1. Monetary Base Control

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THE MONETARY BASE

Strictly, the monetary base or high-powered money is defined as the monetary liabilities of the monetary authorities ie. the Bank of England and the Treasury. The classical definition of the base is therefore:

Monetary Base (MB1)	=	Notes and coin in total	+	Balances held by Banks at the B/E

2. In a non-mandatory system of monetary base control, this would indeed be the relevant aggregate. However, in a mandatory system, specific requirements are placed on the banks' holdings of base assets. A narrower concept, the banks' component of the base, becomes relevant. This would be:

Monetary Base (MB2)	=	Notes and coin held by Banks	+	Balances held by Banks at the B/E

3. Further, since the mandatory requirement is arbitrary, and since the share of total notes and coin between banks and non-banks is erratic and often unpredictable, it may be easier to express the requirement solely in terms of bankers' balances above. Thus the base then is defined:

Monetary Base (MB3)	=	Balances held by Banks at the B/E

4. There are thus three separate items involved which can be aggregated together to form successively wider definitions of the base. These components are as follows:

a) Bankers' balances at the Bank of England
b) Notes and coin held by the general public
c) Notes and coin held by banks.

Each of these components is discussed in turn.

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5. Bankers' balances. The path taken by this series is shown in Chart I. Overall, the series has tended to rise over the period though with considerable erratic swings. Considerable care, however, is required in interpreting its movement because of the institutional framework of UK banking.

6. Up to October 1971, the London Clearing Banks were required to hold 8% of assets in the form of cash - either till money or Bankers' balances. After that time, the London Clearers were required instead to hold 1½% of their eligible liabilities in the form of Bankers' balances, on average over the banking month. Thus throughout the period the recorded figures cannot be taken to indicate balances which the banks would voluntarily hold, but are constrained by the insitutional agreement. It should be noted that the non-clearing banks have virtually no demand for balances with the Bank of England. Transactions between such banks are normally conducted by means of accounts held with the Clearers.

7. One might further argue that since Bankers' balances carry no return and since the required quantities are reputedly well in excess of what the banks would choose to hold, the series carry no information at all. It will never be profitable to hold excess balances and any observed excess must be due to accidents arising from the vagaries of the public sector's financial balance. On the other hand, Knoëbel and Bond of the IMF have argued that observed excess Bankers' balances do carry genuine information. To the extent that banks wish to avoid the implicit, if non-precuniary penalties involved in breach of the 1½% requirement, they will hold excess balances to guard against unexpected shortages. Optimally, banks will buy degrees of "insurance" depending on its price. Thus the higher are interest rates, the lower will be excess balances and we may expect a stable interest rate - Bankers' balances relationship in spite of the institutional framework.

8. Two points can be made against this:

a) there are no formal penalties for breaches of the 1½% requirement and it is not clear if the banks do fear the consequences of accidental breaches;

b) more importantly, because the Bank of England operates freely as lender of last resort - usually at non-penal rates - the banks can always borrow the cash they need in event of a sudden shortage.

9. One way to test these hypotheses, empirically, is to look for the presence of systematic components in the series for excess balances. If by contrast the series turns out to be purely random then it cannot be related to interest rates which have certainly moved in a systematic way. It would instead support the view that excess balances are primarily due to accident.

10. Calculating the autocorrelation function for excess balances, the following conclusions may be drawn:

a) average excess balances are very small. Over the period October 1971 to October 1980, they were only 0.06% of eligible liabilities.

b) the hypothesis that the series is random could not be rejected at the 95% level (though it could at the 70% level).

11. The conclusion seems to be that there is little information to be drawn from the past behaviour of the Bankers' balances series. Of course, this point only applies to past data, given institutional conditions. If the Bank of England stopped acting as lender of last resort - as would be required, for example by a move to monetary base control - then the possibility o

an interest rate - Bankers' balances relationship appearing would emerge. But it would be some time before we could be confident of having identified it.

12. Banks' holdings of notes and coin. Chart II shows the path of banks holdings of cash - till money. The series has risen markedly over the period 1963 to 1980 but with large and erratic movements. There was some tendency for the series to fall back after the introduction of Competition and Credit Control in 1971.

