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SOURCES OF GROWTH IN THE SWEDISH MONEY STOCK, 1871-1971*

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Abstract

The sources of secular and cyclical changes in the Swedish money stock during a period of one hundred years are studied in this paper. The analysis is based on a framework where the fluctuations in the money stock are decomposed into the contributions of three monetary aggregates: the monetary base, the currency-money ratio and the reserve-deposit ratio. The contributions of these three proximate determinants of the money stock are quantified. Computations covering the long run indicate that the monetary base represents the major source of secular growth in the volume of money. The cyclical picture which emerges, however, is more complex. The two asset ratios as well as the monetary base contribute significantly to the cyclical movements in the Swedish money stock. No consistent pattern is found for all the subperiods studied. The results derived are compared with the patterns of other countries, particularly the USA. This study constitutes the first step in an analysis of the factors influencing the growth of the Swedish money stock.

I. Introduction

The role of money has been the subject of considerable empirical research during the last two decades. The question of causality between the money stock and nominal income has been and still is a central issue in this field. One approach to studying the nature of the relationship between money and economic activity has been developed by Friedman & Schwartz and Cagan.¹ They focus on the money supply process in their inquiries, organizing them around a money stock identity consisting of three aggregates. This approach, which has proved very fruitful in their studies of the American monetary experience, is adopted in this paper.

The following framework is used. The money stock (M) is defined as the sum of the holdings of currency (C) and bank deposits (D) by the public; expression (1). The monetary base (B) is set equal to the total holdings of currency (C) by the public and holdings of base money reserves (R) by the

* I wish to thank Axel Leijonhufvud for helpful comments on earlier drafts.

¹ See Friedman & Schwartz (1963) and Cagan (1965). The results reported in this article are part of a study of Sweden's monetary history; see Jonung (forthcoming). This study employs an approach similar to that adopted by Friedman & Schwartz and Cagan.

banking system; expression (2). These two definitions form the identity in expression (3).

$$M = C + D \quad (1)$$

$$B = C + R \quad (2)$$

$$M = \frac{1}{\frac{C}{M} + \frac{R}{D} - \frac{C}{M} \cdot \frac{R}{D}} \cdot B. \quad (3)$$

In expression (3), the money stock is related to three monetary aggregates, the monetary base (B), the currency–money ratio (C/M) and the reserve–deposit ratio (R/D). These three variables have been termed the proximate determinants of the money stock.¹ This choice of terminology signifies that their movements should be related to the development of factors which can be described as the “ultimate” determinants of the money stock before any conclusions can be drawn concerning the causal relationship between the money stock and other variables. In the Friedman–Schwartz–Cagan approach the monetary base is assumed to be under the control of the monetary authorities. The public is postulated to choose its desired currency ratio and the banking system to decide the ratio between reserves and deposits given legal reserve requirements. However, a task for empirical research is to investigate the extent to which these assumptions are in accordance with actual developments. Evidence from Swedish monetary history largely tends to support this interpretation, although the assumptions have to be qualified depending on the monetary institutional arrangements in force.²

Expression (3) has been used by Cagan and others in a two-stage procedure for studying fluctuations in the money stock. In the first stage the fluctuations in the money stock are related to movements in the three proximate determinants. In the second stage the variables that have caused the variations in the proximate determinants are examined. Thus, this expression constitutes a method for organizing a study of money supply developments. This paper concentrates on the first step in order to assess the importance of the monetary base, the currency–money ratio and the reserve–deposit ratio as sources of secular and cyclical changes in the Swedish money stock. For this purpose, the money stock identity is expressed in terms of rates of changes as expression (4):

$$\frac{\Delta M}{M} = \frac{\Delta B}{B} - \frac{M}{B} \cdot \left(1 - \frac{R}{D}\right) \cdot \Delta\left(\frac{C}{M}\right) - \frac{M}{B} \cdot \left(1 - \frac{C}{M}\right) \cdot \Delta\left(\frac{R}{D}\right) + i, \quad (4)$$

¹ For a detailed description of this framework see Appendix B in Friedman & Schwartz (1963) and Chapter 1 in Cagan (1965).

² On this point see Jonung (forthcoming).

where Δ denotes the change per period and i is an interaction term.¹ Expression (4) constitutes the starting point for computations where a given change in the money stock is decomposed into the contributions of the proximate determinants.

