

# KESKUSTELUALOITTEITA DISCUSSION PAPERS

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THE LIQUIDITY RATIO AND MONETARY POLICY:  
THE DUTCH EXPERIENCE AND THE APPLICABILITY IN FINLAND

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## CONTENTS

Introduction		1
Chapter 1	The use of the liquidity ratio in the Netherlands	4
1.1	Basic principles	
1.2	The liquidity ratio versus monetarism	
Chapter 2	Applicability of the liquidity ratio in Finnish monetary policy	14
2.1	Graphical approach	
2.1.1	GDP growth rate and the various liquidity ratios	
2.1.2	GDP growth rate and the monetary base liquidity ratio	
2.1.3	Other macroeconomic variables	
2.2	Cross correlation functions	
2.2.1	Method	
2.2.2	Empirical results	
Conclusion		35
Appendices		
-	Monetary survey of the Netherlands 1954 - 1977	38
-	Liquidity ratios of notes and coin, $M_1$ and $M_2$ in Finland	40
-	Some additional comments on "THE LIQUIDITY RATIO AND MONETARY POLICY: The Dutch experience and the applicability in Finland" (28.5.1982)	42
Literature		46

## Introduction<sup>1)</sup>

In the 1970's there were fundamental changes in the problems the economic policy makers faced. Inflation had gained momentum even before the oil shocks. External imbalances were no longer confined to notorious deficit countries, but also plagued traditionally strong currency countries. Many countries faced problems of unemployment and inflation at the same time (stagflation). It was felt that unemployment could not be cured before inflation and the external balance were under control. In quite a lot of countries there was a shift from cyclical fine tuning to policies aimed at structural stability and the establishment of the prerequisites for sustainable growth.

The absence of a satisfactory explanation of inflation meant that in some countries increased support was given to the monetary (quantity theory) explanation of inflation, and monetary authorities found themselves in the limelight.

Budget deficits put further strain on the monetary authorities and certainly contributed to the willingness of the central banks to focus on and to commit the policy making authorities to money supply targets.

In Finland, where the "Scandinavian explanation"<sup>2)</sup> for inflation has been widely expounded, the changes in monetary policy thinking and in the conduct of monetary policy have not been as pronounced as elsewhere. Monetary policy has traditionally played

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1 I am indebted to the economists from the Monetary Policy Department and to Juha Tarkka from the Research Department for their help and useful comments.

2 See e.g. Edgren, Faxén and Odhner, Swed. Journ. of Econ., 1969, pp. 134-160.



an important role and monetary stringency was used in the 1960's to combat inflationary pressures and external imbalances. The monetarist view of the need to control the money supply in any of its multifarious and fluctuating definitions was not greeted with open arms. This does not mean, of course, that money does not matter or that monetary conditions are not considered important when analysing economic activity. But money growth is not viewed as the exclusive cause of inflation. According to the above mentioned "Scandinavian approach" monetary expansion affects in the first place the current account through changes in the demand for imports. Prices are in the long run determined by the foreign price level.

Numerous studies have examined the determinants of the demand for money and the causal relationship between monetary aggregates and the GDP<sup>1)</sup>. This study is an explicit attempt at data mining to find relationships between monetary aggregates and important cyclical variables such as GDP and investment in Finland.

One of the crucial questions is, which monetary aggregates are relevant and which are not, given the structure of the Finnish economy. In principle, this study is to be considered as a first step in investigating the causal relationship between money or liquidity and key target variables. The methods (the graphical approach and the cross correlation functions) used in this study do not provide any definitive evidence. The advantage of these methods lies in their easy applicability, which makes it possible to do a relatively large number of tests. The results of these tests indicate which relationships between monetary aggregates and key target variables might be relevant for monetary policy.

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In Finland e.g. Lilleberg (1979) and Suvanto (1976).

In the Netherlands the monetary authorities have focused on the money supply or more exactly the money supply relative to GNP, i.e. the liquidity ratio, for more than thirty years. Although there are a number of important differences between the Dutch and Finnish economies, it may be useful as a starting point to have a look at the Dutch case, since the Netherlands is - like Finland - a small and open economy, highly dependent upon economic developments abroad.

Chapter 1 contains a description of the Dutch approach with emphasis on the basic principles of monetary policy conduct and the experiences the authorities have had with the approach. Furthermore, the Dutch monetary policy will be compared with the monetarist approach in general.

In chapter 2 the possible use of the liquidity-ratio concept in monetary policy planning in Finland is investigated. First, an attempt is made to arrive at appropriate definitions of liquidity on an a priori basis. This is followed by some empirical experiments. Finally, the results are summarized and evaluated.



## Chapter 1. The use of the liquidity ratio in the Netherlands

### 1.1 The basic principles

The monetary-theoretical views which have prevailed in the Netherlands since the Second World War, were initially expounded by M. Holtrop, President of the Netherlands Bank from 1946 to 1967. He developed and introduced a version of the monetary approach to inflation which is still a cornerstone of Dutch monetary policy.<sup>1)</sup> This model is meant to be an analytical instrument for determining the causes of monetary disequilibrium and for locating the origin of the monetary disturbances. One of the basic elements of Holtrop's analysis is the view that "money matters". Excess money gives rise to inflation and a shortfall hampers real demand. It is the responsibility of the monetary authorities to keep the supply of money consistent with the underlying growth of the economy and any "inevitable" inflation. The money supply proper has been replaced for operational reasons by the broader concept of liquid assets, which - in addition to money in the traditional sense - includes all short-term claims on the banking system and the public sector which can be readily converted into money.

Economic units wish to hold certain cash balances in relation to the level of activity.<sup>2)</sup> They also adjust their cash balances in reaction to factors other than

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1 The model is described in Holtrop (1972).

2 The cash balance theory of D.H. Robertson.

pure transactions demand. An upward shift in the desired level of cash balances relative to economic activity, money hoarding, means a withdrawal of active purchasing power. Dishoarding again adds to demand derived from current income. In Dutch terminology an increase in the velocity of circulation is considered as an activation of existing liquidity. In order to preserve monetary equilibrium, the actual supply of money should be kept in line with the demand for money. Under these circumstances the monetary authorities should neutralize monetary shocks arising from the supply components (e.g. bank credits, current account). Structural changes in preferences of people to hold money should be accommodated.

From the point of view of the monetary authorities it is essential to be able to identify the sources of liquidity disturbance. The model used by the Netherlands Bank distinguishes between causes originating at home and abroad. Domestic monetary impulses have the following three sources: the central government, the local authorities and the money creating institutions. External monetary impulses are reflected in the outcome of the balance of payments. Thus the model provides a technical framework for evaluating the development of liquidity and for planning policy actions in a consistent way. Appendix 1 surveys monetary events using this framework.

Another important aspect which must be kept in mind when viewing the Dutch monetary policy is that the latter is not expected to do the whole job in achieving the final objectives of economic policy. In fact the role of monetary policy is considered to be defensive and aimed



at preventing monetary disturbances that could threaten balanced economic development. It is therefore thought important to act at a very early stage before excessive increases of liquidity have been able to affect expenditure.

The instruments used to keep the creation of liquidity in the banking sector in line with the targeted liquidity ratio for the economy as a whole are rather straightforward. Direct and indirect credit restrictions have alternatively been used. Ceilings on liquidity-creating bank lending were used until recently. Credit expansion as such was not limited, only credit expansion which gives rise to bank liabilities which are included in the liquidity concept. Thus, the ceiling applies to the difference between the growth in bank lending and the increase in non-monetary liabilities of the banks. The banks have to go to the capital market for funds or try to attract funds to long-term savings accounts. Saving accounts are, entirely included in the definition of liquidity, only when their velocity per year exceeds 2. When their velocity is between 0,5 and 2 they are partly included on basis of a weighting principle. If the velocity is below 0,5 they are excluded. In addition the central bank regulates the lending potential of the banks by means of adjusting the cash reserve requirements and the conditions for obtaining central bank finance.

Capital movements often complicate the regulation of liquidity. In principle the view is taken that variations in short-term capital transactions in connection with trade in commodities and securities are by nature reversible and do not, therefore require compensatory action. No attention is paid to short-term variations, say over 3 - 4 months. The time horizon used in



planning and implementing monetary policy is a longer one, of one year or more. Nevertheless, changes thought to be temporary often turn out to be persistent.

Public sector finances can also complicate monetary policy, depending upon the way budgetary deficits are financed. If it is financed out of capital market resources, it does not influence monetary equilibrium directly. Monetary financing on the other hand, easily affects monetary equilibrium. With heavy budget deficits a certain allowance for liquidity creation by the Government has been agreed upon in the last few years. The normative size of the budget deficit is, however, one that corresponds to the savings-surplus of the other domestic sectors and can be financed on the capital market without pushing up the rate of interest or causing the current account to deteriorate.<sup>1)</sup>

The annual reports of the Bank do not give a straightforward answer to the question of what is the optimal liquidity ratio. The downward trend after the Second World War is noted and when the liquidity ratio stood at 33,5 at the end of 1971, this level was referred to as a "historical low". Chart 1 shows the liquidity ratio of the period 1961 - 1979. With respect to the liquidity ratio as a cornerstone for monetary policy three points should be mentioned. First, prediction of inflation and real growth of the national income are of primary importance. As national income statistics are usually subject to substantial revision there is a great deal of uncertainty not only concerning the future course of the economy but also concerning



economic performance in the recent past. Secondly, one should clearly distinguish between potential and actual inflation.<sup>1)</sup> If the liquidity ratio is above its necessary minimum level as determined by the level of transactions, there is an potential source of inflation. In this case it is the task of the monetary authorities to influence the liquidity ratio in such a way, that it gets closer to the minimum necessary level. Bringing the liquidity ratio down does not automatically mean that actual inflation is combatted in an adequate way. When nominal income rises more sharply than was assumed beforehand, the decrease of the liquidity ratio is the result of higher inflation, rather than a reflection of effective monetary policy in combatting inflation. The third point is the difficulty in implementation of the liquidity ratio arising from the fact that the numerator is influenced by changes in the demand for money as well by changes in its supply.<sup>2)</sup> The central bank can only influence partly the supply of money.

Furthermore, the definition of liquidity evolves continuously in response to institutional changes and changes in payment and saving habits of the general public. An essential extention of the definition of liquidity occurred at the end of 1978 as the Act on the Supervision of the Credit System was revised.<sup>3)</sup> Since then, near-banks may be subjected to monetary supervision. This is of major importance, since short-term deposit taking of near-banking institutions has increased steadily since the 1960's.

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1 Annual Report of the Netherlands Bank for 1970, p. 13.  
2 Bosman, p. 344.  
3 Annual Report of the Netherlands Bank, 1978.