13. In spite of the erratic nature of the series, however, it proves possible to explain its movements fairly well. Research in the Treasury produced the following equation as part of a wider model of bank behaviour:

$$\frac{CASHCB}{NDEP} = \underset{(0.63)}{-0.0121} \log ARSHRT + \underset{(1.45)}{0.0369}\ \frac{BDEP}{NDEP}$$

$$\underset{(1.19)}{+0.0294}\ \frac{ADV}{NDEP} \underset{(3.57)}{- 0.1225}\ \frac{SDCALL}{NDEP} \underset{(4.40)}{- 0.1351}$$

where S.E.= 0.0195

CASHCB = notes and coin held by banks
NDEP = non-deposit liabilities of banks
BDEP = bank deposits
ADV = bank advances
SDCALL = the level of Special Deposits
ARSHRT = the 3 month interbank rate adjusted for the taxation effects of the reserve asset ratio and Special Deposits.

14. The equation explains banks' holdings of cash primarily in terms of precautionary demand. An increase in the level of bank deposits or of bank advances increases the demand for cash. By contrast, a call for Special Deposits strongly reduces it. Presumably this is an indication of the belief by individual banks that the authorities would release Special Deposits to that ba

in the event of a run on its tills. In that sense Special Deposits ma be a close precautionary substitute for cash. A rise in interest rates - after allowing for implicit taxation effects - reduces the demand for notes and coin. This effect is scaled by the level of the banks' non-deposit liabilities. This term represents the wealth of the banks and they are taken to become less risk averse as their wealth rises. Hence they become more sensitive to interest rates and reduce their precautionary holding of cash more as interest rates rise. However, while this effect is of the correct sign, it is small and insig nificant. The interpretation seems to be that banks' demand for cash is rather interest-inelastic.

15. Howard, of the US Federal Reserve Board, has produced a different equation for till money. This is a single equation rather than a part of a complete system of bank behaviour. It has the following form:

$$XR/D = \underset{(2.8)}{378.7}\left(\frac{P}{D}\right) + \underset{(6.94)}{0.0531}\left(\frac{TD}{D}\right)$$

$$+ \underset{(3.59)}{0.544}\left(\frac{DD}{D}\right) \; rtb \; \underset{(3.85)}{0.2165} \; rtb \; \underset{(1.93)}{0.0265}\left(\frac{CTB}{D}\right)$$

Where

XR = excess cash and Bankers' balances
P = the price level
D = £ bank deposits
TD = £ bank deposits other than sight deposits
DD = £ bank sight deposits
rtb = the Treasury Bill rate

The interpretation of this equation is not entirely straightforward. Strictly the left hand side measures Bankers' balances and cash in excess of the 1½% requirement. But since as argued above excess Bankers' balances are normally negligible, the equation is really one for banks' till money. (Howard admitted this when we spoke to him). Its main features are:

a) rises in prices, not suprisingly, raise the demand for till money in nominal terms;

b) an increase in time deposits increases the demand for till money;

c) an increase in Treasury Bill rate would have a marked downward effect on till money if all deposits were time deposits. But when the banks hold demand deposits, the effect is reduced since, presumably, it increases the banks pure precautionary demand. In fact, given the proportion of demand deposits in banks' total deposits observed normally, the effect of interest rates is very weak. This accords with the Treasury result;

d) Treasury Bills are not a good substitute for till money, so far as the banks are concerned. This is scarcely surprising. Banks' customers can scarcely be expected to make their withdrawals in Treasury Bills.

Thus, while there seems to be a stable relationship between interest rates and banks' demand for cash, the effect is weak. This component of the base is interest inelastic.

16. The Public's Demand for Cash It is normally assumed that the public's demand for cash is virtually entirely for transactions purposes. Speculative balances will not typically be held in this form since there are assets - time deposits, for example - which carry the same capital certainty but a higher yield. It should be noted that this is by far the largest component of the monetary base and currently accounts for about 85% of the widest definition.