The following breakdown of the changes in the Swedish money stock thus quantifies the contributions of the monetary base, the currency ratio and the reserve ratio to the growth in the money stock. This information is of interest in the analysis of several monetary problems. First of all, a study of the Swedish money supply process requires a knowledge of these developments in order to examine the roles of the monetary authorities, the public and the banking system in the creation and extinction of money. Consequently, it may also have implications for the conduct of Swedish monetary policy. Secondly, it has been postulated that the effects of fluctuations in the money stock depend on the route taken by money stock movements; for example a monetary expansion due to an increase in the monetary base may have a different impact on economic activity than that of a monetary expansion caused by a fall in the reserve ratio. A search for the existence of such effects can begin with a breakdown of the changes in the money stock into the contributions of the proximate determinants.² Finally, a study of the causal relationship between money and economic activity in Sweden can initiate from such a decomposition of the growth in the Swedish money stock.³

II. Definitions, Data and Computational Procedures

Definitions of the Monetary Aggregates

The money stock (M) is defined here as the sum of the public's holdings of *Riksbank* (Central Bank) notes (C), private bank notes, and demand and time deposits with the commercial banking system (D). The monetary base (B) is comprised of the public's holdings of *Riksbank* notes—this aggregate corresponds to the concept of currency (C) in expressions (1) and (2)—and the total of the following commercial bank assets: *Riksbank* notes, gold, short-term deposits with the *Riksbank* and the National Debt Office and silver held during the silver standard prior to 1873. This latter aggregate represents the volume of commercial bank reserves (R) in expression (2).

¹ This expression is derived by differentiating the natural logarithm of expression (3) with respect to time and then approximating the instantaneous changes with discrete changes. Cf. the presentation in Appendix B in Friedman & Schwartz (1963). The interaction term, i , which represents that part of the change in the money stock which cannot be attributed to the currency ratio or the reserve ratio separately is, as a rule, insignificant in the computations based on expression (4). Consequently, the term is ignored in the following.

² The view that the effects of monetary changes differ depending on how money is injected into the economic system is generally associated with the work of Cantillon; see Thygesen (1971, pp. 87-89). An attempt to establish the existence of Cantillon-effects using the same framework as this article has been made by Bordo (1975).

³ Some of the above issues are discussed at length in Jonung (forthcoming)

Data

This paper is based on a collection of data on Swedish monetary aggregates that has recently been compiled and hence not previously used for a study of this kind. All aggregates are based on end-of-month data with the exception of a few aggregates in the early 1870's, where approximations have been made from quarterly and yearly aggregates. An international comparison suggests that the monetary statistics used here are unique in terms of the length of period they cover, their consistency and the inclusion of practically every commercial bank on record.

Computational Procedures

The growth rates in expression (4) are computed by taking natural logarithms of the value of the ending date minus the natural logarithm of the starting date, and dividing by the number of years in the period—in this way the rates are compounded instantaneously. The computations for the secular growth patterns are based on unadjusted monthly data averaged on a yearly basis. The cyclical results are derived from monthly data adjusted for seasonal fluctuations and for trend. The weights for the currency ratio and the reserve ratio,

$$\frac{M}{B} \left(1 - \frac{R}{D}\right) \quad \text{and} \quad \frac{M}{B} \left(1 - \frac{C}{M}\right),$$

are set equal to the average values of the weights of the initial date and the terminal date for the period covered by the computation.¹

III. The Secular Pattern

The sources of secular changes in the Swedish money stock are computed for several time periods deemed interesting in a long-run perspective. First of all, the whole period 1871–1971 is covered. Then a division of this one-hundred year period is made with an emphasis on the existing monetary arrangements. The following periods are selected: 1871–1913, which corresponds roughly to the prewar gold standard, 1919–1924, the interwar paper standard, 1925–1931, the interwar gold standard, 1932–1938, which was a period of paper standard from 1932 to 1933 and from then until 1939 a pound standard, and finally 1946–1971, the postwar dollar-gold standard. The two World War periods, 1914–1918 and 1939–1945, are also singled out in order to investigate the monetary experience of these two intervals. Although Sweden was not militarily engaged in war action, the Swedish economy was strongly influenced by mobilization, disruptions in trade and other reallocations due to the wars. Further, the prewar period 1871–1913 is separated into 1871–1896 and 1897–

¹ The choice of empirical definitions of the monetary aggregates and of the data used here is described in Jonung (forthcoming). The secular movements in the money stock, the monetary base, the currency ratio and the reserve ratio are plotted in Jonung (1973) and (1974).

