)	.024 (0.30)	-.195 (3.90)	.051 (2.20)	.967 (9.98)	.996	2.146	.008
- 71(4)	.180 (0.93)	.126 (1.59)	-.121 (3.58)	.058 (2.47)	.859 (9.01)	.996	2.007	.009
- 72(4)	-.402 (2.34)	-.020 (0.24)	-.112 (2.79)	.091 (3.22)	1.064 (11.00)	.997	1.570	.012
- 73(4)	-.560 (6.60)	-.046 (0.86)	-.050 (1.62)	.055 (2.38)	1.106 (19.81)	.998	1.547	.013
- 74(4)	-.324 (4.72)	.042 (0.77)	-.010 (0.29)	.072 (2.80)	.995 (18.64)	.998	1.336	.015
- 75(4)	-.158 (2.30)	-.036 (0.57)	-.016 (0.40)	.064 (2.06)	1.054 (16.78)	.998	1.112	.018
- 76(4)	-.127 (1.95)	-.085 (1.76)	-.030 (0.88)	.069 (2.24)	1.100 (21.68)	.998	1.213	.018

Table 5

	<u>Constant</u>	<u>Y</u>	<u>CD</u>	<u>IA</u>	<u>Consol</u>	<u>Bond variability</u>	<u>M₋₁</u>	<u>M₋₂</u>	<u>R²</u>	<u>DW</u>	<u>SE</u>
- 70(4)	- .502 (1.52)	.101 (0.83)	.111 (1.94)	-.134 (2.24)	-.058 (1.27)	-.001 (0.17)	.868 (4.80)	.103 (0.55)	.995	2.164	.009
- 71(4)	- .315 (1.20)	.183 (1.62)	.044 (1.14)	-.061 (1.56)	-.065 (1.54)	.001 (0.19)	.856 (4.75)	.015 (0.08)	.997	2.282	.009
- 72(4)	- .879 (3.66)	.093 (0.84)	.010 (0.27)	-.035 (0.90)	-.085 (1.73)	.0004 (0.09)	1.058 (5.49)	-.033 (0.17)	.997	2.090	.011
- 73(4)	- .984 (4.39)	.057 (0.71)	-.004 (0.17)	-.014 (0.52)	-.096 (2.68)	.004 (0.87)	1.088 (6.50)	-.015 (0.08)	.998	2.043	.011
- 74(4)	- .957 (4.34)	.166 (2.82)	-.021 (1.45)	.021 (0.96)	-.120 (2.92)	.002 (0.36)	1.080 (7.31)	-.115 (0.72)	.999	2.207	.012
- 75(4)	- .341 (1.42)	.044 (0.59)	-.016 (0.56)	-.005 (0.19)	-.048 (0.92)	.005 (0.89)	1.401 (8.77)	-.392 (2.19)	.998	2.154	.016
- 76(4)	- .176 (0.95)	-.036 (0.70)	-.018 (0.67)	-.018 (0.78)	-.008 (0.18)	.004 (0.70)	1.453 (10.15)	-.387 (2.30)	.998	2.060	.016

5

Mr Wiggine

ROLLING TARGETS

I attach some brief headings.
I was much helped by some
of the work done for the Bridgeman
Committee in mid '76, and I
attach a note prepared by
the Bank then.

The next stage is to play around
with some real figures, and I
am now doing that.

Whitman
18.10

MONETARY AGGREGATES: ROLLING TARGETS

Problems with a Fixed Target

- 1) Getting caught in the final period with no room for manoeuvre.
- 2) Inflexible if change in underlying conditions.

Other Countries

1) USA: A target is set (and announced to Congress) at the start of each quarter for the next 12 months. It is based on quarterly averages from the previous target to that 3 quarters hence; i.e. in July ^{'77} fix target for ~~3rd~~ 2nd $\frac{1}{4}$ '77 to 2nd $\frac{1}{4}$ '78.

2) Germany: Rolling targets are not used. However, the target for the next 12 months is an annual average increase (i.e. average for the 12 months, compared with the average for the previous 12 months) rather than an end year to end year increase.

How often should a target be changed?

1) Depends on how update it to be justified — presumably by "exogenous factors". But the argument for monetary targets is that the Government should be regressive, not extrapolative. It would be difficult to

②

increase a target as a result of eg greater than expected wage increases or inflows without being open to the charge of being a non-believer.

2) Internally forecasts are linked to the NIF. Therefore difficult to announce other than ^{same} at time as announcing revised prospects for economy as a whole. Suggests maximum of 3 times a year - Budget; Summer package; November package.

DCE or M3?

1) M3 (£M3 in our case) because of has more meaning to a monetarist.

2) DCE, however, under closer (relatively) control by Government.

3) Depends on IMF's view - but do they want a target or a ceiling?

4) Avoid DCE and M3 targets - if problems this year.

Single Figure or Band?

1) Bundesbank prefer a single figure; Fed a band.

2) Single figures tend to become ceilings; this suggests a band would be preferable, but must not go outside it.