17. Chart III shows the path of this variable. Like the other components of the base it trends upwards over the period - reflecting the increasing nominal value of transactions - but its path is less erratic than that of the rest of the base. In order to model the series we have always used a simple transactions model of the kind:

$$CASHPR = \alpha + \sum_{i=0}^{M} \beta_i X_{-i} + \sum_{i=0}^{N} \gamma_i R_{-i}$$

where

CASHPR	=	the public's demand for notes and coin
X	=	some expenditure measure (proxying transactions)
R	=	an interest rate measuring the opportunity cost of holding notes and coin

18. The latest work on this used a logarithmic specification and used the rate on 7-day bank deposits as the competing interest rate. While consumers' expenditure was found to be the most suitable expenditure component to represent X, personal income was found to outperform all the expenditure measures tried. The best equation thus had the following form:

$$\log CASHPR = -0.366 + 0.2313 \log CASHPR_{-3}$$
$$+0.569 \log CASHPR_{-4} + 1.2351 \log PC - 0.630 \log PC_{-1}$$
$$-0.4056 \log PC_{-4} + 0.3988 \log RPDI + 0.202 \log RPDI_{-1}$$
$$-0.1773 \log RPDI_{-3} \quad (1.1) \qquad -0.2972 \log RPDI_{-4} \quad (1.9) \qquad -0.00564 RDEP \quad (4.1)$$
$$-0.00300 RDEP_{-4} \quad (1.6)$$

Estimation period: 65(1)-80(2)
S.E. = 1.83%

19. The most surprising features about this equation is its very strong interest rate term. The long run [illegible] - elasticity is -4.32. However, it would appear that this crucial elasticity is not independent of the sample period. Re-estimating over different data periods we obtained the following long-run elasticities:

Estimation Period	Standard Error	Income Elasticity	Interest Rate Semi-elasticity
65(1)-80(2)	1.83%	0.633	-4.32
65(1)-79(4)	1.76%	0.505	-2.50
65(1)-78(4)	1.74%	0.462	-1.12
65(1)-77(4)	1.76%	0.382	-1.43
65(1)-76(4)	1.84%	0.339	-1.97
70(1)-80(2)	1.94%	0.464	-3.61

While it seems clear that this component of the base is somewhat interest-elastic, it would be idle to pretend that we have any idea what the elasticity is. Adding the two most recent periods of data, the estimated semi-elasticity is nearly doubled while the last six quarters' experience would have led us to revise our estimate upwards by a factor of four.

20. A further point to note is the relatively high standard errors associated with these equations. They are approximately twice as high as those typically found for the wider aggregates M1 and PSL1 and about three times as high as those for £M3 and PSL2.

21. The base as a whole. Chart IV shows the monetary base as a whole built up from the components. Not surprisingly in view of the above discussion, while the public's holdings of notes and coin dominate the total, much of the variability is provided by the two minor components.

22. Perhaps because of the disparate nature of its components there is no work that I am aware of on the demand for the base as a whole.

23. Relationship between the Base and Other Macroeconomic Aggregates. Again, there is very little work on this issue for the United Kingdom, presumably because of the uncertainty as to whether the base as a whole has any significance in the UK conte t. There are, however, at least three exceptions, two relating the base to the wider monetary aggregates and one to GDP.

24. Of the former type, Parkin has derived a simple relationship in a paper for the Mont Peleri Conference, August 1980. It relates the growth rate in M1 and £M3 to the growth rate in the base and to changes in the Treasury Bill rate. Using an annual model, 1964-79, he finds:

$$\dot{M}1 = \underset{(0.09)}{-0.19} + \underset{(3.98)}{0.81\,\dot{MB}} + \underset{(0.95)}{0.19\,\dot{MB}_{-1}} \qquad R^2 = 0.63$$

$$\dot{\pounds M3} = \underset{(1.95)}{6.00} + \underset{(1.48)}{0.43\,\dot{MB}} + \underset{(2.27)}{0.09\dot{R}/R} \qquad R^2 = 0.32$$

The IMF study of Knoëbel and Bond also found a relationship between the base and M1:

$$\log M1 = \underset{(0.4)}{-0.11} + \underset{(24.2)}{1.1 \log MB} \underset{(1.40)}{-0.09\ tbr} \qquad R^2 = 0.99$$