Table 1. Absolute and relative contributions to the growth rate of the Swedish money stock (M) by the monetary base (B), the currency-money ratio (C/M) and the reserve-deposit ratio (R/D) for selected periods, 1871-1971

Annual percentage rate of change and annual per cent, respectively

Period	Average growth rate of M per year (1)	Absolute contributions by			Total change in M (5)	Relative contributions in per cent by		
		B (2)	C/M (3)	R/D (4)		B (6)	C/M (7)	R/D (8)
1871-1971	6.0	5.8	-0.2	0.3	100	97	-3	5
1871-1913	6.0	4.5	0.6	1.1	100	75	10	17
1871-1896	5.1	2.5	1.8	1.2	100	49	35	24
1897-1913	7.2	7.6	-1.5	1.2	100	106	-21	17
1919-1924	-4.9	-6.1	1.1	0.0	100	124	-22	0
1925-1931	0.3	1.7	-1.3	-0.1	100	567	-433	-33
1932-1938	3.5	14.2	-4.2	-7.4	100	406	-120	-211
1946-1971	7.2	5.8	1.1	0.3	100	81	15	4
1914-1918	21.5	24.8	-3.6	0.2	100	115	-17	1
1939-1945	8.2	9.4	-3.9	2.8	100	115	-48	34

Comments: Due to approximation errors the sum of the contributions of the proximate determinants may not equal the total change in the money stock. This applies especially to periods where the weights of the asset ratios for the initial year and the terminal year differ substantially.

1913, motivated by the elimination of commercial bank notes and the establishment of the *Riksbank* as the sole issuer of notes around the turn of the century.¹

The contributions of the three proximate determinants to the secular growth rate of the Swedish money stock for the periods chosen are displayed in Table 1, which also exhibits the relative contributions. These are derived by dividing the absolute contributions by the average growth rate of the money stock. The most notable feature of Table 1 is probably the large contribution of the monetary base to the secular growth in the money stock in relation to that of the currency ratio and the reserve ratio. This predominance holds for all periods, although it is less pronounced for the interwar years, 1919-1938, than for the prewar, 1871-1913, and the postwar, 1946-1971, periods. The interwar years exhibit a pattern which differs markedly from other intervals—the contributions of the asset ratios, that is of the currency ratio and the reserve ratio, are more significant for these years. This is a

¹ This classification on a monetary institutional basis is to a certain extent arbitrary. The monetary arrangements during some periods did not quite adhere to the above groupings; the silver standard was officially upheld until 1873 and the paper standard during the period 1914-1924 was *de facto* a gold standard for long stretches of time. At any rate, the conclusions reached using this classificatory scheme are not significantly altered by using a slightly different choice of starting and ending years for the periods. The selection of initial and terminal years tends to become more decisive as the number of years in a period is reduced. The results obtained for shorter time periods in the above classification do not, however, appear to be crucially modified due to the precise dating of periods.

reflection of specific monetary events in the 1930's, when both asset ratios rose sharply.

The pattern in Table 1 essentially implies that in the long run the monetary base multiplier, defined as the ratio between the money stock and the monetary base, has been comparatively constant in the sense that it has contributed substantially less to the growth rate of the money stock than the monetary base. The contributions of the base money multiplier are readily obtained simply by adding the contributions of the reserve ratio and the currency ratio, i.e. columns (3) and (4) for the absolute contribution and (7) and (8) for the relative contribution. These contributions offset each other for some periods. However, the opposite holds for most years—movements in the asset ratios tend to exhibit a positive covariation. By examining the contributions of the asset ratios on a yearly basis, it turns out that for the one hundred years covered here, these contributions reinforce each other in 62 years and offset each other in 38 years.

The two subperiods during the prewar years display some differences in the contributions of the proximate determinants. The higher growth rate in the monetary base during the later half of these years is partially a reflection of the establishment of the *Riksbank* as the sole issuer of notes. This institutional change also contributed to the negative contribution of the currency ratio between 1897 and 1913, which rose when private bank notes were taken out of circulation.¹

The two periods of war years show rather identical patterns. The growth rates of both the money stock and the monetary base are above the long-run trend rates for 1871–1971. The expansion of the monetary base, which is higher than that of the money stock, is to a large extent due to the financing of government expenditures by increasing government indebtedness to the *Riksbank*, thus increasing the volume of base money. The much stronger growth in the money stock and in the monetary base during World War I is explained by several factors. The authorities wanted to minimize monetary expansion during World War II in light of experiences from the first war—government expenditures were financed to a larger extent by borrowing from the public in the 1940's. Sweden was also more isolated from foreign trade during the latter war. Consequently, the considerable inflow of foreign reserves that characterized the period 1914–1918 was not experienced in 1939–1945. The increase in the currency ratio and thus the negative contribution of this ratio during the war years, which is rather considerable, is due to the general uncertainty and insecurity caused by war events. Specifically, strong tendencies to hoard cash in the form of notes were observed at the outbreak of both wars. Furthermore, the increase in demand for notes relative to com-

¹ Private bank notes are included in the denominator while *Riksbank* notes, i.e. base money, are included in the numerator of the currency–money ratio.