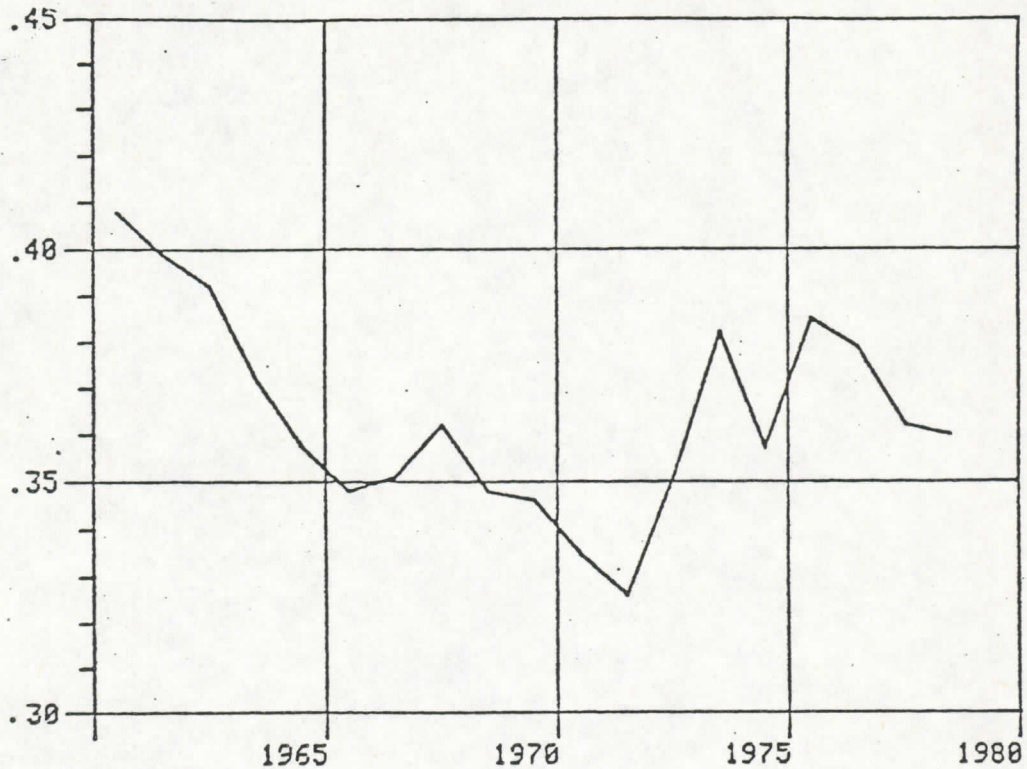


Chart 1. The liquidity ratio in the Netherlands 1961 - 1979.

Despite uneasiness about the theoretical justification - not enough is known about the transmission mechanism - and technical difficulties in implementation, the fact that monetary policy has been based on the liquidity approach for some thirty years suggests that the approach on the whole has been useful. Evidently one reason for this is that the aim of monetary policy, as already mentioned, has been limited to preventing monetary disturbances. Some degree of underlying stability is assumed or achieved in other ways. Fiscal policy has



traditionally had a rather active role and at times the authorities have intervened in the formation of prices, wages and salaries. Compared with many other countries the Dutch have been rather successful in avoiding major imbalances in the economy. Part of this however, is due to the dependence on a large, successful and fairly stable economy, West Germany and to the presence of substantial energy resources in the form of natural gas.

In the 1950's and 1960's there was an almost continuous tendency towards external surpluses. With the fixed exchange rate regime this meant that imported inflation had to be accepted to a certain extent. Compared with Finland it seems that not only the range of objectives for monetary policy has been smaller but also inflationary pressures at least used to be weaker.

## 1.2 The liquidity ratio versus monetarism

The Dutch approach shares with the monetarists a common view on the causal relation between the money supply and the national income. Both approaches believe that the money supply (or its rate of change) influences the nominal national income. The fact that the Dutch express the money supply as a percentage of net national income does not change this underlying thinking about the direction of causation. This causal relationship is a main topic in the Keynesian-monetarist controversy. Keynesians consider the money supply to be an endogenous factor.

A brief exposition of Zijlstra's<sup>1)</sup> view on this topic may help. Consider Fisher's quantity equation  $MV = PT$ .

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Zijlstra, 1979.

The minimum cash balances (necessary for transactions) depend on payments customs, existing techniques of payments, etc. In the case when the money supply is at its minimum, the causal relationship is unidirectional running from the money supply to national income. In a situation of full employment this means that the adjustment within the national income will centre on  $P$ , and thus on the value of money. When however the money supply is larger than its minimum there is a certain indeterminacy in the system, and other causal connections than from the money supply to the national income are possible. Zijlstra calls the difference between the actual money supply and the necessary minimum money supply "monetary latitude". Sooner or later, according to Zijlstra, any monetary latitude finds its way into investment and expenditure. The money supply should be seen as the exogenous factor. The monetary authorities, however, can at time create the monetary latitude which is necessary in order not to disturb actual movements in wages, prices, investment and public expenditure. Thereby they can make the money supply an endogenous factor.

Does the liquidity ratio as a monetary target essentially differ from a target expressed in terms of a growth rate of the money supply? It goes without saying that a target with respect to the liquidity ratio implicitly implies a target with respect to the growth rate of the money supply and vice versa. The liquidity ratio emphasizes the existence and the size of monetary latitude if the minimum necessary level of the liquidity ratio is known. This latitude is not explicitly visible in the desired rate of growth of the money



supply. One could say, that the two targets basically are similar, provided that in fixing a target growth rate account is taken of a possible variation in the velocity of circulation. A difference however is that the liquidity-ratio approach uses predictions of the growth of the nominal income and tries to keep the growth rate of the money supply in line with these. In contrast, a pure monetarist approach would fix targets with respect to nominal GDP, which implies a certain growth rate for the money supply. In this sense the pure monetarist approach also tries to smooth out the disturbances arising from outside the monetary sector.

Dutch monetary policy differs from monetarist monetary policy with respect to the control of the money supply. Control of the money supply in the Netherlands is conducted at all sources of the liquidity creation, viz. public sector finance, the balance of payments and net credit expansion of the banking sector. According to some monetarists the money supply should be controlled through control of the monetary base (the amount of bank notes plus the liquid reserves of the banking system). The total money supply is linked to the monetary base by the money multiplier. This multiplier is assumed to be fairly stable. This stability should follow from the stabilities of other relationships, viz. the ratios of demand deposits to time deposits and of deposits to currency held by the public and the ratio of the liquidity reserve desired by the banks (i.e. that part of the reserve which is above the required amount) to their deposit liabilities. This might theoretically be a reasonable approach. In Dutch practice however, the relationship between the money supply and the monetary base does not seem to be stable. Nor the model to predict the

money multiplier - which is a cornerstone of the monetary-base approach - seems to be stable according to the results of empirical research.<sup>1)</sup>

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Fase, pp. 190 - 200.



## 2 The applicability of the liquidity ratio for Finnish monetary policy

Could the liquidity ratio be of any use for monetary policy in Finland? In this chapter an attempt is made to find an answer to this question with the aid of some empirical experiments. First, some features of the Finnish economy and the monetary system are briefly discussed.

Like the Netherlands, Finland is a small and open economy. In the 1970's about 30 per cent of the total output of the economy was exported. A significant difference lays in the composition of the exports. While the exports of the Netherlands are diversified, this is not case with the Finnish exports. Finnish exports consist for about 50 per cent of paper products, timber and pulp. Prices of these products fluctuate rather sharply and - as a result - export earnings are volatile. Traditionally, the demand for these products is very sensitive and fluctuates more than world trade on average. This is one of the reasons that the cyclical fluctuations of the Finnish economy have been stronger than in most OECD countries. Another source of instability is investment which is more volatile than elsewhere. These strong fluctuations might make it more difficult for Finland to predict the growth rate of the national product. This is a drawback if one wants to use the liquidity ratio to implement monetary policy, since predicting the growth rate of the national product is of essential importance (see Chapter 1).

The secondary market for securities in Finland is not well-developed and does not provide any significant source of liquidity.



This is probably one of the reasons why the Finnish economy resembles the "Hicksian" overdraft economy.<sup>1)</sup> Households and firms have to rely on banks for their liquidity needs. The liquidity of the private sector consists partly of deposits, but a major source of liquidity are also the overdraft facilities which are agreed at the banks. Banks in their turn do not deal in Government bills, nor do they hold much liquid deposits of any importance at the Bank of Finland. This is why they have to rely on the central bank credit for the liquidity needs. During the last six years this has mainly taken the form of a call-money-market facility, operated by the Bank of Finland.

Interest rates in Finland are rigid and international capital flows are regulated. This implies that the credit market is not always in equilibrium. Both excess demand for loans and excess supply of loans can be observed. In other words, interest rates do not reflect market conditions. In a situation of credit rationing, which prevails when there is an excess demand for loans, the money supply is genuinely exogenous from the public's point of view. In this case the significance of money- or credit aggregates for monetary policy is evident. According to some studies, periods of excess demand for loans and excess supply of loans have alternated.<sup>2)</sup>

Using the liquidity ratio as a target assumes implicitly that the demand for money is related to income. Fluctuations in the liquidity ratio therefore reflect the degree of excess liquidity (monetary latitude in the terminology of Zijlstra). In Finland the demand

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1 Hicks (1974).

2 Tarkka (1979).



for broad money may not always be satisfied because of the interest rate rigidity and imperfections in the markets for substitutes of money. The actual money balances can therefore persistently differ from the desired balances. If one wants to measure the liquidity of the Finnish economy one should include the portfolio items of that part of liquidity where excess demand for or supply of liquidity is absorbed. These assets or liabilities are referred to as the monetary buffer stock.

## 2.1 The graphical approach

The approach used in this section is very simple: on the basis of graphs an attempt is made to study the correlation between key macroeconomic variables and liquidity ratios of various monetary aggregates.<sup>1)</sup>

The graphical method provides no indication of the direction of causality, or even of its existence. Nor is it a formal method for drawing conclusions concerning correlations. It might, however, be a useful starting point.

### 2.1.1 The GDP growth rate and liquidity ratios

The liquidity ratio was calculated for the following four monetary aggregates:

1. notes and coin in circulation.
2.  $M_1$  (notes and coin plus cheque accounts).
3.  $M_2$ , i.e.  $M_1$  plus 1-5 month time deposits and ordinary savings accounts.
4.  $M_3$ , which includes  $M_2$  plus all term deposits.