25. Both studies purport to have found a significant link between growth in M1 and the base. (On the other hand, there is apparently no significant relationship between £M3 and the base.) If true, these conclusions would be important. But there must be a question mark over their validity. First, at a theoretical level, one would expect to find a relationship between £M3 and the base more strongly than between M1 and the base. Banks are normally taken to demand base assets for precautionary reasons to back their deposit liabilities. M1 includes only the banks' demand deposits and this by no means embraces all the deposits for which the banks will require backing. Nominal 7-day time deposits, for example are effectively demand deposits, given UK institutional arrangements,

and even banks with no demand deposits at all will require high-powered money backing for any asset liability maturity mismatch in their portfolios.

26. Perhaps more important are the empirical objections to these studies. The IMF study, for example , ignores the point that both the base and M1 have been trending upwards steadily over time. There is also bound to be a strong correlation between the two - because of the spurious correlation problem - even if there were no true relationship at all. Parkin avoids this criticism by using growth rates rather than levels so that the common trending problem does not occur. One consequence is that the significance of the base terms is much reduced in Parkin's equation as compared to that in the IMF relationship. But there are two further damaging criticisms which apply to Parkin's work as well as the IMF study. First, neither considers the problem that the correlation may be spurious because some third set of factors determines both base and M1 movements. Indeed this is very likely since notes and coin, the bulk of the base, and M1 are both determined by transactions and interest rates. Thus while base and M1 may well be correlated there is no causal connection between the two. Second, about 30% of M1 consists of the public's holdings of notes and coin while about 85% of the base consists of the same series. This is bound to give an upward bias to the coefficient on the base variable. Correcting for this bias would seriously weaken the apparent correlation between these variables.

27. It was a National Institute study by Matthews and Ormerod which established an apparent linkage between movements in the base and GDP. Setting up a "St Louis" model for the United Kingdom they obtained:

$$\Delta GDP_t = \sum_{i=0}^{4} \alpha_i \Delta BASE_{-i} + \sum_{i=0}^{4} \beta_i \Delta F_{-i}$$

$$\bar{R}^2 = 0.64$$

where

GDP = quarterly expenditure measure of GDP
BASE = public's holding of notes and coin + Banker's balances
F = full employment public sector financial deficit (representing fiscal stance)

and	α = 0.084 (0.15)	δ = 0.606 (2.81)
	1 = 1.250 (2.49)	1 = -0.105 (0.52)
	2 = 1.140 (2.89)	2 = 0.066 (0.31)
	3 = 0.827 (1.57)	3 = 0.167 (0.76)
	4 = 1.410 (2.42)	4 = -0.754 (2.92)
	$\Sigma\alpha_i$ = 4.701 (7.12)	$\Sigma\beta_i$ = -0.019 (0.25)

The conclusion of this study is that fiscal policy has only an impact effect on expenditure with no significant long run effect, whereas monetary policy has a permanent effect, increasing in impact over the course of a year.

28. The authors themselves were somewhat surprised by this strong monetarist result and there are indeed some criticisms we can make of it. First, as a minor point, the base definition used is odd since it excludes bank's holdings of notes and coins. More importantly, base money has not been specifically controlled by the authorities over the estimation period but is endogenous to the system. It may well be therefore that the same set of exogenous factors which ultimately led to the growth in GDP first of all affected the demand for base. This would again give an apparent leading indicator role for the base even though it had no causal relationship with GDP. Nevertheless, this result seems to be fairly robust and certainly suggests that the relationship is worth further investigation.

Summary

This note has examined the path taken by the monetary base and considered the factors which affect the demand for its components. The main points seem to be:

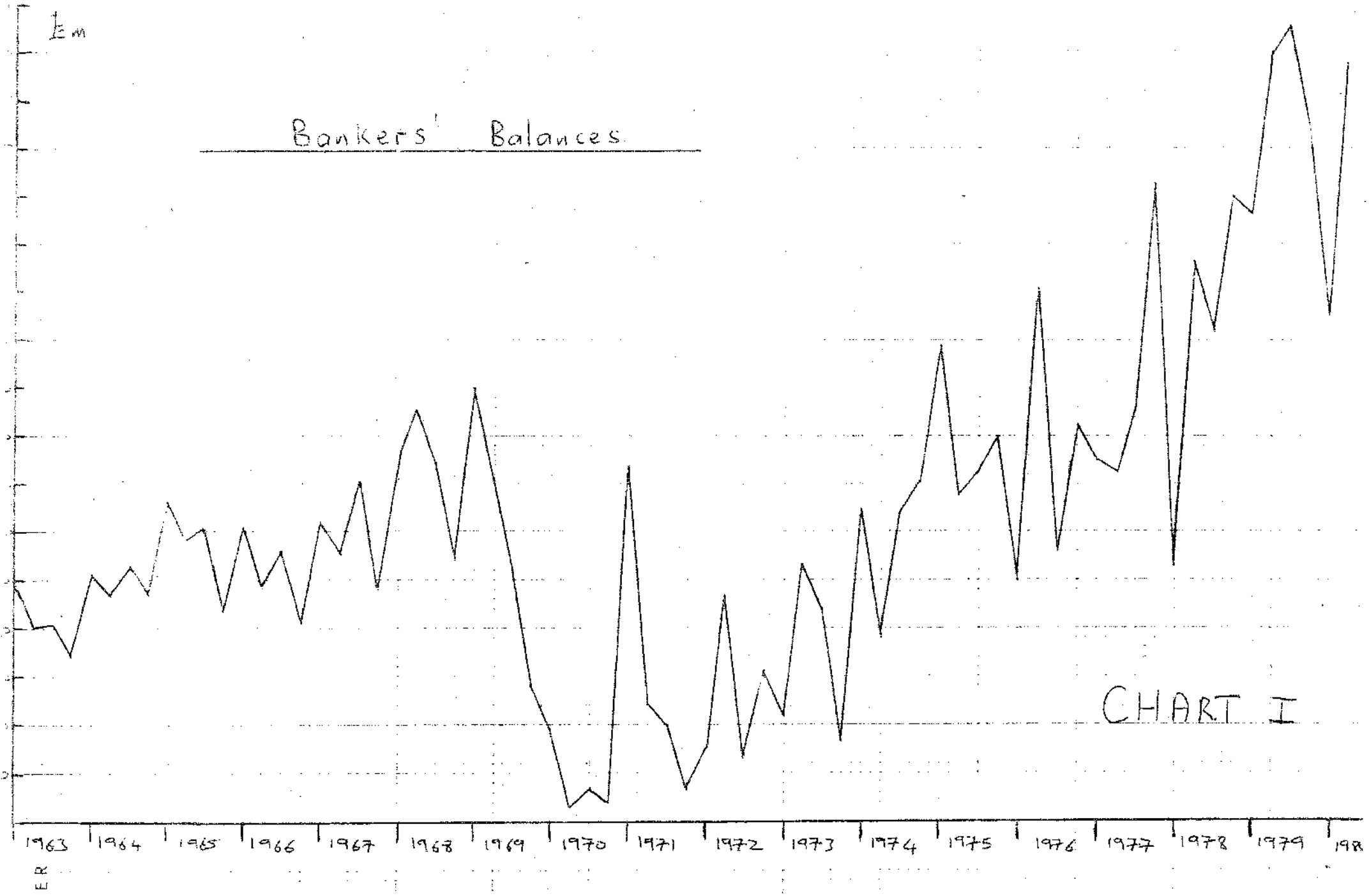
a) Bankers' balances have been institutionally determined over the past and we do not know what the unconstrained demand would be if the institutional framework is changed;