Table 2. Sources of the rate of change in the American money stock; averages for selected periods, August 1875 to December 1955

Growth rates in per cent

Period	Changes in <i>M</i> (1)	Contributed by			Total change (5)	Relative contributions		
		<i>B</i> (2)	<i>C/M</i> (3)	<i>R/D</i> (4)		<i>B</i> (6)	<i>C/M</i> (7)	<i>R/D</i> (8)
All years	5.7	5.2	0.5	0.1	100	91	9	2
War years	16.0	16.3	-5.5	6.0	100	102	-34	37
Non-war years	4.9	4.3	1.0	-0.3	100	88	20	-6
Before Mar. 1917	6.8	4.3	1.6	0.6	100	68	25	10
After Nov. 1918	3.2	4.4	0.2	-1.4	100	138	6	-44

Source: Table 2, p. 19, in Cagan (1965).

mercial bank deposits is also explained by the extent of black market operations and the mobilization of armed forces.¹

Briefly then, the long-run growth in the Swedish money stock is closely associated with the growth in the monetary base. The behavior of the public and the banking system as reflected in the currency ratio and reserve ratio contributed little to the secular expansion of the money stock.²

The secular sources of change in the Swedish money stock as displayed in Table 1 are most readily compared with a similar breakdown of the growth in the American money stock made by Cagan.³ His results, reproduced in Table 2, are based on the years 1875-1955, which is a slightly shorter time interval than the one hundred years of Swedish monetary history covered in Table 1. A comparison of these two tables reveals that for both Sweden and the United States, the monetary base represents the largest contributions to the growth rate in the money stock in the long-run perspective, while the contributions of the asset ratios are substantially smaller. Cagan also suggested that the long-run movements in the asset ratios largely offset each

¹ On these points see Jonung (forthcoming).

² How does the evidence on the secular pattern in Table 1 conform to alternative views on the money supply process? From a Swedish standpoint two views are of special interest, i.e. those found implicitly in the writings of Wicksell (1898) and Cassel (1904) on the causes of secular price level movements. At the turn of the century, both of them proposed alternative theories to explain the long-run movements in prices in the 19th century. Their theories carry implications concerning the behavior of the proximate determinants of the Swedish money stock. In Wicksell's cumulative process the behavior of the commercial banking system as reflected in the reserve-deposit ratio is assigned crucial importance. Cassel, however, focuses his inquiry on the demand for and supply of gold. The implications regarding the development of Swedish monetary aggregates of Wicksell's and Cassel's theories of secular movements in prices are investigated by Jonung (1976). The explanatory power of Wicksell's cumulative process has been studied by Cagan (1965) and Patinkin (1968). They base their arguments on a breakdown of the American money stock into the contributions of the three proximate determinants.

³ See Chapter 2 in Cagan (1965).

other. However, this impression is based on a rather small set of periods selected—five in Table 2 as compared to eleven in Table 1. A choice of longer intervals would probably tend to result in a picture closer to the Swedish one, judging from the behavior of the U.S. currency–money ratio and reserve–deposit ratio, where secular movements in the two ratios tend to exhibit a positive covariation.¹ War-time monetary experiences in Sweden and the United States exhibit identical patterns. Cagan found that during the war periods, March 1917–November 1918 and November 1941–August 1945, the growth rate in the monetary base and the money stock were much higher than during the non-war years and that the growth rate in the monetary base was larger than that of the money stock. This was also the case for Sweden. Furthermore, for both countries, the currency–money ratio produces a negative contribution but the reserve–deposit ratio gives a positive one during the two World Wars.

The Swedish pattern as displayed in Table 1 can also be compared with the British and Canadian secular picture.² In both of these countries—in the United Kingdom between 1880 and 1962 and in Canada between 1875 and 1958—most of the secular fluctuations in the money stock are attributable to changes in the monetary base. During the two World Wars the expansion in the money stock and the monetary base was above the trend growth rate. These results are the same as those which hold for Sweden and the United States. On the other hand there are much fewer similarities concerning the contributions of the asset ratios in Canada, Great Britain and Sweden.

In all three countries, however, the currency–money ratio fell in the 19th century. This picture is explained by a faster spread of commercial bank deposits than of the volume of currency, reflecting the rapid growth in commercial banking in this century.

Other comparisons between the Swedish and foreign secular experiences are hampered by the lack of data for long spans of time, as most foreign results are derived from the post-war period. Furthermore, differences concerning the choice of definitions of monetary aggregates and concerning institutional settings are obstacles to such investigations. However, in spite of these objections, the main pattern of the foreign secular monetary experience is similar to the Swedish one in the sense that the growth in the monetary base contributes the most to the growth in the money stock. However, nothing very conclusive can be said about the contributions of various asset ratios. This impression is based on the monetary background of Denmark, 1951–1968, The Netherlands, 1953–1971, Argentina, 1935–1945 and 1958–1962, Canada, 1955–1965 and Italy, 1958–1969.³

¹ Cf. Chart 1 in Cagan (1965).

² See Hay (1968) and Sheppard (1971).

