Review of the monetary target

At its meeting on July 24, the Central Bank Council of the Deutsche Bundesbank reaffirmed its monetary targeting for 1997-8 and the monetary target for 1997. After the target had been exceeded up to and including May of this year, the money stock M3 returned to the target corridor in June. All the same, the Central Bank Council considers a further slowdown in monetary growth necessary for stability reasons. Moreover, it reaffirmed that, as in the past, it considers the money stock M3 to be the central reference point for German monetary policy.

The Central Bank Council's decision on the review of the monetary targeting for 1997 and 1998 and the monetary target for 1997 reads as follows:

"The Deutsche Bundesbank abides by its monetary targeting plan adopted in December 1996, which envisages a rate of growth of around 5 % over the course of each of the years 1997 and 1998. It likewise reaffirms the target corridor of between 3½ % and 6½ % which it set in addition for the year 1997.

Up to and including May of this year the target was overshot. But this was due mainly to a large statistical overhang at the end of 1996 caused by substantial borrowing in anticipation of the change in the special depreciation regulations, especially relating to rented dwellings in eastern Germany, and the increase in the tax on the acquisition of land and buildings. In June the growth of the

money stock M3 slowed to within the target corridor. From the present perspective, the Bundesbank believes that a further weakening of monetary expansion would be appropriate to the requirements of stability policy.

By its decision to abide by the monetary target, the Bundesbank is underlining the fact that it continues to regard the money stock M3 as the key target variable governing its monetary policy. Although monetary growth was subject to major fluctuations in the past two years, the underlying long-term monetary relationships remain sufficiently stable. The Deutsche Bundesbank will continue, as hitherto, to assess the signals emanating from movements in the money stock as part of a broad-ranging analysis of all the data relevant to price movements; in this context, it attaches particular importance not only to the data from the real sector but also to the external value of the Deutsche Mark and to developments in the financial markets."

Benchmark figures of the derivation of the target still valid

As usual, the monetary targeting for 1997 and 1998 was based on medium-term considerations. Specifically, a growth of just over 2 % in all-German real production potential, a medium-term price assumption of 1½ % to 2 %, and an add-on of 1 percentage point in respect of the slowdown in the trend of the velocity of circulation of money were presumed. Even now, these benchmark figures would not be set differently. The estimate of the real potential growth, which implies a somewhat greater increase than in the year 1996, assumes that investment activity in the corporate sector will revive over the course of this year. This assumption is based on the currently favourable overall conditions for investment, such as the moderate wage settlements, the continuously low interest rate level, and the normalisation of the real D-Mark external value, in addition to the higher degree of capacity utilisation in the manufacturing industry.

Last December, the Central Bank Council lowered the medium-term price assumption from 2 % (unchanged since 1985) to 1½ % to 2 %. The reason for this step was the expectation that the rate of consumer price inflation, which in 1995 was already below 2 %, would continue to remain below this level. In actual fact, the price situation in Germany initially did remain stable; however, one cannot fail to see that the last few months have shown an increased rise in consumer prices. The Bundesbank will orient its policy towards maintaining the virtual price stability which has been achieved. The add-on of 1 percentage point in respect of the slowdown in the trend of the velocity of circulation of money has been confirmed by updated trend calculations.

Monetary starting position

Apart from these overall economic benchmark figures, the Bundesbank takes due account of the respective monetary starting position when setting the target at the end of the year. At the end of last year the monetary starting position was marked by an overshooting of the four-quarter target and by a strong monetary growth as an average for the entire year. A major factor here was particularly a distinct rise in special savings facilities which to some extent represent "disguised" monetary capital. Furthermore, the

domestic money stock was inflated by shifts from Euro-deposits and money market fund certificates to M3 components. To this extent, monetary expansion over the past year overstated the increase in liquidity affecting expenditure. The Bundesbank therefore refrained from making a deduction in the 1997 and 1998 multi-quarter monetary target in order to take account of the overshooting of the monetary target for 1996. This assessment has not changed, even though the supply of liquidity appears more abundant than was estimated at the time of the setting of the monetary target due to the unexpectedly strong growth in the money stock towards the end of the year.