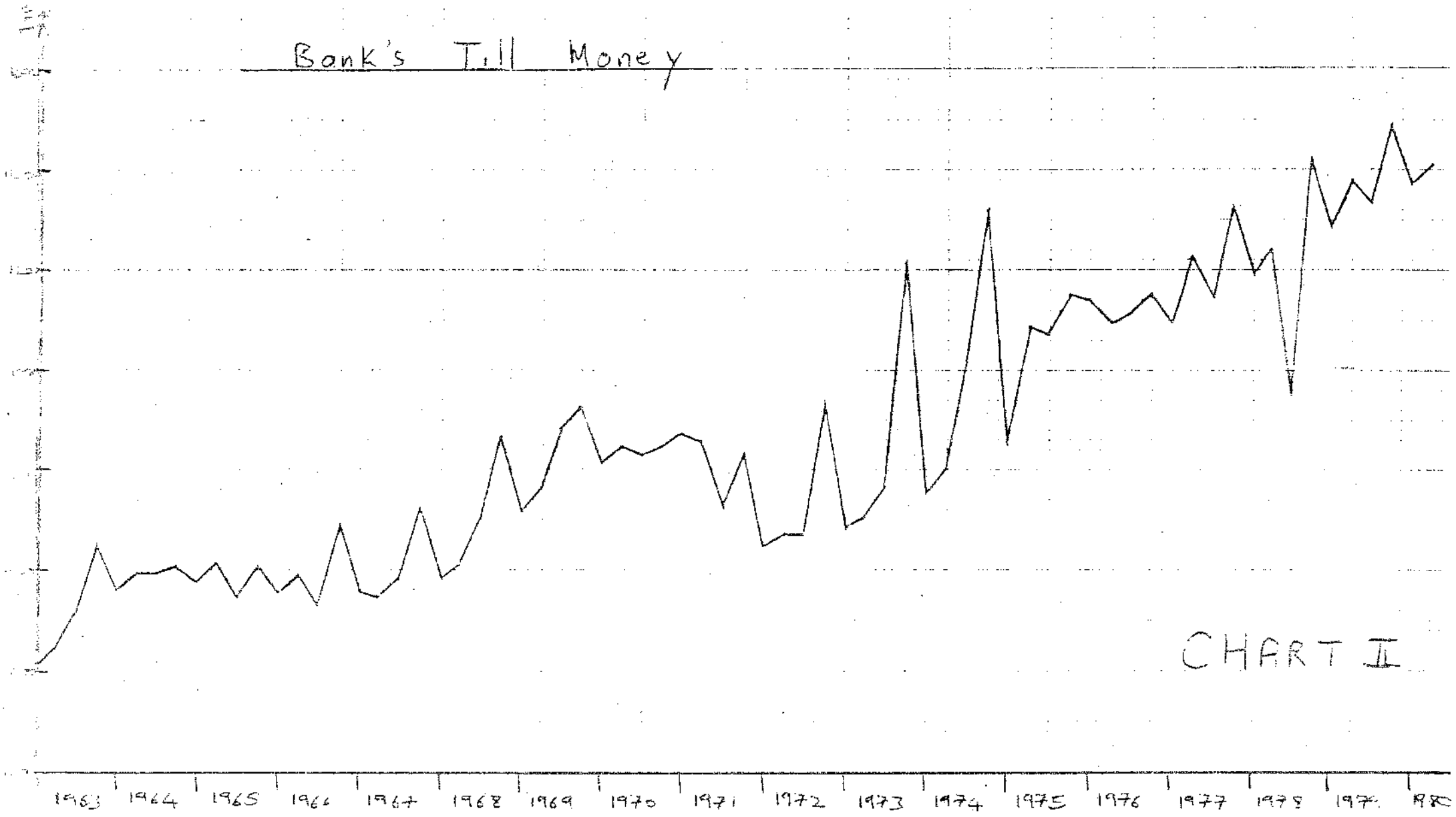
b) the banks' demand for cash seems to be reasonably stable and predictable but is relatively insensitive to movements in interest rates;

c) the public's demand for notes and coin is probably far more interest-elastic but the demand function seems to be unstable;

d) some work has suggested that there may be a relationship between movements in the base and in M1. But these conclusions are questionable;

e) there does, however, seem to be a relationship between the base and current price GDP. It seems possible that the base might act as a leading indicator for GDP even if it is not the ultimate causal agent.