³ This conclusion is based on Thygesen (1971), Korteweg (1973), Diz (1970), Kelly (1969) and Fratianni (1971).

IV. The Cyclical Pattern

In order to ascertain the cyclical pattern, seasonal fluctuations were first eliminated from the monthly series of the monetary aggregates by a twelve-month moving average. Then the time series were adjusted for trend by expressing them in terms of rate of change derived as month-to-month percentage changes on a yearly basis. Growth cycles in the rate-of-change series for the money stock were dated according to the National Bureau method.¹ A total of 18 growth cycles or specific cycles were classified for the period 1871-1971. Every growth cycle is divided into nine cycle stages where stages I and IX are centered around the trough and stage V around the peak. Consequently, stages II, III and IV encompass the expansion phase and stages VI, VII and VIII the contraction phase. The rate of change in the money stock and the contributions of the proximate determinants are computed for each cycle stage.

The results of these calculations form the basis for describing the absolute and relative contributions of the proximate determinants. The cyclical picture is displayed here by computing the contributions of the proximate determinants for various groupings of cycles in the growth rate of the money stock. In this way we can examine the possible existence of a consistent cyclical pattern or—if such a pattern does not exist—search for explanations for the differences among the cycle groupings. Five cycle classes are studied: the entire period, the prewar years, the period 1912-1947 covering the two World Wars and the interwar period, the “war” cycles of 1909-22 and 1940-47 and the postwar period. The second and last groupings coincide with the gold standard and the dollar-gold standard, respectively, while the others encompass varying forms of monetary arrangements.

IV a. *The Absolute Contributions*

To find the “typical” pattern, episodes that can reasonably be regarded as “atypical” should be eliminated. In particular, developments emanating from the supply side in the form of specific institutional changes may be excluded for this reason. Four such developments are observed here. First, during the cycle of 1875-1878, the one crown *Riksbank* note, which commanded a considerable part of the note supply of the *Riksbank*, was withdrawn from circulation. Simultaneously private bank notes increased their market share. The decline in the monetary base and in the currency money ratio during this cycle, which to a large extent was due to this administrative step, is not fully comparable with the experience of later cycles. The same holds for the cycle of 1878-1881, when private five crown notes were abolished by a government decision, leaving the *Riksbank* as the sole supplier of this note

¹ The National Bureau procedure for studying specific cycles is discussed in Burns & Mitchell (1946).

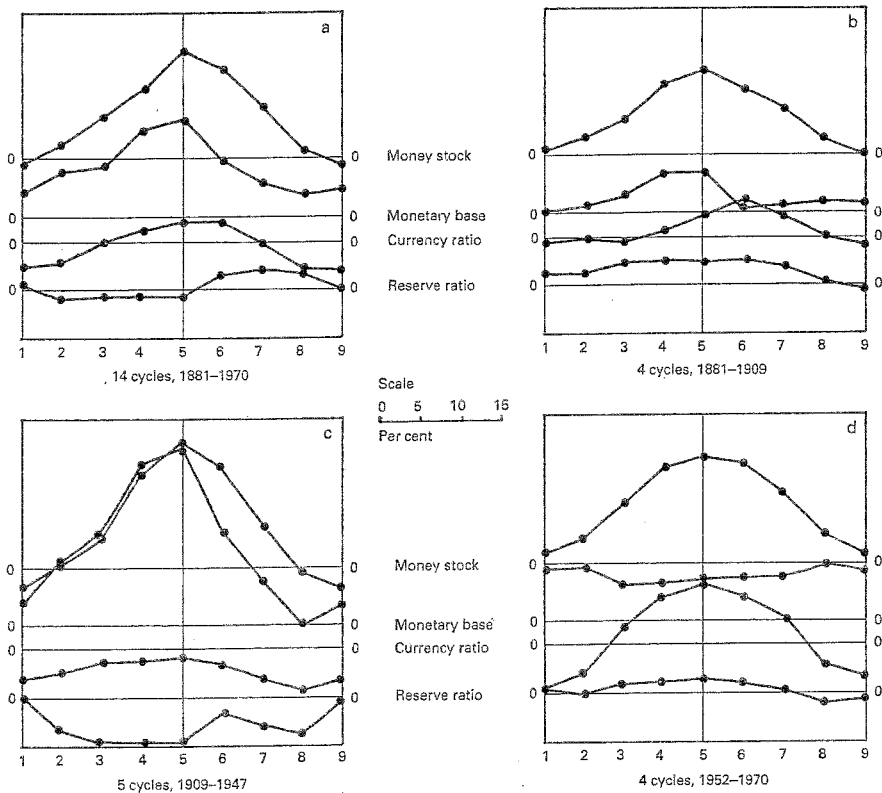


Chart 1. Average contributions of the proximate determinants to cycles of the rate of change in the Swedish money stock for four periods, annual percentage change.