All these monetary aggregates refer to the liquidity of the public. On graphical grounds no useful relation was found between the first three monetary aggregates and the GDP.<sup>2)</sup>

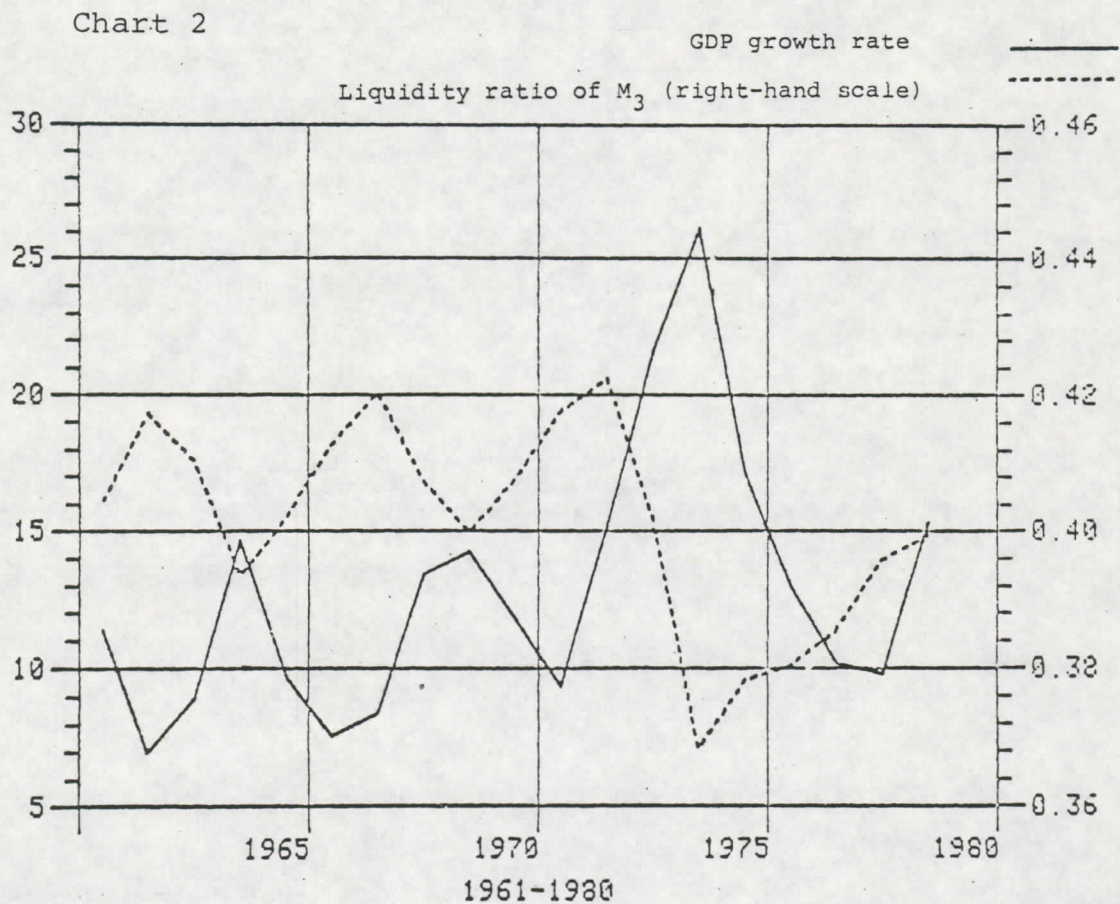
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1 All figures are annual data, the figures of the monetary aggregates are averages of end-of-month data. The data refer to the period 1961 - 1980.

2 The charts are presented in appendix 2.



On the other hand, a clear relation exists between the growth rate of the GDP and the liquidity ratio of  $M_3$  (chart 2).



At first glance  $M_3$  seems to be a useful concept for further tests. One advantage of this concept of liquidity is that it is not sensitive to the introduction or abolition of different kind of deposits, since it includes all



deposits in the regulated market. If one assumes that the excess liquidity or shortfall of liquidity is reflected in deposits, the concept of  $M_3$  could serve as a measure of liquidity for the entire economy.

#### 2.1.2 The GDP growth rate and the liquidity ratio of the monetary base

The assumption of the previous section that the excess or shortfall of liquidity (the monetary buffer-stock) is reflected in the monetary assets of the public could, however, be relaxed.

Changes in the liquidity position of the public might also be reflected in borrowing from the banks, which in turn affects the liquidity position of the banks. In this case the monetary base<sup>1)</sup> has to be used to capture the monetary buffer-stock. One way of defining the monetary base is notes and coin plus the free reserves of the banks. Since the Finnish economy is an overdraft economy, the concept of free reserves is defined in a different way from that of asset economies. In an overdraft economy free reserves consist of that part of central bank debt facilities which is not used. They can also be negative if the banks exceed their preferred amount of central bank financing.

In order to clarify the meaning of the concept of the monetary base, the following model is presented. Suppose, that due to the public's habits of money holding a constant proportion of the money stock (M) is held in holdings of notes and coin (S):

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The use of the concept of the monetary base was proposed by Juha Tarkka.



$$cM = S \quad (2-1)$$

in which  $c$  is the cash ratio.

The monetary base is the amount of notes and coin which would be in circulation after full adjustment of central bank debt to the level preferred by the banks. Denote the monetary base by  $S^*$ . Then the long-run money supply ( $M^S$ ) will be

$$M^S = \frac{1}{c} S^* \quad (2-2)$$

The identity-equation of the balance sheet of the central bank is

$$S + OL = NFA + D + ODA \quad (2-3)$$

in which

OL = other liabilities (e.g. compulsory reserves)

NFA = net foreign assets

D = central bank debt of the banks

ODA = other domestic assets

In the balance-sheet equation of the central bank, the items OL, NFA and ODA are exogeneous from the point of view of the banks. However, they manage their lending in order to achieve an optimal level of central bank debt  $D^*$ . The adjustment from  $D$  to  $D^*$  implies the monetary base concept

$$S^* = NFA + D^* + ODA - OL \quad (2-4)$$

Subtraction of equation (2-3) from equation (2-4) and re-arranging the terms yields

$$S^* = S + D^* - D \quad (2-5)$$



Since  $D^*$  is not observable empirically, we have to use a proxy.  $D^*$  is approximated by the banks' quotas at the central bank until 1975. After 1975 a call money deposit and overdraft facility was established.<sup>1)</sup> This is taken into account in the proxy for  $D^*$  as follows:

1. When the difference between the call money interest rate ( $r$ ) and the lending rate (average) of the commercial banks ( $i$ ) is smaller than 2 %<sup>2)</sup>, it is assumed to be optimal for the banks to take the observed amount. The net debt of banks in the call-money market is added to  $D^*$  (is true for the period 1978<sup>II</sup> - 1979<sup>III</sup>).
2. When the difference is larger than 2 %, it is not optimal for the banks to borrow funds from the call money market.  $D^*$  is equal to the banks' quotas at the central bank (period 1975<sup>IV</sup> - 1978<sup>I</sup> and 1979<sup>IV</sup>).

By substituting the empirically observable amounts of the relevant monetary items for  $D$  and  $D^*$  in equation (2-5), the following proxy for the monetary base is obtained:

$$\hat{S}^* = S + \underbrace{Q + CM^*}_{D^*} - \underbrace{(B + DB + CM + A)}_D \quad (2-6)$$

in which

$\hat{S}^*$  = notional monetary base

$Q$  = the banks' quotas at the central bank

$S$  = notes and coin

$B$  = term bonds

$DB$  = discounted and rediscounted bills

$CM$  = net debt of the banks at the call money market

$CM^*$  =  $CM$  when  $r - i \leq 2$

0 when  $r - i > 2$

$A$  = net check account debt of the banks of the central bank

1 Bingham & Heinonen, B. of F. Monthly Bulletin no 7, 1980.

2 See also Oksanen, chapter 4.



The monetary base defined as above reflects the borrowing power of the banks since it includes the excess debt of the banks or their excess liquidity. The position of the banks in this respect largely determines their willingness to grant loans. Since the flow of total credits is closely connected with investment, the monetary base might be a useful concept in predicting financial influences to the level of economic activity.

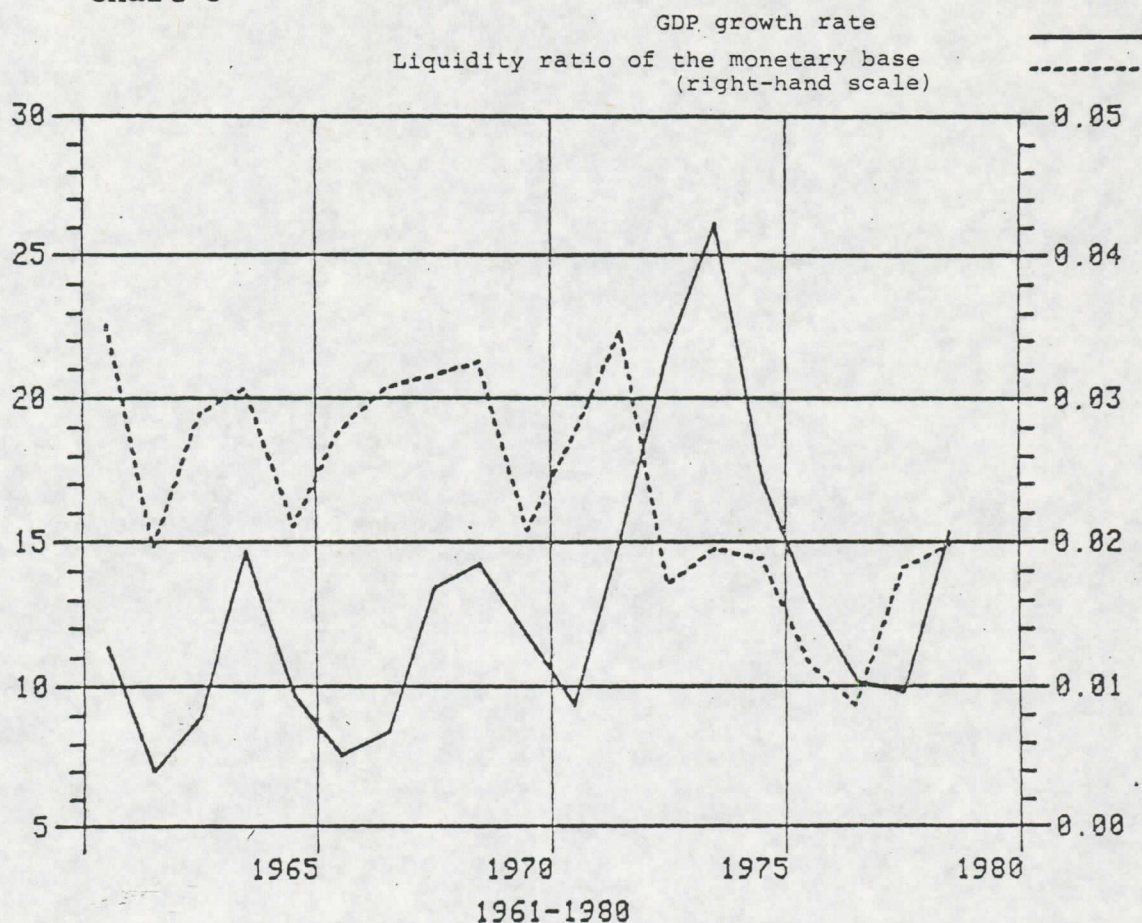
This monetary aggregate includes the monetary buffer stock of the public when  $r-i > 2$ . If monetary shocks are absorbed by deposits it means that the liquidity position of the banks changes (liabilities to the public increase, central bank debt decreases, and thus the monetary base increases). If monetary shocks are absorbed in paying back loans, the central bank debt of the banks decreases, as the debt of the public to the banks decreases and so the monetary base increases. The situation is different when  $r - i < 2$ . In this case, changes in  $D^*$  and  $D$  are equal and the monetary base remains unchanged.