3) Difficult to monitor achievement of a single



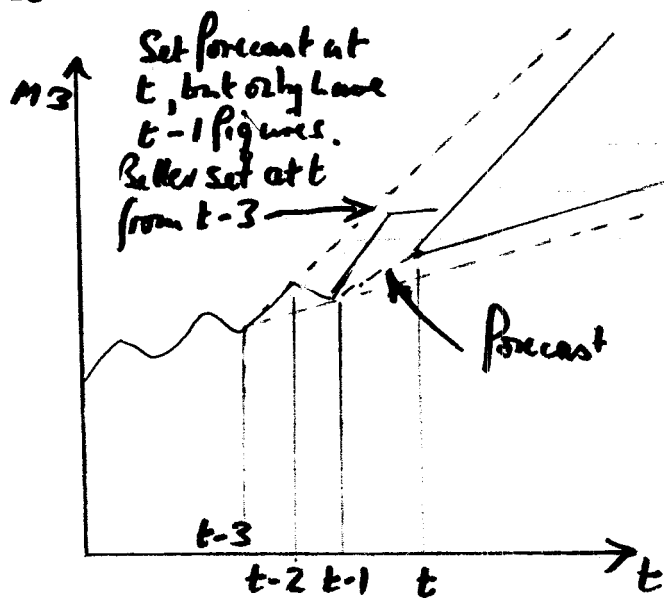
figure is being rolled forward, except by crude extrapolation.

How Far Look Ahead?

1. Depends on how far base is rooted in the past. The Bank (in July 76 exercise) envisaged announcing a target in the middle of a period t - i.e. at next year's budget we announce a target from eq. end (banking) Sept ~~to~~ end 1977 to end Oct 1978. But authorities would be criticised for too much caution.

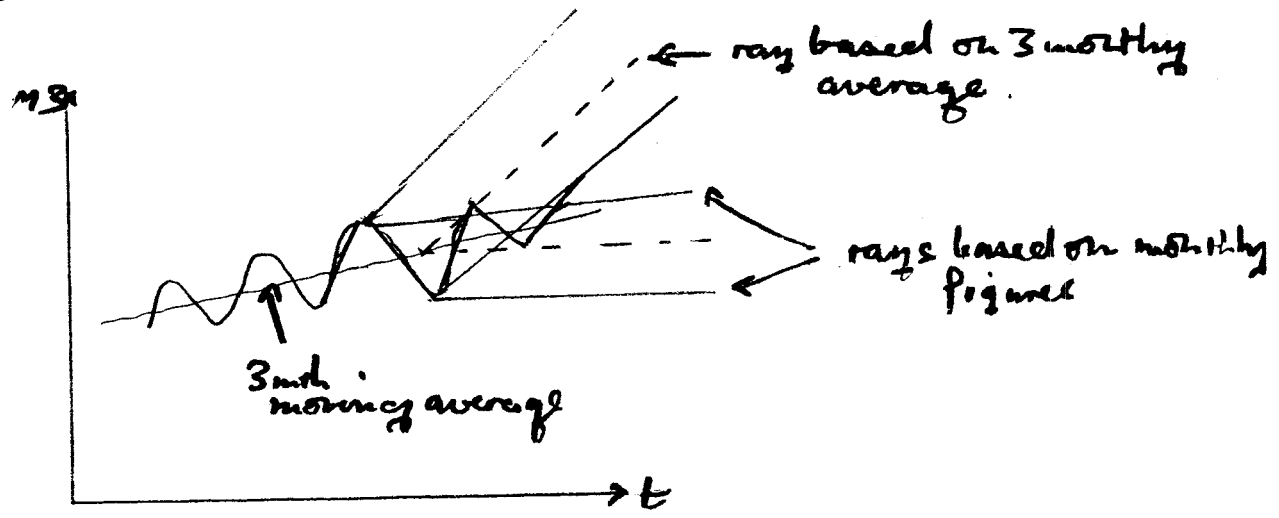
2. Inevitably linked publicly to next forecast for the economy. Since this usually stretches 12 months ahead, it would be difficult to avoid setting a 12 month target.

3. Problem of not having correct starting point - particularly difficult if monitored by usual way, as this seems to suggest insufficient room for manoeuvre at the start of the period, and too much at the end. See Diagram.



Base Period

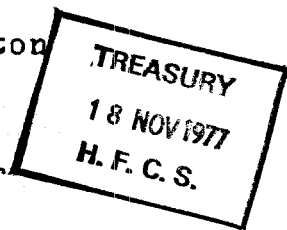
- 1) US 3 month average has considerable advantages over a monthly figure because of fluctuations.
- 2) Germany 12 month average seems to be going too far.
- 3) Corollary of setting a ~~max~~ target based on averages is that it should be monitored on the same basis. Otherwise target may could start off monthly series.



4) As noted above, monthly figures are always likely to move outside a target range in the early months.