Comments: The sum of the three lower lines, representing the contributions of the reserve ratio, the currency ratio and the monetary base, is equal to the percentage change in the money stock as shown by the top line.

denomination. This event gives an upward bias to the contribution of the monetary base and a downward bias to that of the currency ratio and probably also to the reserve deposit ratio as *Riksbank* notes were to some extent substituted for private bank notes in the bank reserves. These two cycles are considered "atypical" and are thus excluded from the following computations. The same holds for the two cycles in the beginning of the 1890's, cycles 5 and 6, as these cycles in the money stock cannot be dated with sufficient precision due to an interruption in the monetary data. Furthermore, the withdrawal of private bank notes in 1900-1903 makes it appropriate to eliminate stages VIII and IX and stages I and II in the 7th and 8th growth cycles in the money stock.

After these adjustments, which are made to facilitate a comparison between various periods, the average cyclical patterns are obtained (1) for the whole period 1881-1970 covering 14 cycles, (2) for the prewar period 1881-1909 based on four cycles, (3) for the years 1909-1947 including five cycles and (4) for

the postwar period 1952-1970 encompassing four cycles. The introduction and abolishment of the cash reserve requirements in the early 1950's represent a unique episode in the postwar monetary experience so that the cycle of 1947-1952 has been excluded from the calculation of the postwar pattern. The results for these four cycle groupings are shown in Chart 1.

What conclusions can be drawn from Chart 1? First of all, it should be emphasized that the number of cycles underlying the calculations is quite small, at most 14 cycles but only 4-5 for each subperiod. Consequently, there is a limited number of observations and a cycle with "extreme" values can dominate a pattern. Inspection of the chart shows that the money stock exhibits a fairly uniform and smooth shape for all periods. The contributions of the proximate determinants on the other hand display more divergent patterns. The contributions of the monetary base have generally peaked in the expansion stages simultaneously with the money stock and also appear to be larger than those of the two asset ratios, except for the postwar cycles. The dominating position of the monetary base in the period 1909-1947 is due to the two war cycles and the cycle in the first half of the 1930's. Looking only at the prewar and postwar cycles, however, changes in the volume of base money have contributed less to the growth in the money stock.

In contrast to the monetary base, the two asset ratios have given both positive and negative contributions to the growth in the money stock. There is a tendency for the contributions of the currency ratio to peak in the expansion stages—this is most pronounced in the 1950's and 1960's—while the reserve-deposit ratio displays a pattern of comparatively small fluctuations, particularly in the prewar and postwar years. The behavior of the banking system as summarized in the contributions of the reserve ratio during cycles in the growth rate of the money stock seems to have been about the same during both periods. The sharp increases in the reserve ratio in the early 1930's and early 1940's account for the negative contributions of this ratio during 1909-1947. The contribution of the currency ratio is very pronounced for the postwar cycles. It could be suggested that the countercyclical design of the *Riksbank's* actions during these years, combined with the policy of administrative controls on the flow of bank credit and of other forms of non-price rationing of credit has contributed to this pattern.¹ The calculations for the two war cycles 1909-1922 and 1940-1947, which are not exhibited here, show that the average cyclical growth rates for the money stock and

¹ The patterns in Chart 1 and Table 3 for the postwar years indicate that the *Riksbank* has implemented a discretionary stabilization policy as opposed to previous periods. The Bank has decreased the growth rate of the money stock during booms in the 1950's and 1960's and expanded it in periods of low economic activity. The volume of bank deposits has moved countercyclically due to the design of monetary policy. The volume of notes, however, has moved procyclically, being determined primarily by the demand of the public, which rises during booms and falls during periods of low economic activity. In this way the contribution of the currency ratio has been higher during booms than during recessions.

Table 3. *The relative contributions of the proximate determinants to specific cycles in the growth rate in the money stock for selected groupings of growth cycles in the money stock when the intracycle trend is removed*

Standard deviations of the relative contributions are shown in parentheses

Specific cycles	Total change in <i>M</i>	Contributed by a change in		
		<i>B</i>	<i>C/M</i>	<i>R/D</i>
All cycles, 1881–1970	100	51 (28.7)	52 (7.5)	–3 (28.5)
Four prewar cycles, 1881–1909	100	45 (25.7)	27 (19.4)	30 (18.5)
Five cycles, 1909–1947	100	98 (50.5)	25 (15.4)	–22 (60.3)
Four postwar cycles, 1952–1970	100	–17 (11.4)	99 (13.2)	18 (13.5)
Two war cycles	100	83 (79.0)	23 (35.7)	–7 (64.8)

Comments: This table is derived in the following way. First, the trend-adjusted contributions of the proximate determinants for every cycle stage are divided by the corresponding value for the money stock, except for stages 3 and 7, which have been excluded. This is done in order to avoid dividing the contributions of the determinants by growth rates in the money stock that are zero or very close to zero, which would give rise to indefinitely high and thus not very meaningful relative contributions. Second, the average relative contribution for all seven cycle stages are computed for each cycle grouping. Stage 6 in the 1894–1902 cycle has also been excluded, as the contributions of the currency ratio appears to be “atypical” for this stage due to the elimination of private bank notes.