Another advantage of the concept of the monetary base in Finland is, that it will largely reflect monetary impulses from abroad, since the banks change most of the foreign currency they receive at the Bank of Finland. In the Netherlands and many other countries the commercial banks keep large amounts of foreign currency.

Chart 3 indicates a clear correlation between the growth rate of the GDP and the monetary base liquidity ratio. On basis of this result and on theoretical grounds the monetary base would seem useful for further research.



Chart 3



### 2.1.2 Other macroeconomic variables

Similar graphical tests relating the monetary base and the  $M_3$  liquidity ratio to the rates of growth of investment and consumption have been done. For reasons of space not all the charts are shown. The results with respect to the growth rate of investment look promising (chart 4 and 5). There seems to be a clear correlation with both the base money and the  $M_3$  liquidity ratio. The same is true for consumption and the  $M_3$  liquidity ratio.

Chart 4

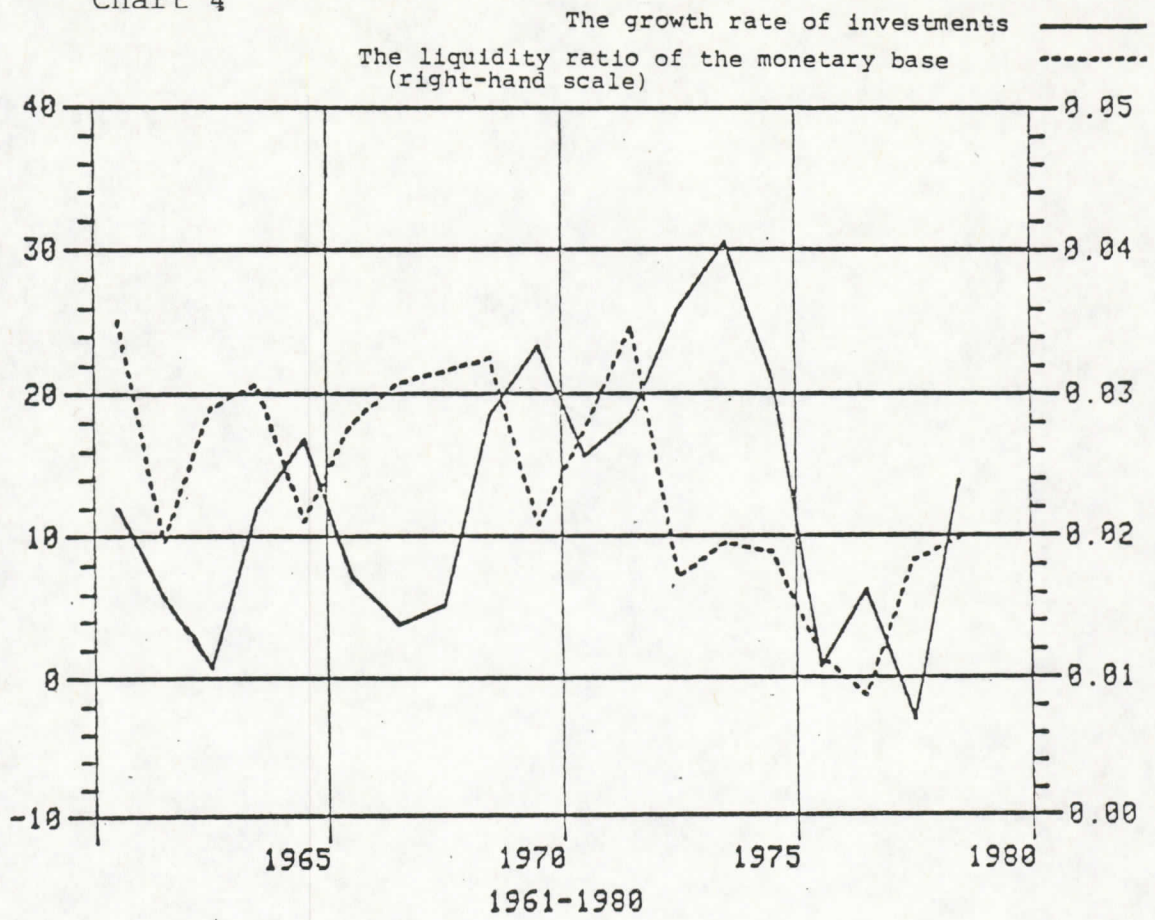
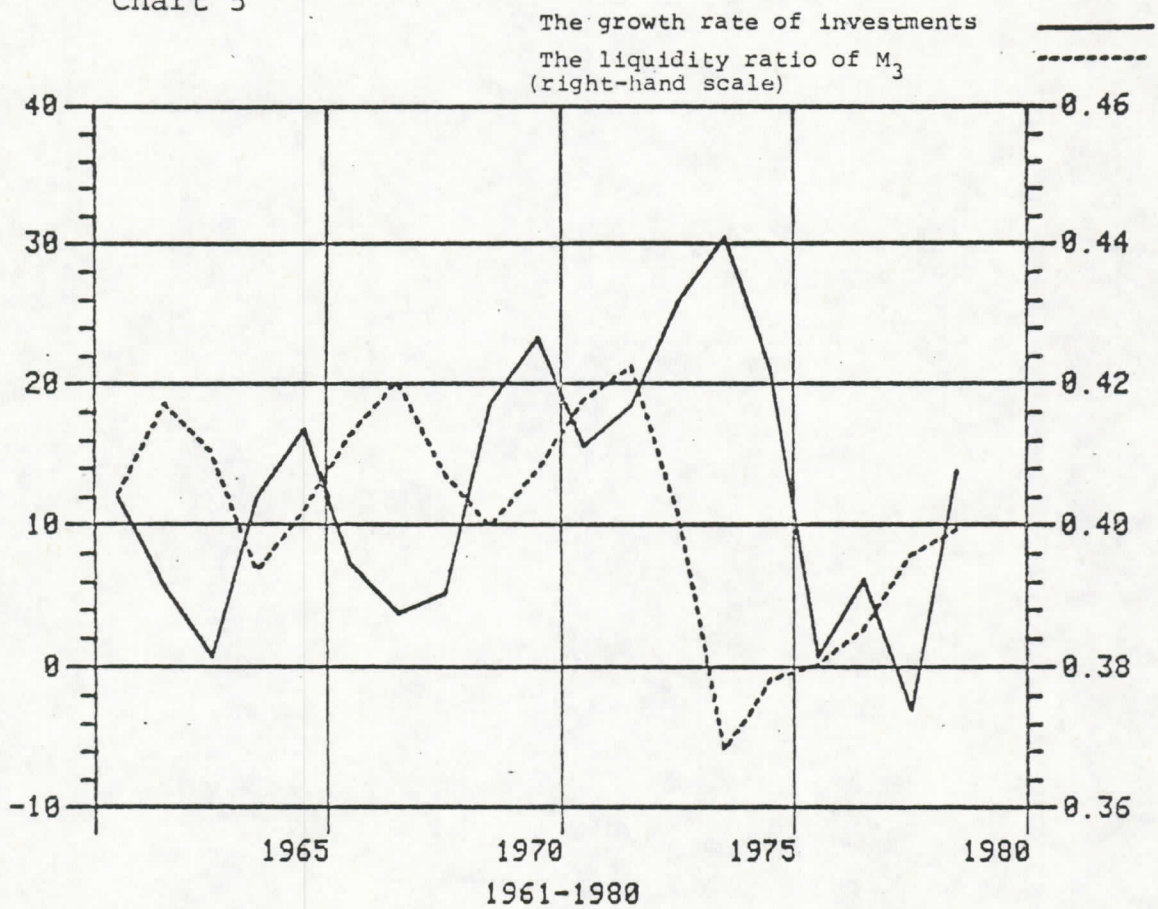


Chart 5





## 2.2 The cross correlation functions

### 2.2.1 The method

The cross correlation function method aims at providing some insight into the correlation which exists between two variables at different lags. Although this method does not provide any definitive evidence, it gives a clear indication concerning both direction of causation and the existing lags.

Before presenting the results of the empirical tests a brief explanation of the method is in order.<sup>1)</sup> The cross correlation function of two variables  $x$  and  $y$  is defined as the total of the cross correlation coefficients between the two variables at lag  $k$  ( $k = 0, \pm 1, \pm 2, \pm \dots$ ). The cross covariance coefficients between  $x$  and  $y$  at lag  $+k$  are:

$$\gamma_{xy}(k) = E \left[ (x_t - \mu_x)(y_{t+k} - \mu_y) \right] \quad k = 0, 1, 2, \dots \quad (2-7)$$

and the cross covariance coefficients between  $y$  and  $x$  at lag  $+k$

$$\gamma_{yx}(k) = E \left[ (y_t - \mu_y)(x_{t+k} - \mu_x) \right] \quad k = 0, 1, 2, \dots \quad (2-8)$$

It should be noted that  $\gamma_{xy}(k)$  is not the same as  $\gamma_{yx}(k)$ . However,

$$\begin{aligned} \gamma_{xy}(k) &= E \left[ (x_{t-k} - \mu_x)(y_t - \mu_y) \right] = E \left[ (y_t - \mu_y)(x_{t-k} - \mu_x) \right] \\ &= \gamma_{yx}(-k) \end{aligned} \quad (2-9)$$

in which  $\mu_x$  is the mean of  $x$  and  $\mu_y$  the mean of  $y$ .