MR. ATKINSON

cc Sir Douglas Wass
 Mr. Couzens
 Mr. Ryrie, Washington
 Mr. Jordan-Moss
 Mr. Barratt
 Mr. Hancock
 Mrs. Hedley-Miller
 Mr. Bridgeman
 Mr. Middleton
 Mr. Fitchew
 Mr. Britton
 Mr. Michell
 Mr. Gill



1978 MONETARY TARGETS

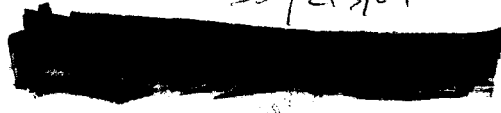
Your minute of 19 October to Mr. Couzens on US monetary policy raised the question of UK monetary targets for next year.

2. We shall need to settle this in our discussions with the IMF at the end of November, although I would not rule out the possibility of agreeing with them that our conclusions at the time should be regarded as provisional, to be re-examined, say, just before the Budget, and not publicised - or not publicised with any degree of commitment - until the time of the Budget.
3. You and others may find it helpful to know the procedure I have in mind.
4. Mr. Middleton is working on the financial side of the up-date of the forecasts, aiming to have preliminary indications during next week. At the end of next week, after some Treasury/Bank of England discussion, I want to put forward a paper, with proposals, as a basis for discussion more widely in the Treasury, possibly with the Chancellor. I think we could usefully take two bites at the question: deferring discussions of particular numbers until the current forecast exercise has been completed, and taking initially a number of general and conceptual problems, such as: the relationship between monetary targets and gross plus inflation; the relative roles of DCE and £M3; the width of any target range and its meaning; the possibility of "rolling" targets and the associated modalities; and possibly some questions of presentation.

(J.G.LITTLER)

21 October, 1977

20/10/77



G. Lushoole

TREASURY
28 OCT 1977
H.F.C.S.

Mr Wiggins

cc Mr Pondgamon
Mr Middleton
Mr Matthews

2 -> HFCS.

ROLLING TARGETS.

I attach some hurriedly written notes on targetry. I started off with the general problem in mind, only subsequently focusing on whether to make an announcement towards the later end. The early paragraphs can therefore be read rapidly.

I am afraid that these notes are nowhere near the paper that will need to be written. But we will more readily be able to prepare that when we have a conclusion.

whithams
21 October 77

10



THE BASE PERIOD

In setting at the time of the Budget a target for the banking financial year we had (this year) figures up to banking February only. Since the base is end banking April, two banking months had to be forecast before the base could be fixed.

The outturn figures were (this year) somewhat less than the end-April forecast. (I have taken the forecast from the March "forward look"). By starting from a base higher than expected we have been more generous to ourselves; ie we have excluded the high April forecast from the target period. This is shown in Graph 1.

If we had chosen to start on the March figure we would have been less fortunate; ie we would have taken a figure below trend (and below forecast) as our base. The solution could be to base the forecasts on an earlier period. Graph 2 shows the 9 - 13% target range based on the start of the calendar banking year. But the figures at the turn of this year were very odd. January was exceptionally high compared with February (and March) so the chosen target would have appeared very favourable from the point of view of the authorities. Moreover, the February figures were known at the time of the Budget. This would have meant public demand either:

- (a) To base the range on February (see dotted ray in Graph 2); or
- (b) To chose a lower target range (but this is not arithmetically sound; and it would produce oddities from one target period to the next); or
- (c) To base the target on a trend value (this would be a logical solution, but the trend is not obvious - see below).

Monthly Averages

The Chancellor does not justify in public the target chosen. The implication is that the trend rate of growth will be consistent with the expected expansion of domestic credit, given a forecast of inflation and GDP growth; ie target base is assumed to be on-trend.

The Fcd bases its target on the previous quarter's average. That would have helped avoid the problem of forecasting the last 2 months of the previous banking financial year. The ray would have started from the March figures (as the middle observation of the quarter), rather than April; and the room for variation would be that much less. Graph 3 shows that the forecast base was very close to the outturn base. Moreover, the moving 3 month average is keeping close to the (13.%) ray.

[REDACTED]

Such close results cannot always be expected. If we had used the average for the first quarter of the banking calendar year as the base (perhaps in the hope of getting some favourable figures under ~~the~~ our belt), the picture would be as Graph 4. Since £M3 fell from November to December to January to February, the three month average is very low. To base our target on that would have been quite unacceptable to informed opinion. Taking into account the then published February figures (dotted ray) would have meant a target less favourable to the authorities, and we might have managed to make it stick. But it does not suggest 3 month averages will always be the answer.

The German System

The German authorities take the argument one step further. They set the annual target as an average of the target year, compared with the average of the previous year; ie the base is effectively a twelve month average.

The system is illustrated in Graph 5. I have shown two pairs of rays; one based on the average of the last financial banking year, the other on the calendar banking year. The results for the UK would have been favourable; and sufficiently confusing to even informed opinion to ~~show as~~ ^{allow us} to get away with it.

On the other hand, if the underlying growth increases towards the end of the base year we could be left with an impossible burden. For example if the growth over the period June to November last year was extrapolated, for another couple of months, there would have been relatively little difference to the position of the target rays, but with an annual average rate would have crept above the upper limit. It would need exceptional figures (as we had at the turn of the year) to swing it on to target.