Due to rounding and approximation errors the sum of the contributions does not necessarily add up to 100.

The standard deviations for the relative contributions over the cycle stages are displayed in parentheses. These standard deviations can be viewed as indicators of the regularity with which each proximate determinant contributes to the growth in the money stock.

the monetary base are higher than the average cyclical growth rates for any other cycle grouping. The currency ratio stands for a negative contribution in the first three stages due to the attempts by the public to hoard *Riksbank* notes in the early part of the two World Wars. The substantial rise in the reserve ratio during 1940–1941 accounts for a strong negative contribution for this asset ratio as an average for the two wars, although the reserve ratio was practically constant during the cycle of 1909–1922.

IV b. *The Relative Contributions*

The relative contributions of the proximate determinants to the cyclical growth in the money stock can be expressed in various ways. A straightforward approach is to derive the average contributions for all cycle stages in a cycle grouping and divide by the average growth rate in the money stock for that cycle grouping. Such a computation—not displayed here—shows that the monetary base represents the largest relative contribution for all cycle

classes except for the prewar cycles, when the reserve ratio gives a slightly higher contribution.

However, this result is influenced by a strong intracycle trend as both the money stock and the monetary base increase in absolute size during most cycles. Once this trend is eliminated—by subtracting the average value of the series for all stages in the cycle from every series in each stage—quite a different picture emerges. Now the relative importance of the monetary base is diminished while the contributions of the asset ratios are more pronounced. The currency ratio shows a larger relative contribution than the monetary base in three of the five cycle classes, namely for all cycles, the four prewar cycles and the postwar cycles; see Table 3. The monetary base contributes more as an average for the cycle class to the growth in the money stock only during the war and the interwar years. The predominance of the currency ratio is most striking during the cycles in the 1950's and 1960's. Here for every cycle stage the trend-adjusted cyclical growth rates in the money stock and the monetary base have opposite signs.¹ Finally, the reserve-deposit ratio represents the source of a comparatively small relative contribution. Thus, the main impression from Table 3 is that the behavior of the public, represented in variations in the currency ratio, is an empirically important variable in an account of the sources of cyclical growth in the Swedish money stock.

The relative contributions of the proximate determinants have varied considerably among the cycle stages within the various cycle classes. One measure of this variability is shown in Table 3 in the form of the standard deviations for the relative contributions. Here the dispersion for the relative contribution of the currency ratio is comparatively small. Thus this ratio appears to have moved well in accordance with changes in the cyclical growth of the money stock. This is also supported by the fact that its relative contribution is positive throughout all cycle classes. The other two proximate determinants exhibit more volatile patterns judging from the size of their standard deviations. They are associated with less regular relative contributions over the cycle stages.

IV c. *Amplitude*

Another aspect of the cyclical pattern can be described in terms of the amplitude of the four series that make up expression (4). Differences may exist in the range of fluctuations in the contributions of the proximate determinants among the five cycle classes studied here. One method of detecting such patterns and later examining their causes is to compute the averages of the absolute values of the trend-adjusted series, representing a measure of their amplitude. The amplitudes computed in this way are shown in Table 4. This table conveys a picture that coincides with what could be expected from Chart 1. The monetary base accounts for the largest amplitude during the

¹ Cf. the preceding footnote.

Table 4. *The amplitude in the contributions of the monetary base (B), the currency ratio (C/M) and the reserve ratio (R/D) to specific cycles in the growth rate of the money stock after adjustment for intracycle trend*

Per cent per year

Cycle groupings	<i>M</i>	Amplitude in the contributions of		
		<i>B</i>	<i>C/M</i>	<i>R/D</i>
All cycles, 1881-1970	4.3	2.4	2.3	1.2
Four prewar cycles, 1881-1909	3.1	1.5	1.5	1.0
Five cycles, 1909-1947	5.3	5.7	1.6	3.5
Four postwar cycles, 1952-1970	4.2	0.7	4.2	0.8
Two war cycles	8.2	9.6	2.5	5.0

Comments: The amplitudes are derived by taking the average for all nine stages of the absolute values of the trend adjusted values for the cycle groupings.