Money stock M3 in the target corridor in June

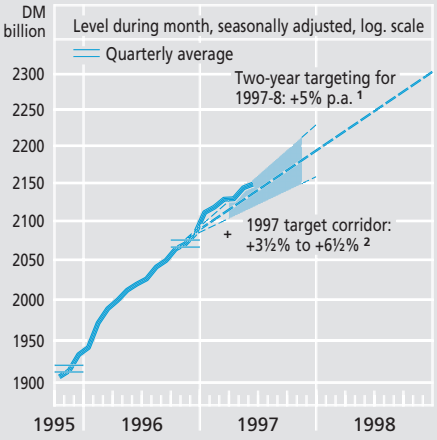
Entry into this year's monetary target period was made considerably more difficult by the strong growth in the money stock at the end of 1996. The main reason here was particularly the anticipatory effects of the changes in the taxation of real estate purchases in eastern Germany, which took effect at the beginning of 1997, triggering an exceptionally high level of new borrowing in the private sector. In the following months, however, monetary dynamism slackened noticeably, and in June, the money stock M3 returned to this year's target corridor of 3½% to 6½%. That month, it exceeded its average level of the fourth quarter of 1996 by 3.7%, seasonally adjusted; its annualised growth rate was 6.4%.

Money stock components

Among the individual money stock components, savings deposits at three months' notice continued to show the strongest growth, yet their growth has slowed down considerably

Growth
of the money stock M3 *

Target and movement to date



* Average of five bank-week return days; end-of-month levels included with a weight of 50%. — + The target corridor has not been shaded until March because M3 is normally subject to major random fluctuations around the turn of the year. — **1** Between the fourth quarter of 1996 and the fourth quarter of 1998. — **2** Between the fourth quarter of 1996 and the fourth quarter of 1997.

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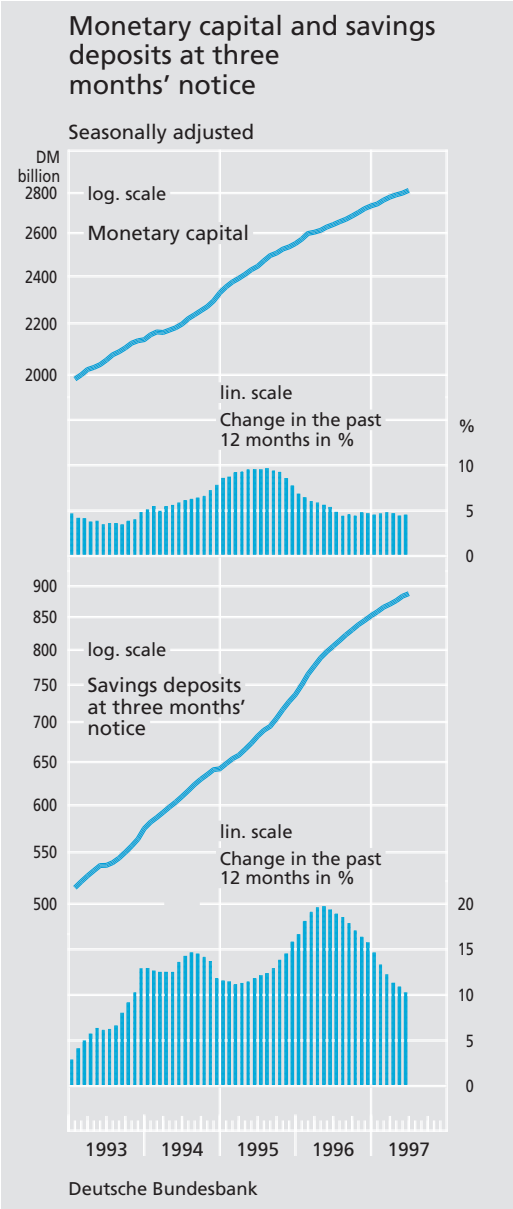
compared with the two preceding years. From January to June, they increased at an annual rate of just over 8½%, whereas this increase had been just under 20% over the same period of the preceding year. It is likely that in the meantime the portfolio adjustments of the savers, in reaction to the diverse innovative products of the credit institutions in this sector which have been developed over the past few years, have lost some significance. Thus, the distortion in the growth of the money stock M3 caused by a "disguised" monetary capital formation has decreased noticeably. Sight deposits and currency in circulation – with strong fluctuations from month to month – overall showed a fairly strong increase in the first half of the year. However, since the rate of expansion of sight deposits has calmed down somewhat



compared with 1996, growth in the money stock M1 has decreased. From January to June, it grew at a seasonally adjusted annual rate of nearly 7 %, compared with just over 11 % in 1996. The decline in shorter-term time deposits, which has been continuing almost uninterrupted since the spring of 1994, has continued at a slower pace.