Monitoring

At the moment a variety of measures are used in the press. Fortunately the single monthly figures are rarely ^{annalised} annalised, but 3 monthly are as are the financial year to date. The logic of an x month average base is to ^{annalised} annalised the last x months compared with the base.

(I note that Jon Shields in his note attached to Bill Ryrie's letter of 17 October to Mr Congens ^{assesses} assesses the US figures on two bases:

- (1) Quarterly base to latest month, ^{annalised} annalised.

[REDACTED]

(2) Quarterly base to latest quarter, annualised.

I would regard the second as more relevant; the ^{first} limit is a hybrid.

Graph 6 plots the implied annualised figures of the UK figures to date. I have shown two pairs of lines: a target year based on financial and calendar banking years, with in each case a target base of the final month of previous target year and the last 3 months of the calendar year. For the 3 months lines, I have annualised on the basis of the last 3 months. The block/dash line shows the figures with which we are familiar. The plots show nothing that we could have derived from the earlier graphs. They do indicate, however, that monitoring on the basis of moving averages smooths the fluctuations from month to month.

Moving averages present a different problem. If we are off-target as we move to the final month of the target-period, the necessary adjustment becomes more and more difficult. Table I illustrates this, on the basis of some hypothetical figures. If the growth rate is 0.05% higher per month (ie 0.06% pa) than the target rate of 8% pa, for the first 11 months of the year then the necessary final month figure must be $+0.1\%$, -1.6% or -3.1% in the 1 month, 3 month or 12 month cases respectively. This reinforces the case for rolling targets if we switch to an average base system.

Justification for Rolling Forward

The argument against a moving target has always been the credibility of any target that is frequently changed. The Fcd manages it but then there heart is known to be in the right place; and there is less public concern so long as the rolled forward targets are progressively lower. I am still surprised that the Fcd can roll forward every 3 months without ever getting even to the middle of a target period. I note that Jon Shields nevertheless measures the US outturn against target for the last 12 months; ie - targets are perhaps not forgotten when rolled forward.

A target is presumably based on:

- (a) The underlying growth in GDP
- (b) The "acceptable" rate of future inflation
- (c) Any expected change in velocity as a result, eg, of interest rate changes.
- (d) The target for the previous period (in the sense this presents a constraint)

A change in (a) to (c) is an argument for changing the target; but whether this is justified depends on how the targets are regarded. A monetarist would insist

28

[REDACTED]

the targets were held in order to prevent inflation. Others (perhaps the City generally) see the target as an indication of the authorities' stance (on wages; interest rates; gilt sales; etc) and its room for manoeuvre; and it acts on expectations thereby. To change a target is therefore acceptable, provided it is not taken as an indication of wrongheaded policies by the authorities (too much expenditure; weakness on wages). Inflows could be seen as ^{such} a justification - they are a sign of strength, or of weakness elsewhere (ie the US); there are probably velocity offsets: and the authorities have shown some determination to reduce the domestic impact (eg pointing to IBELs in the wings). Moreover, inflows are reversible.

A New Target

To set a new target now would be difficult. The problems are illustrated (badly) in graph 7. We are likely to leave the target zone in October, and will not return for some while. At the moment however we are within the target, and have been (effectively) all year. Any new target range on the basis of the past (ie end September or last 3 months) would give us no help. We will be outside the range in the early months. If we moved back down the graph, not only would we be still outside next month (and last?), we would lose the benefit of a relatively high September figure. To change again within the next 12 months would create problems of credibility; and we cannot say now that we will base the target on some future month (eg October). By stepping over the limit from the start of the target period we would lose any margin for a reflationary budget; at least now we have the opportunity of wiping the slate clean. A new target would be much more helpful if we could see a few months favourable figures ahead.

The argument in favour of setting a new target is that we are likely to stay outside the present target range until the end of the financial year. This will in turn create expectations that will prevent us from meeting the target. But we will be announcing a target for the next financial year (assuming the

12

[REDACTED]

Budget is before middle April) after only 10 months figures have been published. Public attention will be focused on the new target. If necessary we can backdate its start, although this will depend on our forecast. The big advantage is that we will have a better idea of exchange rate policy, and the noise generated by inflows will (may) have subsided.

Another possibility is to set a higher target. But on the basis of our forecasts for the next 3 months we would need an upper range of 18 per cent to be seen within target for the next 3 months, assuming we based our target on the average of the last 3 months. For a target based on the one month September, a 16 per cent upper range might be sufficient. But the effect of this on inflationary expectations would be severe. The Government's "stance" would be regarded as inadequate. The figures are too large, even if we are hiccuping. We would do better to point to growth over the last 12 months (which still should be only 9 per cent). However, because of the very low figures at the turn of the year, that comparison would soon start to work against us.