1 For a more extensive exposition of this subject: see Box and Jenkins, pp. 370 - 376.

The function  $\gamma_{xy}(k)$  for  $k = 0, \pm 1, \pm 2, \pm \dots$  is the cross covariance function. The cross correlation coefficients at lag  $k$ , which are computed in this paragraph are defined as

$$R_{xy}(k) = \frac{\gamma_{xy}(k)}{\sigma_x \sigma_y} \quad k = 0, \pm 1, \pm 2, \pm \dots \quad (2-10)$$

in which  $\sigma_x$  is the standard deviation of  $x$  and  $\sigma_y$  is the standard deviation of  $y$ .

The following cross correlation functions are calculated:

the liquidity ratio	base money	$M_3$
the growth rate of		
GDP	X	X
investments	X	X
consumption		X

The figures for the liquidity ratios are quarterly data, averages of end-of-month figures of the monetary aggregate divided by the value of the GDP of that quarter. These data are seasonally adjusted. The rates of change of the macroeconomic variables are with respect to the corresponding quarter of the previous year.<sup>1)</sup>

1 Experiments with quarterly growth rates of the macroeconomic variables did not yield useful results.



The cross correlations are first calculated for the whole sample period 1961<sup>1</sup> - 1979<sup>4</sup>. Then, the sample is split up in two periods<sup>1)</sup>, 1961<sup>1</sup> - 1972<sup>4</sup> and 1968<sup>1</sup> - 1979<sup>4</sup> in order to check whether or not there are any significant differences between the sixties and the seventies.

The charts are drawn in such a way that the horizontal axis shows the lag (k) which exists between the liquidity ratio of the monetary aggregate and the rate of change of the macro-economic variable. For instance, +12 denotes the point of time where the liquidity ratio of the monetary aggregate leads the rate of change of the macro-economic variable by 12 quarters. When the figure is negative, the liquidity ratio lags. Significant correlation coefficients are depicted as  $\uparrow$  while  $\circ$  stands for an insignificant correlation coefficient.<sup>1)</sup>

A few remarks with regard to the interpretation of the correlations should be made. Figure 1 shows four different possibilities with respect to the cross correlation coefficients. The dotted lines stand for the significance borders. Correlations coefficients within the area confined by the two dotted lines are insignificant.

- Figure 1-a shows significant correlation coefficients for  $k < 0$  as well as for  $k > 0$ . The negative correlation coefficients for  $k < 0$  indicate that a higher growth rate of the macroeconomic variable is followed by a decrease in the liquidity ratio, i.e. money does not accommodate. The positive correlations for  $k > 0$  indicate that an increase in the liquidity ratio brings about an increase in the growth rate of the macroeconomic variable.

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<sup>1</sup> The minimum number of observations to obtain useful estimates is about 50.

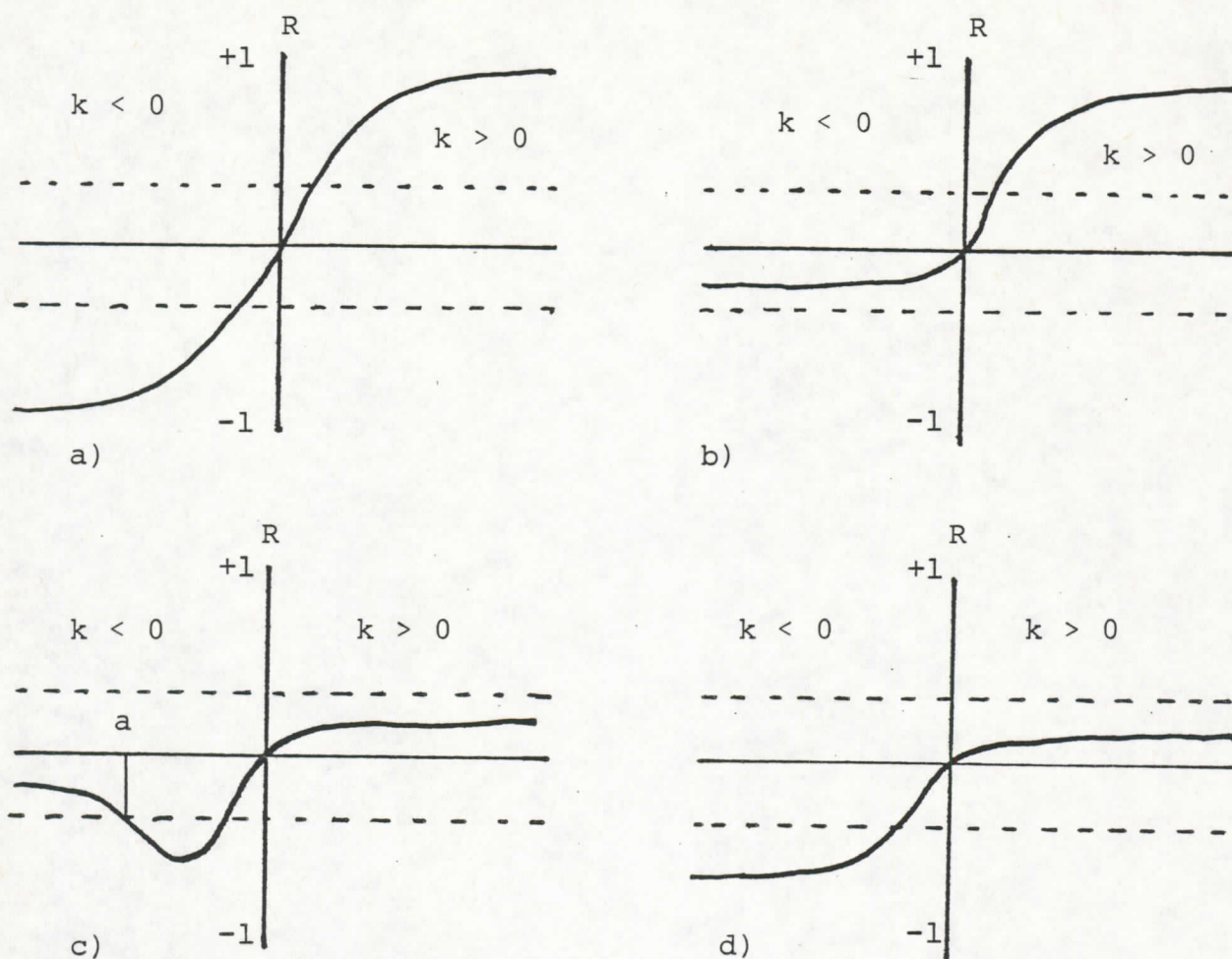


figure 1. Four different outcomes of the cross correlation functions.

- Figure 1-b shows a situation in which the liquidity ratio is not affected by a change in the growth rate of the macroeconomic variable ( $k < 0$ ), i.e. money accommodates. On the right-hand side the correlation coefficients are significant, and the situation is similar to that of figure 1-a.
- According to figure 1-c money accommodates in the medium-term (non-significant relationship between the macroeconomic variable and the liquidity ratio to the left of a. There is no short-term accommodation (significant correlations for small negative values of  $k$ ).



- The money supply does not accommodate in the case of figure 1-d (negative significant correlations for  $k < 0$ ). Changes in the liquidity ratio do not affect the growth rate of the macroeconomic variable (insignificant correlation for  $k > 0$ ).

The results suffer to a certain extent from the presence of autocorrelation. Autocorrelation affects the lag structure, but the order of magnitude of the correlation coefficients remains unchanged.<sup>1)</sup>

For reasons of space not all the charts are shown. Furthermore a table is included which shows the highest cross correlations and the corresponding values of  $k$ . It should be noted however that it is not possible to draw any conclusions concerning causality on the basis of these figures, since the highest cross correlation refers only to a single value of  $k$ , and all significant cross correlations should be taken into account. Moreover this is not a formal method for testing causality, it merely serves to indicate possible causality relations.

### 2.2.2 The empirical results

The period 1961<sup>1</sup> - 1979<sup>4</sup>

The cross correlations for  $k < 0$  between the growth rate of the GDP and the  $M_3$  liquidity ratio (chart 6) are all significant negative. This implies that money does not accommodate. The positive cross correlations mean that there is a positive influence on the growth rate of the GDP when the liquidity ratio rises. The (absolute values of the) correlations are smaller for  $k > 0$  than for  $k < 0$ .

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1 Box & Jenkins, pp. 377 - 388.

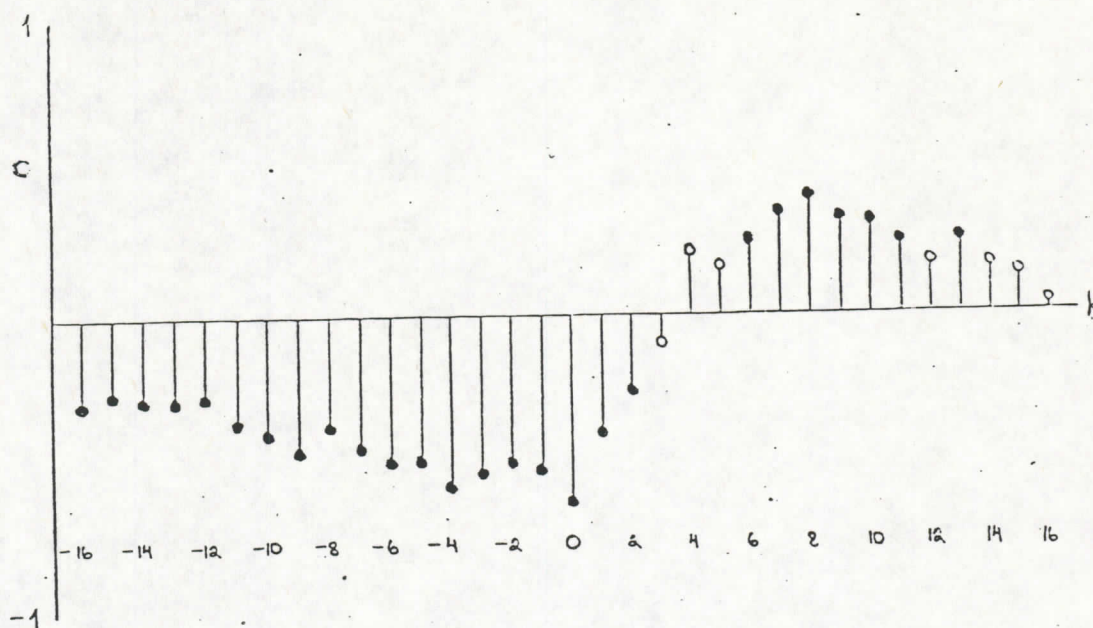


Chart 6. Cross-correlations of the liquidity ratio of  $M_3$  and the growth rate of the GDP (1961I - 1979IV)

Similar conclusions follow from tests with respect to the consumption growth rate. For the growth rate of investment however, the cross correlations are higher for  $k > 0$  than for  $k < 0$ . The correlations for  $k > 0$  are positive. This might imply that an increase in the liquidity ratio is followed by an higher growth rate of investments.