M3 extended is growing at a rate similar to M3

The more broadly defined money stock M3 extended, which, in addition to the money stock M3, contains money market fund certificates, Euro-deposits, and short-term bank bonds in the hands of domestic non-banks, has risen over the past six months at an annual rate of 6½ %, or a rate similar to that of the aggregate M3 (7 %). It is true that domestic non-banks have reduced their holdings of money market fund certificates over the first half of the year once again by DM 5.5 billion – in the light of very low short-term interest rates as well as a rather comprehensive supply of alternative products bearing relatively attractive interest rates offered by credit institutions. However, they slightly increased their Euro-deposits from January to May (no information is available for June yet). On balance, the money stock M3 is at present – as opposed to the previous year – not inflated by repatriation from the expansion components of the more broadly defined monetary aggregate M3 extended.

Persistently sluggish monetary capital formation

Over the course of this year, monetary expansion continued to be promoted by sluggish monetary capital formation. During the first half of the year, monetary capital held at banks, at a seasonally adjusted annual rate of nearly 4½ %, was even enlarged at a slightly lower rate than in the first half of 1996, when there was a very pronounced wait-and-see attitude in respect of longer-term investments. At the same time, the investment of funds abroad has increased sharply. In the first half of the year, domestic non-banks purchased DM 18 billion worth of foreign debt securities and nearly DM 41 billion worth of foreign shares. To this extent, the balance

sheet counterpart of the sluggish monetary capital formation at domestic banks is not an increase in the money stock but a reduction of net external assets of the banking system. Since the sluggish monetary capital formation at home additionally went hand in hand with a visibly slower increase in savings deposits at three months' notice, the distortions of the monetary growth resulting from that will tend to be slight.

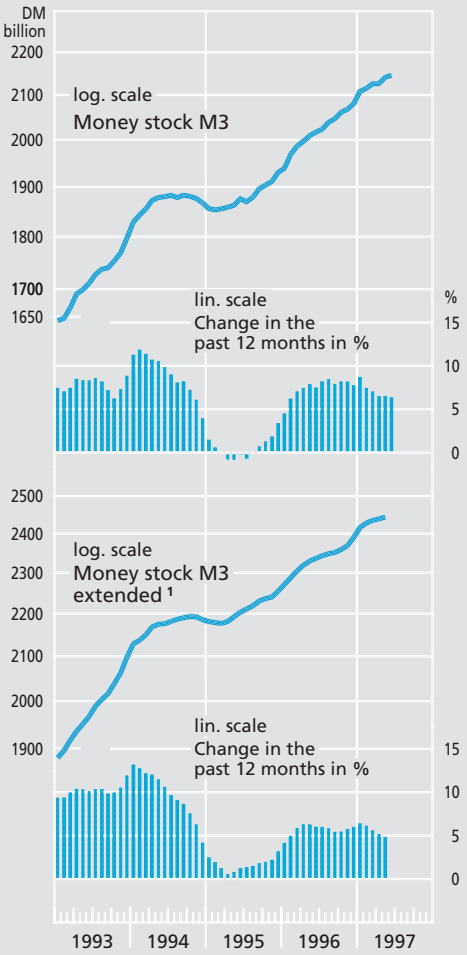
Credit expansion continues to be strong

During the first half of the year, credit expanded fairly strongly. Lending by credit institutions to domestic non-banks increased at a seasonally adjusted annual rate of just over 7 %. Particularly over the first three months of the year, the government borrowed heavily from the banks. Lending to the private sector diminished slightly following the rise in December of last year, yet it remained at a rather high level – in the light of activity in the real economy, which continues to be muted. However, one must certainly take into account the fact that a quarter of these loans consisted of lending against securities, which means an increase in corporate sector securities in the banks' portfolios. Such transactions take place to a great degree on the secondary market and thus to this extent do not represent the granting of new loans to the issuers.