3

① End banking year to end banking year, on basis of data available before Budget

£M3
£bn
45

7999
13%

9%
43-40

actual

forecast

3985

F M A M J J A S O N D F M A M J

1977 1978

44

43

42

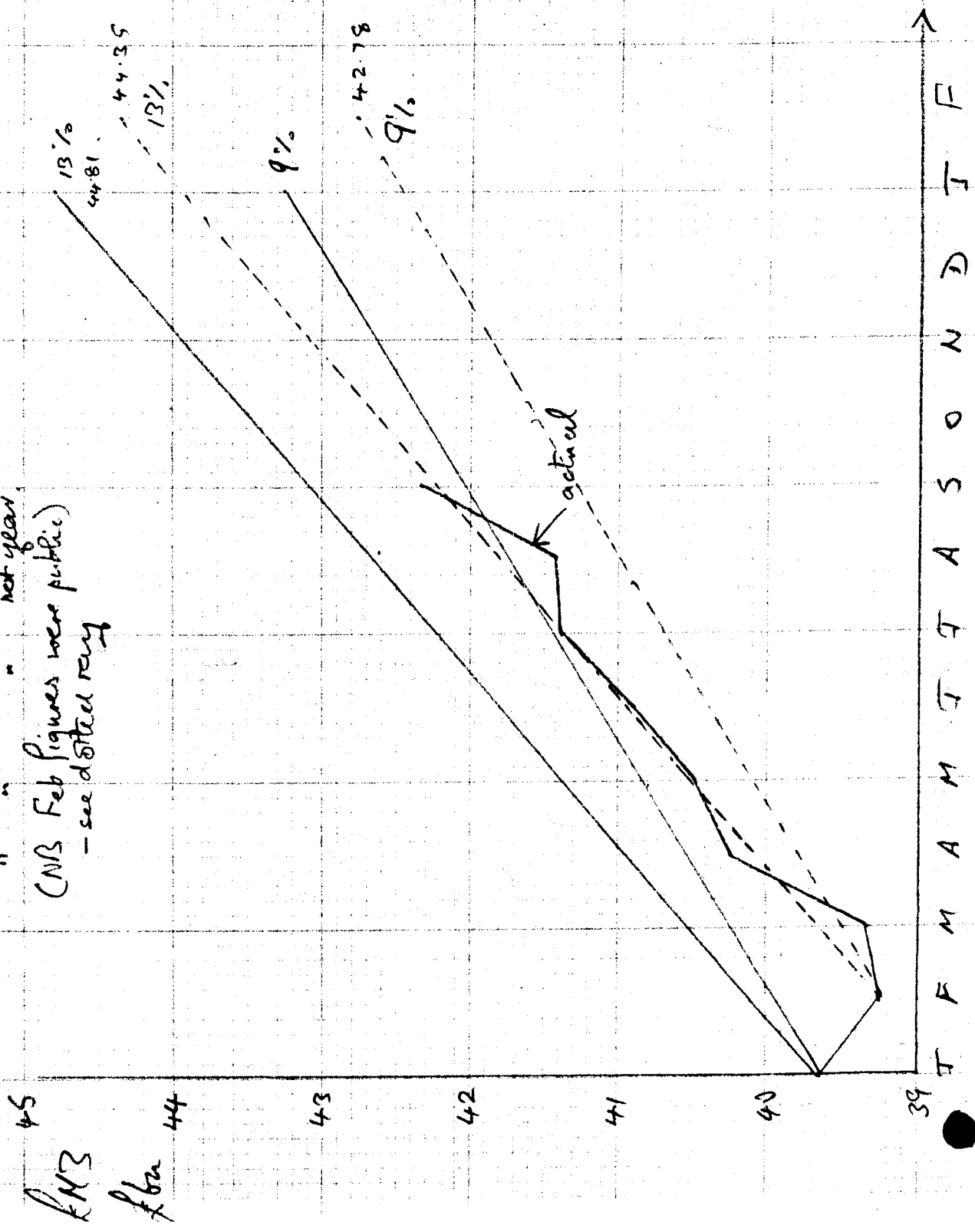
41

40

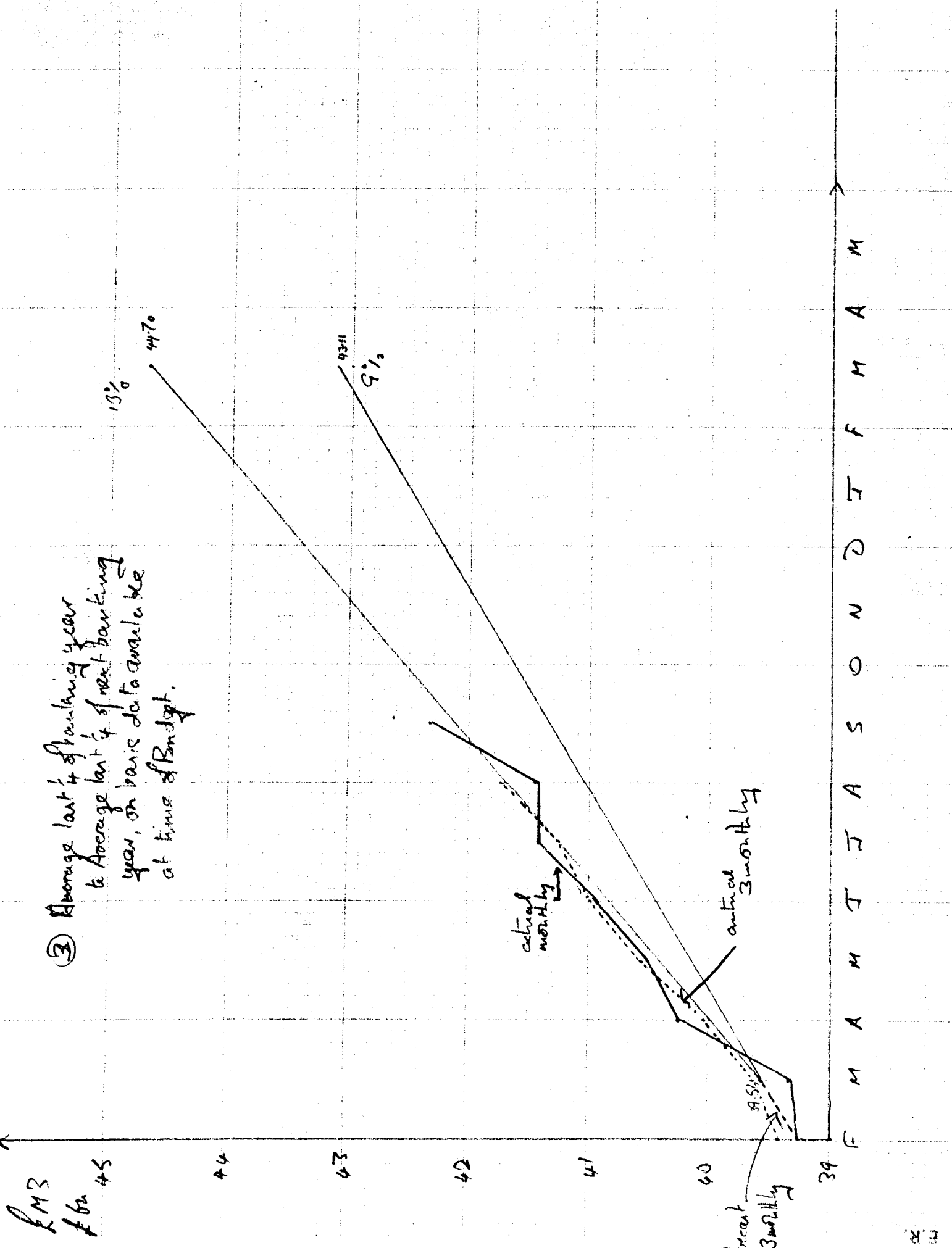
39

TD

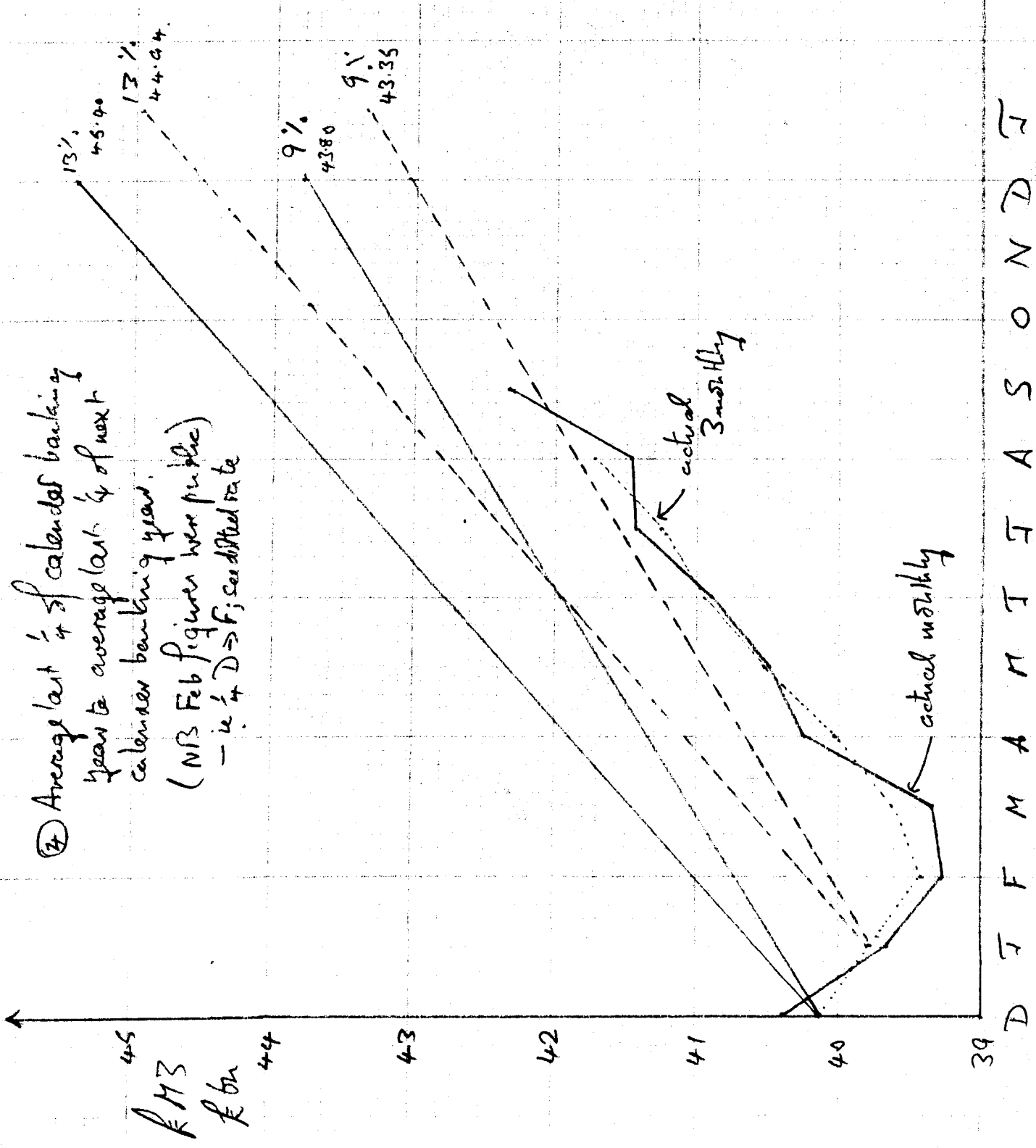
② end banking January to
 " " " " net year
 (NS Feb figures were public)
 - see dotted line