A change in the growth rate of the GDP is followed by a decrease of the monetary base liquidity ratio (chart 7). A possible explanation for this could be that the increased growth rate of the GDP triggers a current account deficit, which in turn eventually tightens the monetary base (the foreign reserves of the central bank decrease and the central bank debts of the commercial banks increase). A change



in the liquidity ratio on the other hand does not change the growth rate of the GDP (non significant correlation coefficients for  $k > 0$ ).

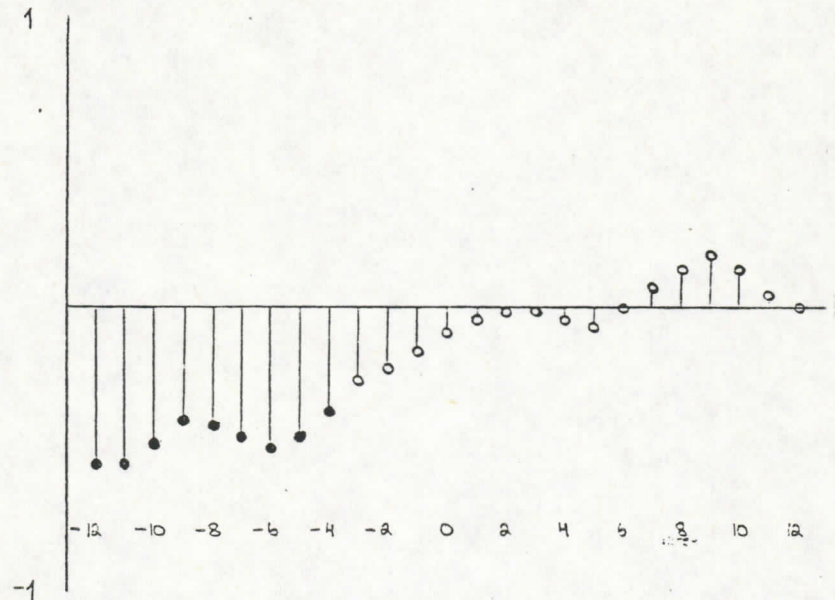


Chart 7. Cross-correlations of the liquidity ratio of the monetary base and the growth rate of the GDP (1961<sup>I</sup> - 1979<sup>IV</sup>)

With investment the situation is quite different. Significant positive correlations for  $k > 0$  indicate that the growth rate of investment increases after an increase in the monetary base liquidity ratio. On the other hand the monetary base accommodates to a change in the growth rate of investments at least in the short run, since the correlation coefficients are insignificant for  $-8 < k < 0$ .

The period 1961<sup>1</sup> - 1972<sup>2</sup>

The positive cross correlations which occurred for negative values of  $k$  with respect to the relationships between the  $M_3$  liquidity ratio and the investment and GDP growth rate are remarkable in this period.

So, when the growth rate of the GDP and investment increases, the liquidity ratio of  $M_3$  increases after some time, implying in a way monetary "overshooting". As far as the growth rate of consumption is concerned the results do not yield any clear evidence.

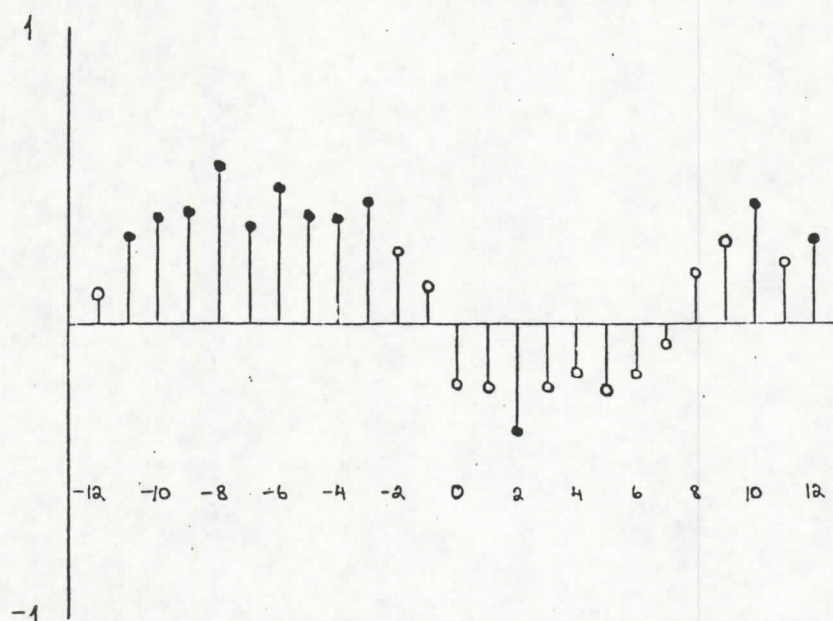


Chart 8. Cross correlations of the  $M_3$  liquidity ratio and the growth rate of investment (1961<sup>I</sup> - 1972<sup>IV</sup>).

With respect to the liquidity ratio of the monetary base and investments it seems that there has also been some monetary "overshooting" with a lag of about 2 years. The evidence is less strong in the case of the GDP. Moreover the negative cross correlations for  $k < 0$  (lag about 1 year) are larger than the positive ones, which means that money has not accommodated in the short-run.



The period 1968<sup>I</sup> - 1979<sup>IV</sup>

The relationship between the  $M_3$  liquidity ratio and the growth rate of the GDP has the shape of figure 1-a, i.e. money does not accommodate (significant negative correlations for  $k < 0$ ) and a higher liquidity ratio is followed by a higher growth rate (significant positive correlations for  $k > 0$ ).

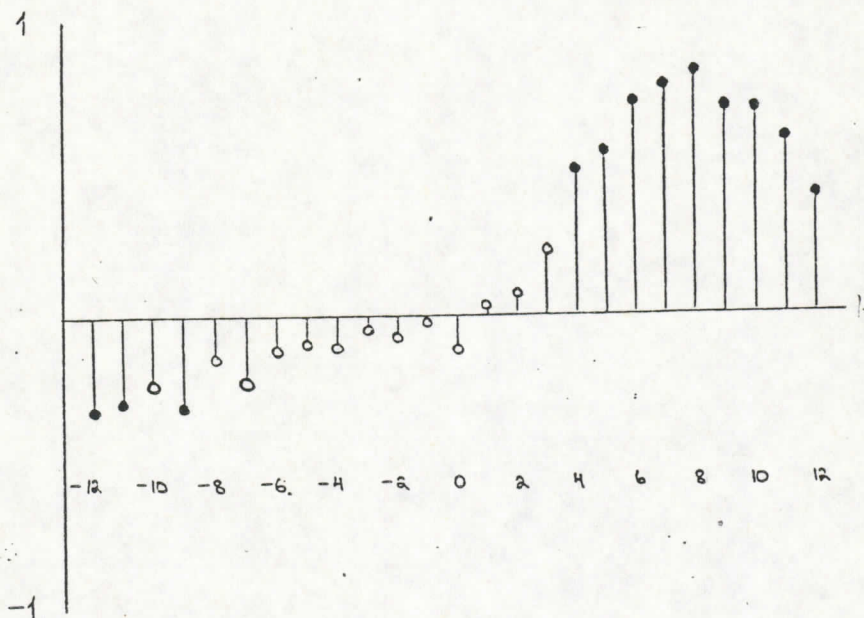


Chart 9. Cross-correlations of the liquidity ratio of  $M_3$  and the rate of change of investments (1968<sup>I</sup> - 1979<sup>IV</sup>)

With respect to the growth rate of investment, broad money seems to accommodate (chart 9). The growth rate of investment reacts strongly to an increase in the liquidity ratio.

The relation between the monetary base liquidity ratio and the growth rates of the GDP and investment is largely the same as in the case of  $M_3$ . The main difference is that the positive correlations for  $k > 0$  are more significant in the case of  $M_3$ . Chart 10 shows the cross correlations of the monetary base liquidity ratio and the growth rate of the GDP.

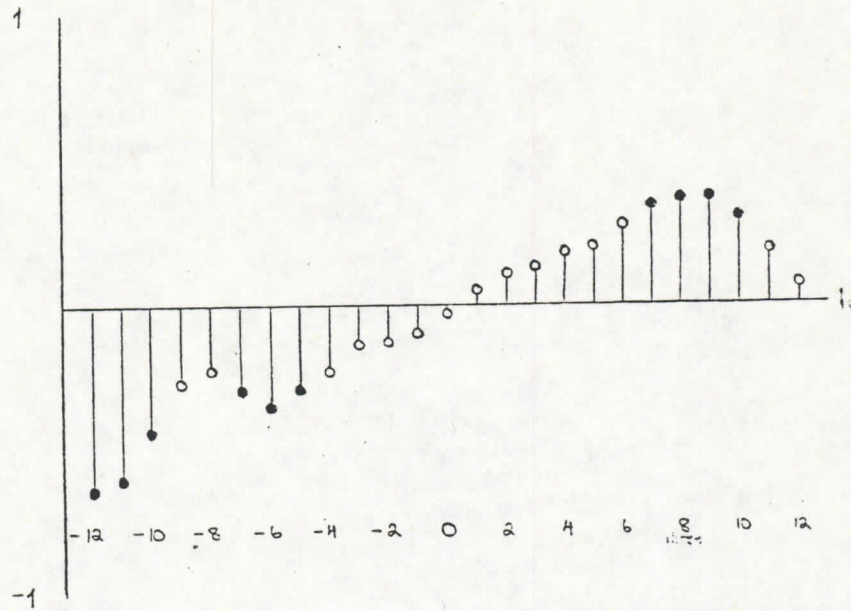


Chart 10. Cross-correlations of the liquidity ratio of the monetary base and the growth rate of the GDP (1968<sup>I</sup> - 1979<sup>IV</sup>)

Finally, table 1 shows the highest cross correlations coefficients for both negative and positive values of  $k$ .