Outflows of funds abroad dampen monetary growth

In the first six months of this year, monetary growth was slowed down considerably by exceptionally strong outflows of funds in foreign payment operations by domestic non-banks. Besides the previously mentioned purchases of foreign securities by domestic non-banks, the fact that foreign investors were rather reluctant to buy securities in the German securities markets from February to May played a role here. The reduction in the net external position is, in the balance sheet context of the monetary analysis, thus likely to have been accompanied not only by a slowdown in monetary growth and monetary capital formation at domestic banks, but also by an increase in lending.

Growth of the monetary aggregates



1 Derived from two end-of-month levels. From August 1994, including money market fund certificates held by domestic non-banks.

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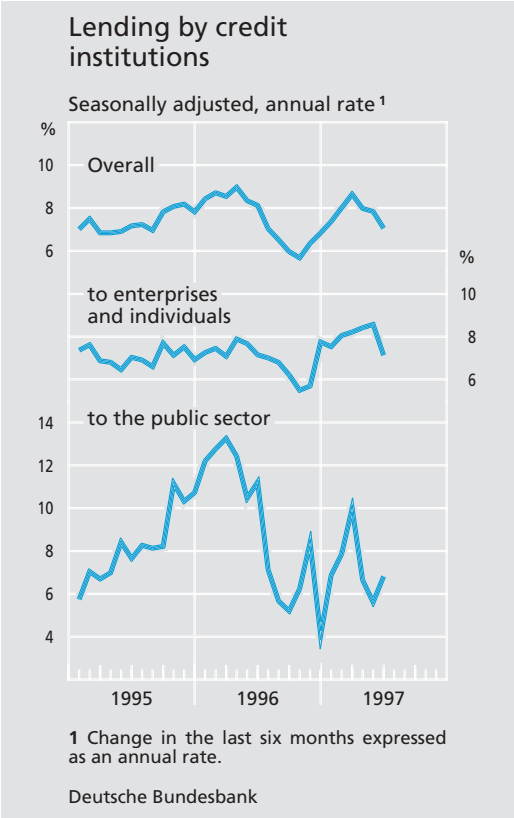

1 Change in the last six months expressed as an annual rate.

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Monetary policy environment

In order to be better able to assess inflationary risks, the Bundesbank will continue to review the signals emanating from monetary growth in the context of a broadly based analysis of all data relevant to price trends. It attaches special significance not only to the real economic indicators but also to the external value of the D-Mark and the events on the financial markets. Since the beginning of the year, the D-Mark has continued to weaken distinctly, especially vis-à-vis the US dollar. The Bundesbank will closely observe further exchange rate trends in respect of stability policy risks. It will also make a comprehensive analysis of events on the financial markets and their possible repercussions on the economic situation and movements in the prices of goods.

Further slowdown in monetary growth appropriate

For stability policy reasons, the Bundesbank at present considers a continued slowdown in monetary growth to be appropriate. This seems necessary in order to avoid a further build-up of liquidity overhangs. The chances of monetary growth proceeding at a moderate pace over the coming months are still quite present. However, expansionary stimuli as a result of public sector demand for credit is still a possibility. Furthermore, a noticeable economic revival might also manifest itself in lending to the private sector. Finally, the portfolio investments of domestic non-banks are causing some uncertainty. All in all, this means that relatively strong fluctuations in monetary growth cannot be ruled out for the coming months, either.

Monetary targeting empirically founded as in the past ...

By reaffirming the monetary targeting for 1997 and 1998, the Bundesbank is underlining the fact that it continues to abide by its strategy of monetary targeting and retaining the money stock M3 as the key target variable for German monetary policy. The use of a monetary aggregate as an intermediate target of a stability-oriented monetary policy presupposes sufficient stability of the long-term demand for money. According to econometric estimates by the Bundesbank and analyses by independent experts, the continued existence of this precondition for the money stock M3 can be assumed.[1] Furthermore, the strategy of monetary targeting requires the money stock to run ahead

1 See Annex, page 27 ff., in addition to, for example, Wolters, J. and Lütkepohl, H., *Die Geldnachfrage für M3: Neue Ergebnisse für das vereinigte Deutschland,* Ifo Studien 1/1997, pages 35-54.

of the prices. Various methods of analysis which take account of the interrelationships with other macroeconomic variables come to the conclusion that this connection for M3 still exists.[2] The major preconditions to using the money stock M3 to anchor a monetary policy oriented towards the medium term and towards the objective of price stability thus seem to continue to be fulfilled.