③ Average last 4 of banking year
to Average last 4 of next banking
year, on basis of available
at time of Budget.

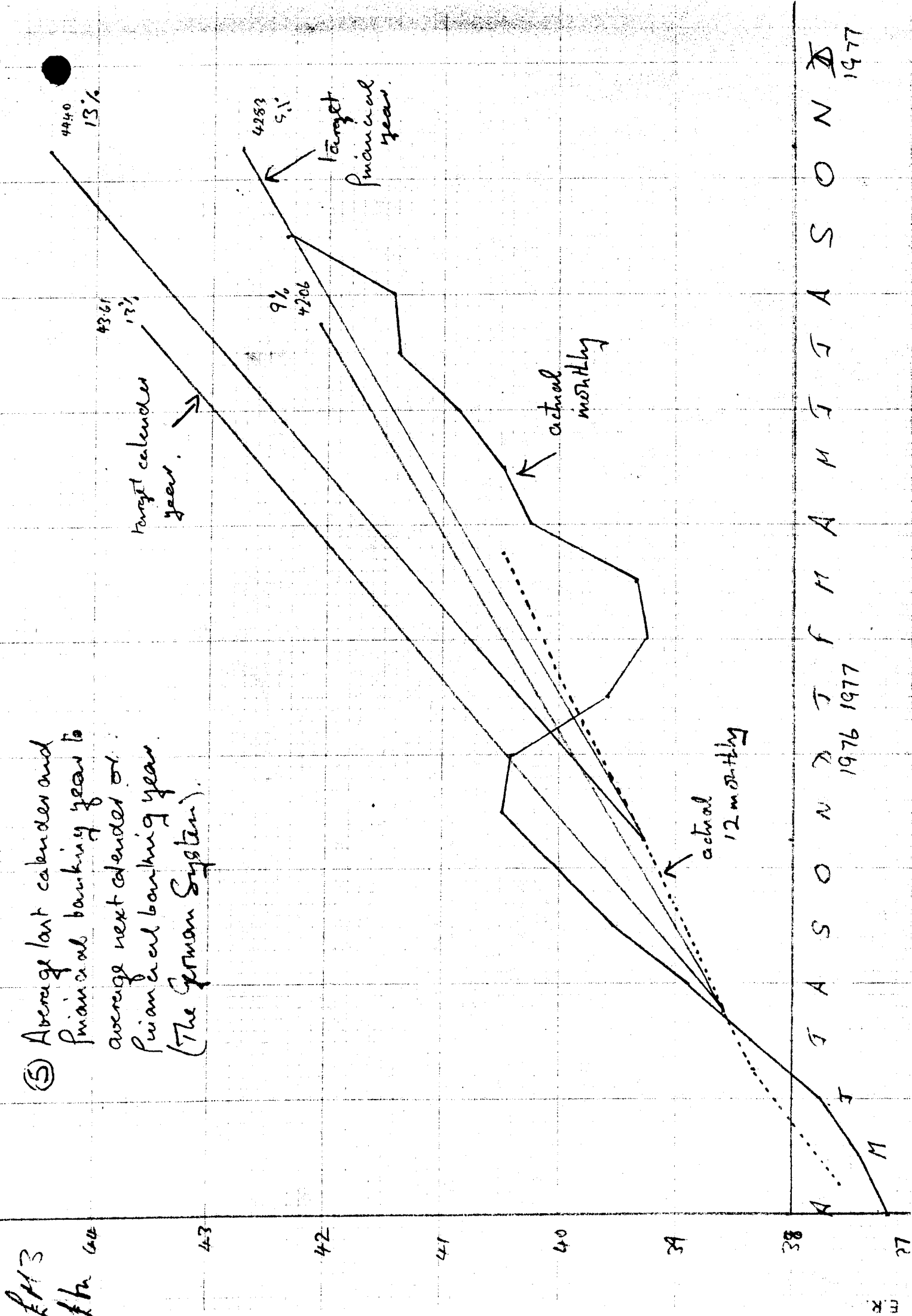


② Average last 1/4 of calendar banking year to average last 1/4 of next calendar banking year.
 (NB Feb figures were public)
 - 1/4 D → F; credited rate