five cycles 1909-1947 and during the two war cycles. The money stock and the contribution of the reserve ratio also display their strongest fluctuations during these two cycle groupings. As discussed above, this pattern is due to the specific monetary events during the wars and during the depression in the 1930's. The amplitudes associated with the asset ratios are smaller than or just as large as those of the monetary base with the sole exception of the 1950's and 1960's, when the range of variation in the contribution of the currency ratio is much larger than those of the other two determinants. It is worthwhile noting that the amplitude in the contribution of the reserve ratio is smaller than that of the currency-ratio except for some years in the 1930's and 1940's. The results in Table 4 mean that the behavior of the monetary authorities has been more volatile than the behavior of the public and the banking system in the sense that the contributions of the monetary base as a rule exhibit a greater amplitude than those of the asset ratios. Furthermore, the same argument suggests that in most growth cycles of the money stock the actions of the public have given rise to a larger range of fluctuations than those of the banking system.

IV d. *Conclusions Concerning the Cyclical Picture*

Examination of the cyclical pattern shows that all of the three proximate determinants have contributed significantly as sources of cyclical change in the money stock. There are substantial differences among the cycle classes investigated here with regard to the behavior of the monetary base, the currency ratio and the reserve ratio. One of these aggregates stands for a major contribution in one cycle class, while it is the source of a small change in the money stock in another cycle grouping. However, it may be concluded that the currency ratio and the monetary base as a rule contribute more to the cyclical fluctuations in the money stock than the reserve ratio. The behavior

of the banking system appears to be more "stable" in this sense than that of monetary authorities and the public. However, it is difficult to find a consistent cyclical pattern that holds for all cycle groupings; rather it seems that every cycle group has a pattern of its own. This conclusion also tends to hold for the amplitude of the contributions of the proximate determinants as well as for their covariation. The picture of the relative roles of the three sources of change is less clear-cut for the cyclical experience than it is for the secular pattern.

The results pertaining to the cyclical picture presented here are comparable to those in Cagan's study of the American money stock. However, it is difficult to make an accurate comparison between the American and Swedish monetary experience on this point for several reasons. First, monthly data on U.S. monetary aggregates are not available for earlier periods. Thus, the dating of the cycle stages in the growth rates of the money stock is less precise in American than in Swedish data. Second, the American money cycles are classified according to their association with severe and mild cycles in the general economic activity following the dating by the National Bureau, while the Swedish cycles are grouped on a chronological basis except for the two war cycles. Finally, there are differences in the computational methods used for analyzing the Swedish and American data and in the empirical definitions of the monetary concepts, although steps have been taken to minimize the latter discrepancies.

In spite of these objections, a few tentative conclusions can be suggested on the basis of a comparison of the American and Swedish records. The Swedish monetary aggregates in Chart 1 tend to exhibit a smoother and less jagged pattern than their American counterparts.¹ Specifically, the U.S. money stock and monetary base display a double-peaked shape for some cycle classes. There is no evidence for such a pattern in the Swedish data. Furthermore, one has the impression that the absolute and relative contributions of the monetary base in Sweden are larger than in the United States, while the opposite holds for the reserve ratio. Disregarding the postwar experience, the U.S. currency-money ratio also appears to have been more volatile than its Swedish counterpart. Such differences might be due to a greater monetary stability in Sweden than in the United States. In the period covered here, Sweden has not experienced any bank runs or other sudden losses of public confidence in the monetary system while the United States did so in several instances. The larger fluctuations in the American asset ratios and the more jagged cyclical pattern of growth in the American money stock and in the contributions of the proximate determinants as compared to the Swedish experience may thus be due to attempts by the public to withdraw bank deposits and attempts by the banking system to contract the volume

¹ The American cyclical pattern is shown in Chapter 2 in Cagan (1965).

of loans when confronted with a decline in public confidence in the solvency of the banking system. Finally, it is worthwhile pointing out that both the Swedish and American cyclical records suggest that the actions taken by the monetary authorities, the banking system and the public have all contributed significantly to cyclical fluctuations in the money stock.

V. Summary

This study of the sources of change in the Swedish money stock has shown that the monetary base represents the major source of secular growth in the volume of money. An investigation of the secular movements in the money stock should thus focus on the factors that have accounted for the long-run growth in the monetary base. The cyclical picture which has emerged here, however, is more complex. All of the three proximate determinants have contributed to cyclical fluctuations in the money stock. No consistent pattern seems to hold for all the cycle classes that have been studied. An inquiry into the causes of the cyclical fluctuations in the amount of money requires the observation of developments which have influenced the monetary base, the currency ratio and the reserve ratio. Finally, it should be emphasized that the discussion in this paper cannot settle any questions concerning causality. It represents a breakdown of the secular and cyclical growth in the Swedish money stock into three components. As such, it is a method for organizing a further examination of the factors that have given rise to the secular and cyclical fluctuations in the Swedish money stock.

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