... and not called in question by shorter-term volatility either

The increase in the shorter-term volatility of the money stock over the course of the nineties is therefore no reason to call in question the monetary targeting strategy. It is true that the need to explain monetary policy has increased. In its interest rate policy, the Bundesbank must also orient itself more strongly towards medium-term monetary trends and towards the overall monetary policy environment. However, short-term fluctuations in monetary growth do not present monetary policy with problems of a basic nature. This is all the more valid as the fluctuations in the money stock over the past few years cannot be traced back to a single systematic cause but are attributable to a number of different factors which are largely independent of one another. Besides reasons relating to unification, the EMS turbulences of 1992 and 1993, and interest rate fluctuations emanating from international financial markets, in particular frequent amendments to tax law have led to sometimes extreme reactions to adjust asset management and credit demand on the part of domestic non-banks.[3] To the extent that the frequency of the appearance of such "shocks" decreases, the short-term volatility of monetary growth should also diminish once again.

Impediments to underlying monetary relationships in the Anglo-American countries by financial innovations ...

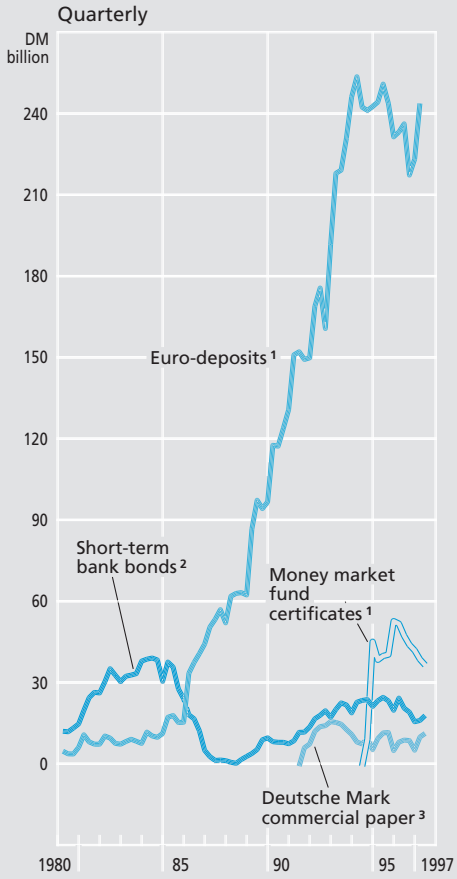
By contrast, the theory, which can be heard now and again, that the increasing spread of financial innovations is a decisive factor behind the shorter-term instability of the money demand in the nineties, is not very convincing. In Germany, the same process is allegedly taking place, which is said to have led to instability in the underlying monetary relationships in the Anglo-American countries during the eighties, albeit with a time lag. In principle, it is correct that the increased use of new financial instruments can have a negative impact on the indicator quality of a monetary aggregate. If the new investment vehicles are close substitutes to components of the money stock, the borderline between money and monetary capital becomes more blurred, and it becomes more difficult to correctly assess the growth of liquidity affecting expenditure.

... does not apply to Germany in the same manner

The development of the financial system in Germany, however, shows fundamental differences to that in the US, Canada or the United Kingdom. An evolution of financing structures which, on the whole, has been rather continuous, has been made possible in Germany by a far-reaching liberalisation and deregulation of the financial system which was undertaken early by international standards, in addition to a favourable macroeconomic environment marked by low and relatively constant inflation rates and interest rates, as well as a flexible universal banking system. Sweeping changes which in other

2 See Annex, page 29 ff.
3 See also: Deutsche Bundesbank, Monetary management since reunification, Annual Report 1995, pages 75-85.

Euro-deposits, short-term bank bonds, money market fund certificates and commercial paper



1 In the hands of domestic non-banks. — **2** Including certificates of deposit; circulation outside the domestic banking system. — **3** Circulation of Deutsche Mark commercial paper issued by domestic borrowers.