<u>Period</u>	<u>Liquidity ratio using</u>	<u>The rate of change of</u>	<u>k &lt; 0</u>	<u>k <math>\geq</math> 0</u>	<u>correlation coefficient</u>
1961 <sup>1</sup> -1979 <sup>4</sup>	base money	investment	- 14	9	- 0,553 0,326
	"	GDP	- 12	9	- 0,387 0,183*
	M <sub>3</sub>	investment	- 16	10	- 0,598 0,576
	M <sub>3</sub>	GDP	- 4	0	- 0,583 - 0,629
	M <sub>3</sub>	consumption	- 6	8	- 0,691 0,354
1961 <sup>1</sup> -1972 <sup>4</sup>	base money	investment	- 10	3	0,485 0,228*
	"	GDP	- 6	0	- 0,474 0,485
	M <sub>3</sub>	investment	- 8	10	0,538 0,404
	M <sub>3</sub>	GDP	- 8	0	0,447 - 0,535
	M <sub>3</sub>	consumption	- 11	8	0,324 0,528
1968 <sup>1</sup> -1979 <sup>4</sup>	base money	investment	- 11	9	- 0,378 0,565
	"	GDP	- 12	9	- 0,629 0,373
	M <sub>3</sub>	investment	- 16	8	- 0,470 0,826
	M <sub>3</sub>	GDP	- 4	8	- 0,618 0,697
	M <sub>3</sub>	consumption	- 6	11	- 0,825 0,706

Table 1. The highest cross correlation coefficients.  
Insignificant values are indicated by\*.

## Conclusion

Monetary policy has played an active role in the Netherlands since the Second World War. The liquidity ratio has been the main object of monetary policy planning. Even though the use of the liquidity ratio involves certain problems, it is still a serviceable aid in monetary policy planning. Policy measures extend to all sources of money creation, viz. bank credit, public sector finance and the balance of payments. This is reflected in medium-term targets for the balance of payments and public sector's borrowing. There are some features of the monetarist approach which are accepted (e.g. the role of the money supply in the economy), control of the money supply through the monetary base however does not seem to be suitable for the Netherlands.

Monetary policy, which aims at keeping the liquidity ratio at a certain level might be difficult to implement in Finland. Differences of both structural and institutional nature hamper such a policy.

However, it might be useful for monetary policy in Finland to follow the development of the  $M_3$  and monetary base liquidity ratios. According to the results of this research the importance of the liquidity ratios as a leading variable increased considerably during the seventies compared to the sixties. Especially the rate of growth of investment seems to lag behind the liquidity ratios. A reason for this might be the increased economic uncertainty which has prevailed since the first oil crisis. Investment behaviour has become more cautious, as the prospects for sustained growth and the predictability of the cycles have weakened. This enlarges the possibilities for the conduct of monetary policy in this respect.



The concept of the monetary base seems to be meaningful in the context of this research both on theoretical and empirical grounds. It includes the monetary buffer stock of the public as well as the impact of monetary impulses from abroad.

A difficulty at the empirical level with respect to the monetary base concept is the measuring of the banks' optimal central bank debt. Further research on this topic is called for.

Most interesting from the point of view of monetary policy are those relationships where the liquidity ratio leads changes in the macroeconomic variable. The cross correlation function is not a formal way of testing causality and it is not justified to speak about "reversed causation" on the basis of the results. Comparing the results of the sixties with those of the seventies it must be said that the importance of the liquidity ratios as leading variables became stronger in the seventies. Most significant in this context are the relationships between the liquidity ratios and the growth rate of investment.

The results of this paper, however, are to be considered as a first step. In order to get stronger evidence concerning the causation between the liquidity ratios and the GDP, investment and consumption on the other hand, explicit causal explanations should be proposed and formal causality tests should be made.

The relationship between the monetary base and the loan market is beyond the scope of this paper, even though it is an essential channel for monetary policy. Oksanen (1977) has done research on this subject, using data up to 1973. Since some structural changes in the economy happened since then, it might be interesting to update his work.

Finally, more sophisticated statistical methods should be implemented to determine the exact lag which exists between a change in the liquidity ratios and a change in the growth rate of the macroeconomic variables.



Appendix 1. Monetary survey of the Netherlands 1954-1977.<sup>1)</sup>

Table 1 shows the results of monetary policy in the Netherlands under the period 1954-1977. The figures are briefly commented below.

During the years 1954-1963, the rate of domestic money creation was kept behind the rate of real growth to about the extent of incidental capital flows from abroad. Price rises were partly financed by an inflow of money from abroad (1.25 %) and partly through an increase in the velocity of money.

The growth in the money supply during the period 1964-1971 was about the same as the rate of growth of real income. Prices increases, which were 6.25 % on the average were partly financed by the public sector and the balance of payments (which was positive mainly because of speculative capital inflows in 1969-1971). The shortfall in financing the price increases out of these two sources was reflected in the low level of the liquidity ratio, 33.5 % at the end of 1971.

The large surpluses on the current account of the balance of payments of the period 1972-1977 was only partly offset by capital outflows, while the remaining inflow of money from abroad could not be met by absorption by the public sector. Bank credits added an amount to the money supply which was three times as much as the growth of real income would have justified. Consequently there was ample supply of money to finance the high price increases. Furthermore, a strong increase in the liquidity ratio occurred. This was partly a result of the greater demand for money, resulting from the more uncertain economic situation. In spite of the greater demand for money, monetary conditions were easy and caused a boom in the housing sector. All in all the results of Monetary policy of this period are poor as compared to the previous periods.

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Source: Den Dunnen, De Economist, no. 1, 1979.

Table 2 Monetary survey of the Netherlands, 1954-1977. All figures are percentages of  $M_2$  at the beginning of the year (annual averages). <sup>1)</sup>

	1954/1963	1964/1971	1972/1977
1. Money inflow from abroad			
a. current account, transactions basis	3½	-1½	9
b. structural capital transactions	-2½	-1	-3½
c. (fundamental transactions = a + b)	(1½)	(-2½)	(5½)
d. incidental capital transactions (residual item)	3½	4½	-1
e. total balance of payments (growth in official gold and foreign exchange reserves)	4½ (2)	2 (2)	4½ (3)½
2. Domestic money creation on behalf of			
a. public sector	-1	2½	-½
b. others (= bank credit <sup>1</sup> )	2½	5½	10½
c. total	1½	8	10
3. Increase in money (1.e + 2.c)	6	10	14½
4. Money absorption through rise in national income in the course of the year			
a. rise in production	4½	5½	3
b. price increases	3½	6½	8½
c. total	8½	12	11½
5. Domestic money creation minus absorption on account of rise in production (2.c-4.a)	-3	2½	7
6. Increase in money minus absorption on account of rise in national income <sup>2</sup> (3-4.c)	1953 -2½	-2	2½
7. Liquidity ratio at end of period	48½	39½	33½

1 Short-term credit to the private sector plus net long-term domestic transactions of the money creating institutions.

2 Tallies with the percentage fall (-)/rise (+) in the liquidity ratio.



Appendix 2. Liquidity ratios of notes and coin,  $M_1$  and  $M_2$   
in Finland

Chart 11.

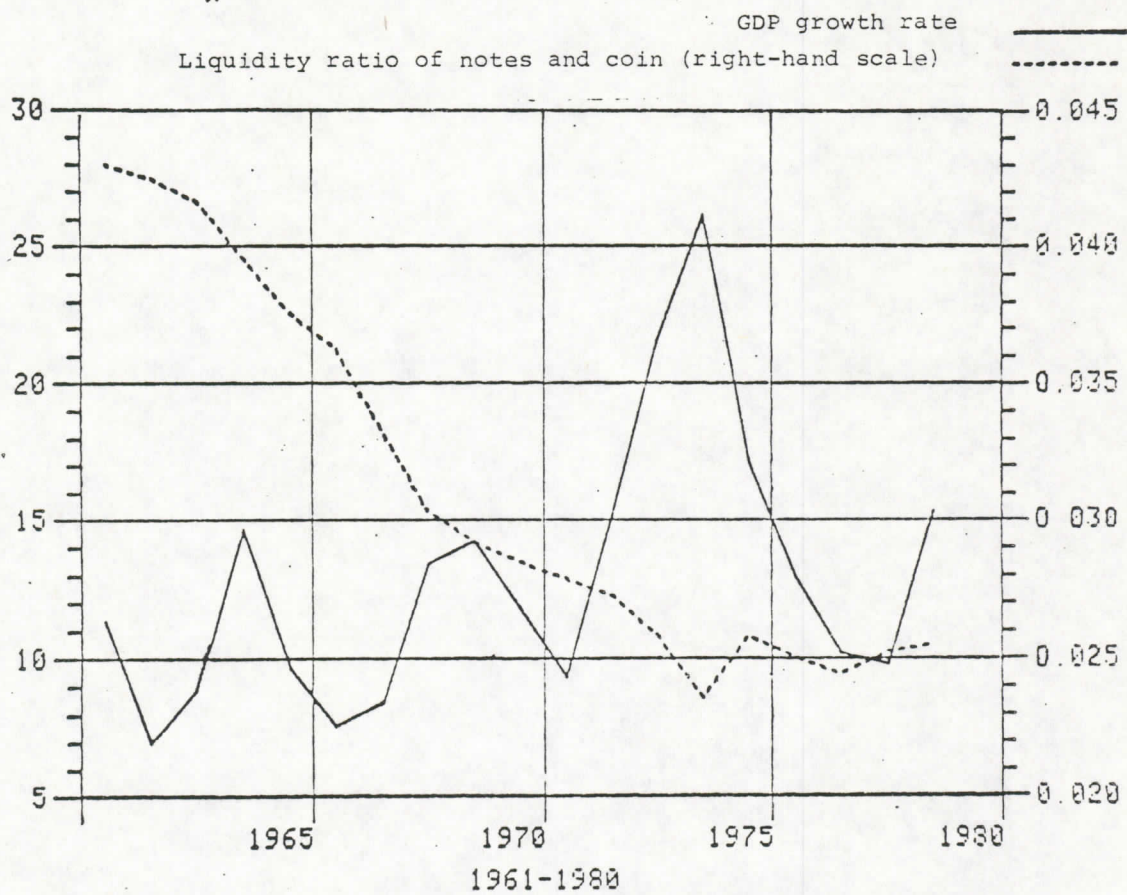


Chart 12.