£m
Bankers' Balances
CHART I
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979


Bank's Till Money
1963
1964
1965
1966
1967
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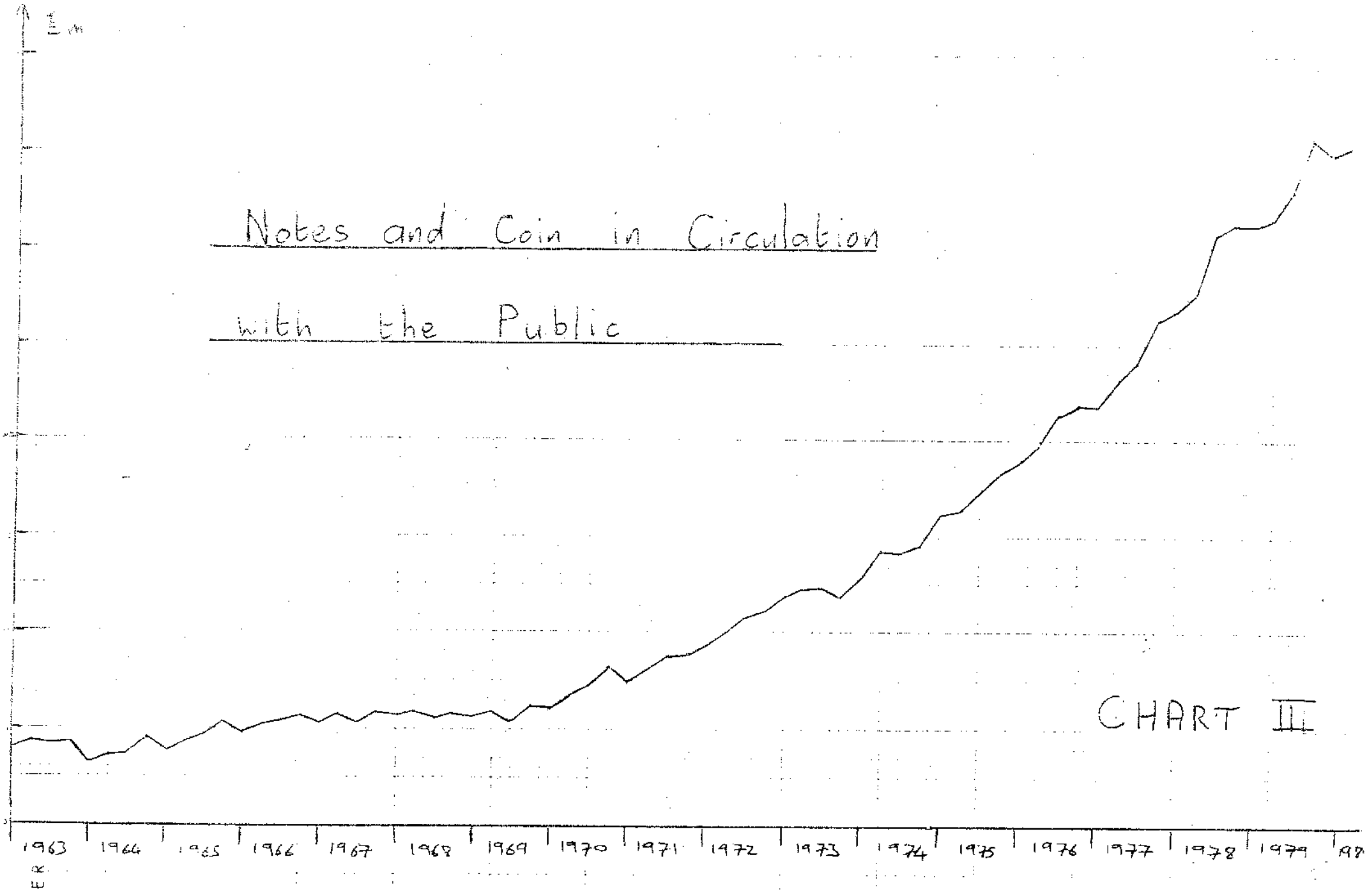
1974
1975
1976
1977
1978
1979
1980