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countries have led to a disruption of underlying monetary relationships have remained largely absent.

Trends towards securitisation in the money market sector relatively unpronounced

Securitisation in the money market sector and the associated trend towards short-termism in financial relationships continue to play a minor role in Germany, by international standards. The rather strong demand for bank bonds with a maturity of under two years in the first half of the eighties – as a result of the exemption from the minimum reserve requirements at the time – has declined drastically with the inclusion of this paper in the minimum reserve requirements starting in May 1986. At the beginning of the nineties, this paper was purchased once again in somewhat greater numbers, yet this has not had any major impact on monetary growth. At the end of June 1997, just over DM 18½ billion worth of bank bonds issued by domestic credit institutions with maturities of under two years (including certificates of deposit) were in circulation outside the domestic banking system. Distortions in monetary growth triggered by the demand for such paper can be recognised rather clearly, since this is recorded in the money stock M3 extended.

CP, Bulis and Bubills

The Deutsche Mark commercial paper (CP) issued by domestic borrowers only showed a slow development since the establishment of the market at the beginning of 1991; at the end of June, there were DM 12 billion worth of this paper in circulation. The issue of Bundesbank liquidity paper (Bulis) between March 1993 and the autumn of 1994, and the authorisation of Treasury discount paper with a maturity of six months issued by the Federal Government (Bubills) from July 1996 (limited to a circulation of DM 20 billion) have also had almost no impact on monetary growth. Both types of money market paper have been or are being for the most part purchased by non-residents.[4] The spread of de-

4 At the end of June 1997, domestic non-banks were estimated to hold less than 4 % of the entire amount of Bubills in circulation.

rivative financial instruments, which could further blur the borderline between money and monetary capital, is relatively limited in the non-bank sector, according to available information.[5]

Euro-deposits

The quantitatively most significant financial innovation which is relevant to monetary policy continues to be the Euro-deposits of the domestic private sector, as in the past.[6] Owing to their interest rate advantage compared with domestic deposits (caused by the fact that they carry no minimum reserve burden) and in connection with the repeated changes in the taxation of capital gains, such deposits have increased sharply from 1986 until the end of 1993. Since they, in principle, represent a close substitute to domestic time deposits, the danger exists that neglecting them in the intermediate target variable will lead to an underestimation of the supply of the economy with liquidity. However, Euro-deposits are probably also formed for investment motives and will then not be connected directly to spending activity at home. It is not least for this reason that the Bundesbank has continued to apply the concept of funds placed within Germany to its primary indicator and has incorporated Euro-deposits into the subsidiary aggregate M3 extended. This more broadly defined monetary aggregate is especially cited to interpret monetary growth when the growth paths of M3 and M3 extended diverge. For example, this was the case last year when Euro-market funds were shifted to the domestic banking system.

Money market funds

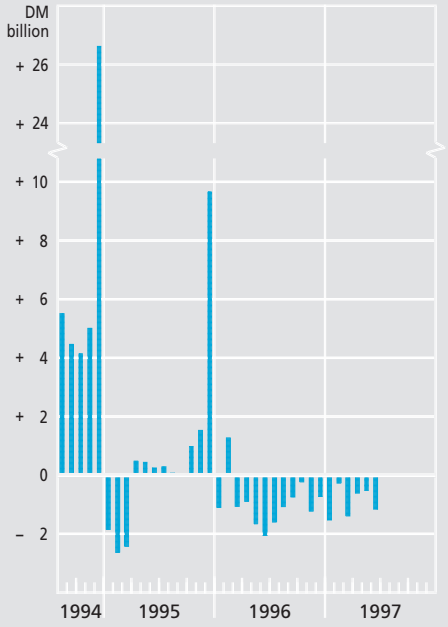
The authorisation of pure money market funds from August 1994 only temporarily had a noticeable impact on monetary growth. Their exemption from the increase in the property tax as of the beginning of 1995 led to tempestuous purchasing in December of 1994 (at a level of DM 26.6 billion) and thus to a downward shifting of the money demand, which also contributed to the undershooting of the monetary target for 1995. If one disregards the increase in purchases in December 1995, which likewise had tax reasons, these certificates have since then tended to be sold once again. Currently domestic non-banks' holdings of domestic and foreign money market fund certificates are just under DM 37½ billion. The authorisation of money market funds has thus up to now not led to any major difficulties for monetary targeting. Incorporation of money market fund certificates into M3 extended and the use of this aggregate to judge the liquidity situation have proven helpful in assessing the monetary situation, too.