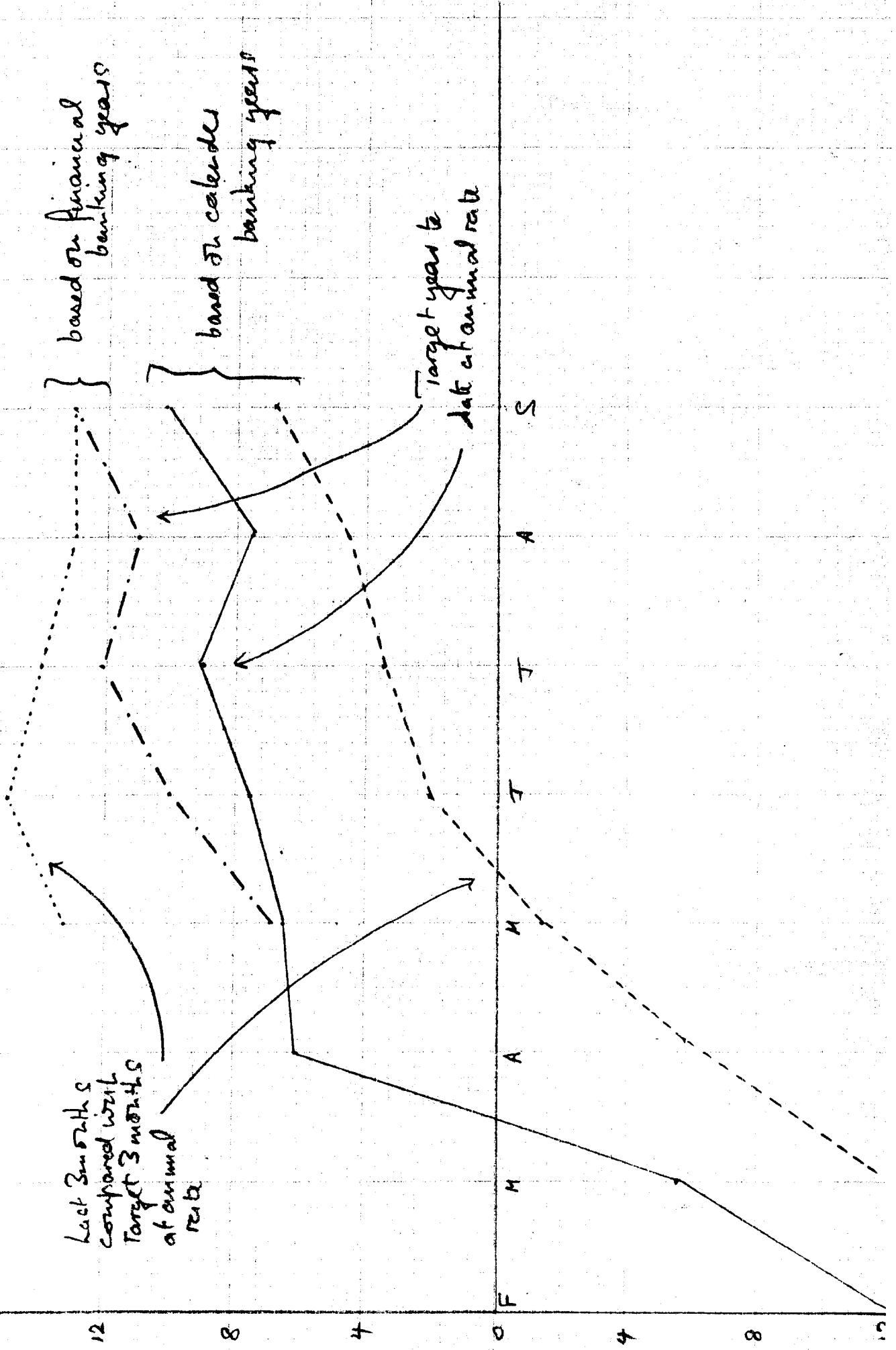
D F F M A M J J A S O N D

⑤ Average last calendar and financial banking year to average next calendar or financial banking year (The German System).



A S O N D J F M A M J J A S O N D 1976 1977

⑤ Target modeling



based on financial banking years

based on calendar banking years

Target year to date at annual rate

Last 3 months compared with target 3 months at annual rate

£M3
Apr 45

⑦ Target rays for rolled forward forecast

13 1/2

Forecast 3 months by

Forecast monthly

→ Forecast

actual

Target rays on average of last 3 months

Target rays on 2 September

39 A M J J A S O N D J F M A M J J A S

14