CHART II


£ m
Notes and Coin in Circulation
with the Public
1963
1964
1965
1966
1967
1968
1969
1970
1971
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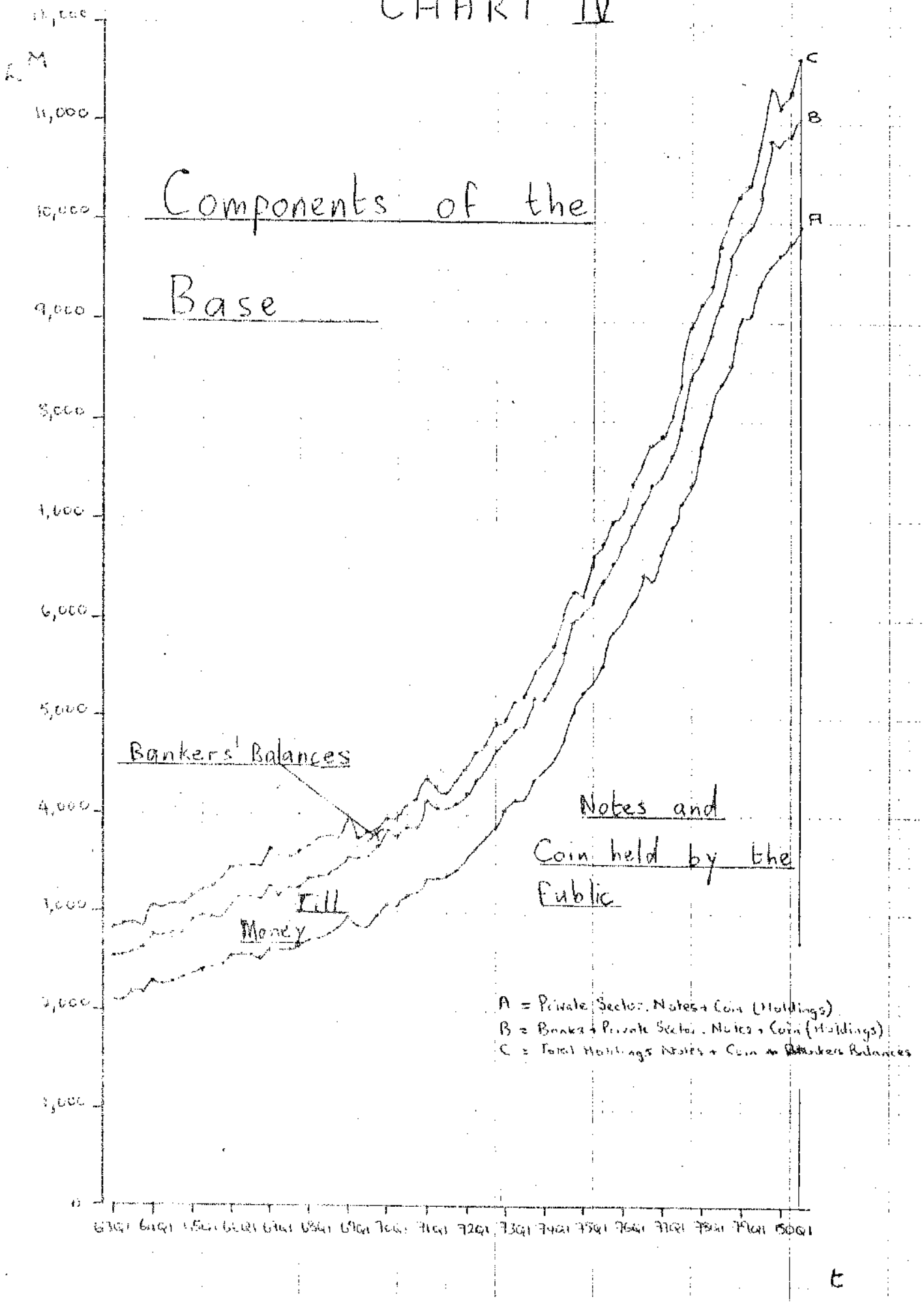
1975
1976
1977
1978
1979
CHART III

CHART IV


£M
11,000
10,000
9,000
5,000
1,000
6,000
5,000
4,000
3,000
2,000
1,000
0
C
B
A
Components of the Base
Bankers' Balances
Till Money
Notes and Coin held by the Public
A = Private Sector Notes + Coin (Holdings)
B = Banks + Private Sector Notes + Coin (Holdings)
C = Total Holdings Notes + Coin = Bankers Balances
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2. Monetary Base Control

Dr Perlman on Monetary Base Control