Special savings facilities

Financial innovations can in principle also influence monetary targeting by causing individual money stock components to bear interest which is more in conformity with market rates and thus to undergo a change in their "character". Not least the increasing competition for investment money – among other things, through the introduction of the money market funds – may have motivated the banks to strongly expand their range of

5 See Deutsche Bundesbank, The monetary policy implications of the increasing use of derivative financial instruments, Monthly Report, November 1994, pages 41-58.
6 See Deutsche Bundesbank, Trends in the Euro-deposits of domestic non-banks, Monthly Report, January 1988, pages 13-21; Deutsche Bundesbank, Recent trends in, and the pattern of, domestic non-banks' Euro-deposits, Monthly Report, May 1995, pages 59-71.

Net purchases of money market fund certificates by domestic non-banks



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special savings facilities bearing attractive interest rates and often very flexible in nature.[7] Since the increased interest is often paid only if the funds recorded in the balance sheet as savings deposits at three months' notice are held for a longer period of time, one cannot rule out the possibility that the "monetary capital character" of the short-term savings deposits has increased in certain interest rate patterns. A change in the information content of the money stock M3 could be the result. Up until now, however, the signs of a permanent change in the demand for savings deposits seem to be relatively few. A certain caution in respect of interpretation is warranted, particularly by the fact that short-term savings deposits have always had a functional "dual character" and that their percentage in M3 is still lower at present than in the preceding low-interest-rate period during the second half of the eighties. Noteworthy distortions in the M3 growth probably only appeared last year when the strong increase in savings deposits at three months' notice had an exceptionally strong contractionary impact on monetary capital formation.

Monetary targeting in Germany not threatened by financial innovations

All in all, the impact of financial innovations on monetary targeting has proven to be controllable up until now. A systematic change in the cash holding patterns of domestic non-banks has not occurred. Temporary distortions were able to be recognised with the aid of monetary analysis and could be incorporated into monetary assessments. Against this background, too, there is thus no cause to deviate from the monetary targeting strategy. However, the Bundesbank will closely observe further developments on financial markets in order to be able to react in an appropriate manner to distortions in the money stock resulting from those developments.

7 See Deutsche Bundesbank, The longer-term trend in savings deposits and its implications for monetary targeting, May 1997, pages 43-62.

Annex

1. On the stability of the money demand

A policy based on monetary targeting presupposes a sufficiently stable long-term money demand. On the one hand, this means that the demand of economic agents for money – adequately defined – should be able to be explained using a small number of macroeconomic variables. On the other hand, the parameter values of these variables should not vary significantly over time.

The available empirical studies on the stability of the demand for money in Germany for the most part reach a positive result. Accordingly, the hypothesis of structural constancy – at least over the long term – cannot be rejected.[8] In some studies, however, doubts have been cast on this finding. Possible causes of instabilities are seen, on the one hand, in financial innovations, and on the other, in changes within the context of German unification.

The Bundesbank has dealt in depth with the question of the stability of the money demand. In the July 1995 Monthly Report, it presented an empirical study concerning the nominal money demand, which also used a wealth variable to explain money demand in some of its estimations. According to the results of this study, the long-term money demand has remained stable following reunification, too.[9]

In this Annex a money demand function in real form for M3 will be analysed applying the Stock method, on the one hand, and the Johansen procedure, on the other. Both approaches estimate the money demand in the form of error correction models, i.e. the short-term dynamics and the long-term equilibrium relationships are considered simultaneously. The study is based on non-seasonally adjusted quarterly data through the period from the first quarter of 1975 until the fourth quarter of 1996. Up until the second quarter of 1990, west German data are used; starting in the third quarter of 1990, data for all of Germany are used.

In order to calculate the real money stock (m – p), the deflator of the gross domestic product (p) is used. The transaction volume (yr) is represented by real gross domestic product. On the basis of theoretical considerations, the interest rates are considered stationary, i.e. the opportunity costs enter into the short-term dynamics in level form.