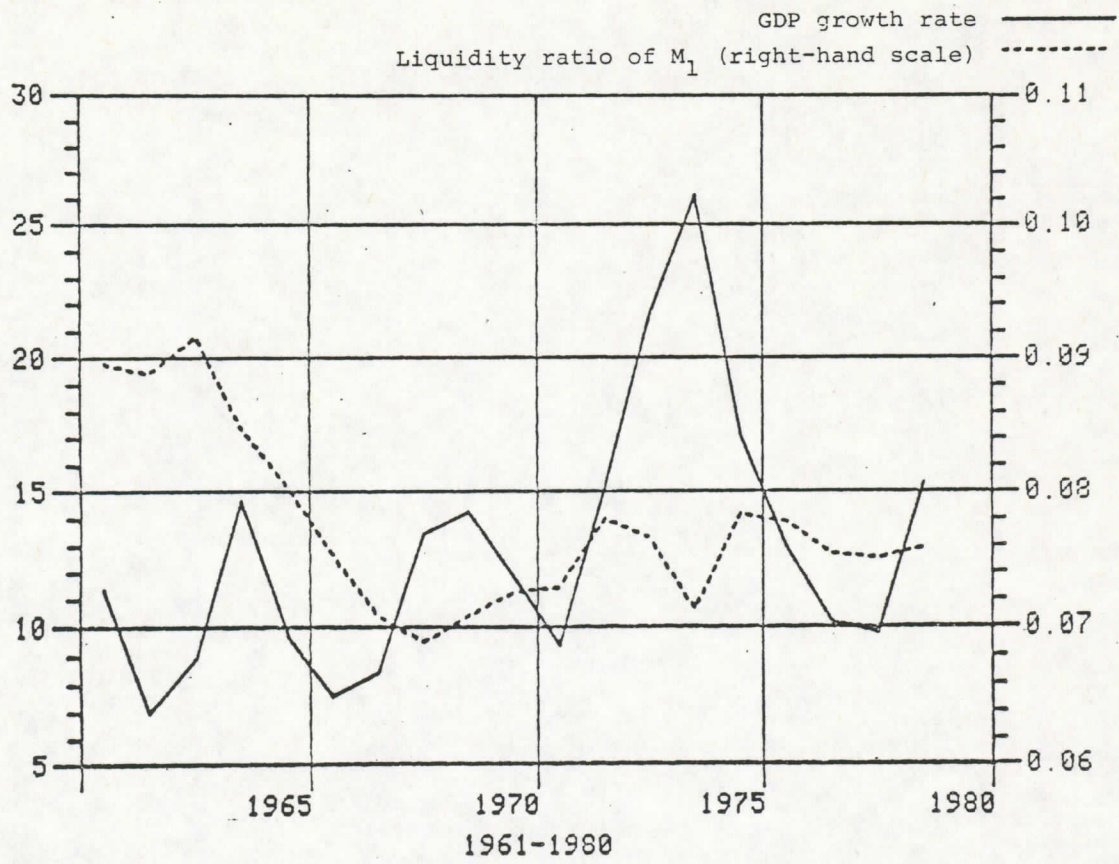
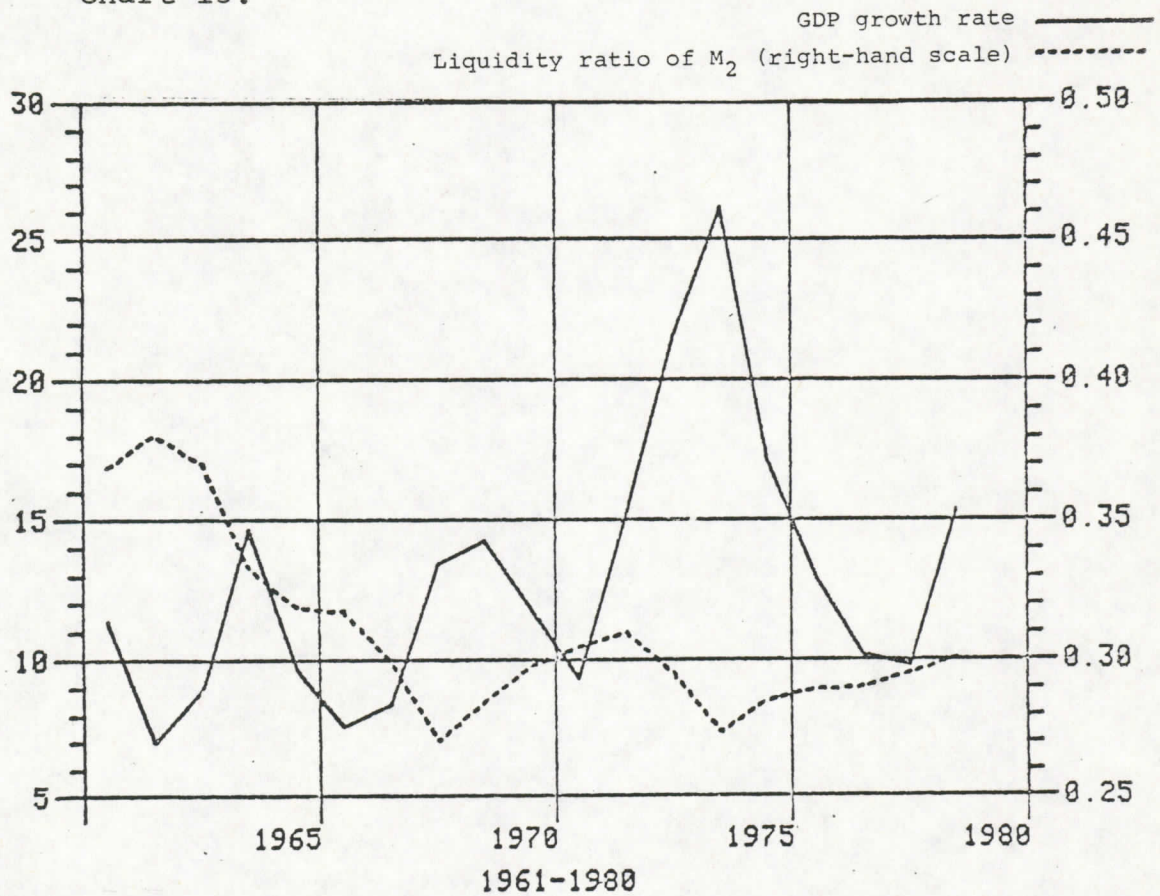


Chart 13.





Appendix 3. Some additional comments on "THE LIQUIDITY RATIO AND MONETARY POLICY: The Dutch experience and the applicability in Finland."<sup>1</sup> (28.5.1982)

- p. 4. Holtrop's analysis as such is not used anymore nowadays. The difficulty is that the model tries to quantify magnitudes which practically can not be quantified. The external impulse was omitted at first. The main thought of relating the increase in the money supply to the increase in the national product, however, is still present in the monetary policy conduct of the Netherlands Bank.

The money supply proper has been replaced by the broader concept of liquid assets not only for operational, but also for theoretical reasons. The concept used by the Netherlands Bank contains beside money those liquid assets which at short notice can be converted into money on a large scale without significant loss.

- p. 5. Domestic monetary impulses in Holtrop's analysis consist beside the three mentioned sources (of domestic liquidity creation) also of hoarding/dishoarding.

The external source of liquidity creation is reflected in the outcome of the balance of payments, the balance of the non-monetary sectors.

- p. 6. The term deposits which are smaller than dfl. 500.000 of households and non-profit organizations belong to the same category as savings deposits. This total is split according to the rate of turnover (i.e. dispositions over 12 months as a % of the average level in this period) over monetary and long term liabilities, which calculation is in principle carried out for each bank separately.

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1. These comments reflect partly the opinions of G. Hogeweg and A.A. v.d. Werff from the Netherlands Bank and prof. H. Visser from the Free University. I am indebted to these persons for their useful comments.

"In addition the central bank ... for obtaining central bank finance." This is the regulation of the conditions for recourse to the central bank. It is used for maintaining equilibrium on the foreign exchange market. Since 1972 the level of the cash reserve requirements has been 1 or 2 per cent and since August 1977 0 per cent.<sup>1</sup>

- p. 7. Prediction of inflation and real growth of the national income is not only of primary importance in case of Dutch monetary policy but also for any kind of monetary policy directed at regulating the growth of M.

The fact that M is partly demand-determined is not relevant for evaluating the merits of the "liquidity ratio" - approach as such.

- p. 8. Near-banks are non-financial institutions whose short-term debt is considered by the holder to be comparable with time deposits at banks, though their debt is not statistically registered as liquidity.

The meaning of monetary supervision of near-banks is to enable the Netherlands Bank to control their activities during times of credit-restrictions.

- p. 10 The fact that the Dutch economy has been kept in line with W-Germany is largely attributable to a maintained participation in European exchange rate systems, supported - if necessary - by money market policy.

- p. 12. Direct control of the foreign sources of liquidity is difficult, since capital movements are practically free.

The outcome of the current account is seen as exogenous, whereas the total account of the balance of payments

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1. Bosman, p. 302.



is also determined by the domestic monetary policy (the rate of interest).

In the Netherlands a system of compulsory liquid reserve requirements does not exist, weakening the link between monetary base and money supply (see also comment on p. 18).

The usefulness of the monetary base in controlling the money supply is a topic of discussion. The opinion which is dealt with in this paper is Fase's. Korteweg<sup>1</sup> on the other hand, is of opinion that the monetary base could be of use in controlling the money supply.

According to Korteweg, the fact that predictions of the money multiplier and the money supply (by means of the monetary base) are liable to errors is not enough to reject the system of money-supply control by means of the monetary base. The crucial point is if these prediction-errors are larger than the prediction error of the predicted money supply in the case of the present system (credit ceilings). There is no evidence for this until so far. Furthermore Korteweg prefers the indirect system because this system allows for better competitive conditions between the banks.<sup>2</sup>

- p. 14. The strong cyclical fluctuations hamper the use of a liquidity ratio as indicator in the short run, it does not, however, exclude the possibilities of such a policy in the long run (i.e. taking the trend of the real GDP and prices as starting-point).
- p. 15. The Finnish economy resembles an overdraft economy. In the Netherlands the private sector resembles an asset economy, the banking sector on the other hand has some features of an overdraft economy. In order to be

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1. Mr. Fase is assistant Deputy Director at the Netherlands Bank and Mr. Korteweg is a former professor of economics at the Erasmus University.

2. Korteweg, ESB, p.1288

able to regulate money market conditions effectively, the Bank opened quota-facilities in 1973. Whenever the banks exceed the quota, additional interest charges may be levied.<sup>1</sup>

- p. 17. The (growth rate of) GDP and the M3-liquidity ratio are by definition inversely related, when the growth rates of the GDP and M3 do not move together. As a consequence the relationship shown in chart 2 might be connected with cyclical variations in the GDP growth rate.
- p. 18. The fact that the Finnish economy is an overdraft economy does not necessarily mean that the underlying thinking of the Dutch monetary policy, i.e. "money matters", does not hold. This situation might be dealt with by adapting the relevant M-concept (e.g. including unused overdraft facilities) to the balance sheet structure of the banks.
- p. 23. The liquidity ratio of M3 seems to lag behind the liquidity ratio of the monetary base. This shows the lag which exists between bank liquidity and M3. It does not necessarily imply that the money-multiplier is unstable.

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1. Bosman, p. 356.



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