Since M3 contains interest-bearing components, ideally the specific interest rate of these variables should be taken into account when calculating the opportunity costs. However, this cannot be calculated with sufficient accuracy. Only since 1993 have the special savings facilities been recorded separately according to their period of notice, and only since November 1996 have their interest rates been recorded separately. If one uses proxies for these variables, for example, the interest rate for time deposits up to DM 100,000 as interest on special savings facilities, substitution relationships are not represented accurately. For these reasons, the present Annex refers to the yields of domestic bearer bonds outstanding as alternative costs of cash holding.

8 See for example Wolters, J. and Lütkepohl, H., *Die Geldnachfrage für M3: Neue Ergebnisse für das vereinigte Deutschland,* Ifo Studien 1/1997, pages 35-54.
9 See Deutsche Bundesbank, Empirical study of the stability of money demand in Germany, Monthly Report, July 1995, pages 29-35.

The inflation rate (Δp) is additionally incorporated into the short-term dynamics. This implies that on a short-term basis price homogeneity does not necessarily have to hold. The impulse dummy D903 accounts for the rise of M3 in the third quarter of 1990 caused by the German monetary union. The dummy variables D934 for the fourth quarter of 1993 and the first quarter of 1994, and D944 for the fourth quarter of 1994, serve to accommodate special effects caused by tax reasons. Since the beginning of 1994, following the distributing funds, the tax withheld on interest income has been payable on interest income from growth funds, too. This has led to massive sales of such paper by domestic non-banks at the end of 1993. At the beginning of 1995, the property tax for household wealth was increased from 0.5 % to 1.0 %, although, among other things, investment in money market funds was exempted. At the end of 1994, therefore, noticeable shifts from M3 components to money market fund certificates took place.

The result of the estimation using the Stock approach is as follows:[10]

$$\Delta(m-p)_t = \underset{}{-0.03} + \underset{(1.67)}{0.09}\,\Delta yr_t - \underset{(6.71)}{0.98}\,\Delta p_t - \underset{(3.29)}{0.20} r_t$$

$$+ \underset{(14.36)}{0.13} D903_t + \underset{(3.64)}{0.02} D934_t - \underset{(2.51)}{0.02} D944$$

$$- \underset{(4.00)}{0.10}\left[(m-p)_{t-1} - 1.20 yr_{t-1}\right] + \hat{u}_t$$

$$R^2 = 0.89 \quad LM(1) = 1.60 \quad LM(4) = 2.47$$

The long-term income elasticity, at a value of 1.20, is clearly above one. This mirrors the declining trend in the velocity of circulation of money, which can be explained by wealth effects. If the wealth variable is neglected as a determinant in the money demand equation, the transaction variable – because of the correlation of income and assets – assumes the wealth dependency, so that the income elasticity is a linear combination of partial income and partial wealth elasticity.

The coefficient of the error correction term shows a negative sign (– 0.10) and – in line with the critical values of MacKinnon[11] – is significantly smaller than zero. This ensures that disequilibria are reduced over time. The estimated equation is free of autocorrelation. LM(1) and LM(4) provide the relevant results of the Lagrange multiplier test by Breusch and Godfrey for autocorrelation of the first and fourth order.

The analysis of the eigenvalues in the context of the Johansen procedure (VAR model with four lags) also indicates that there is a long-term equilibrium relationship between the real money stock and real GDP. In the shorter period, the demand for M3 is influenced by interest rates.

The trace test of the rank of the cointegration matrix provides the following results:

Null hypothesis	Test-statistics	Critical value (5 %)
r = 0	60.19	19.33
r = 1	2.63	9.13

10 With the exception of the interest rates, all variables are logarithmic. The numbers in parentheses denote the t-values of the coefficients. The coefficients of the seasonal dummies are not shown here. The econometric model of the Bundesbank contains a similar money demand function. See Deutsche Bundesbank, *Makroökonometrisches Mehr-Länder-Modell,* November 1996, page 126 f.

11 MacKinnon, J., Critical Values for Cointegration Tests, in: Engle, R. and Granger, C. (eds.), Long-run Economic Relationships – Readings in Cointegration, Oxford, 1993.

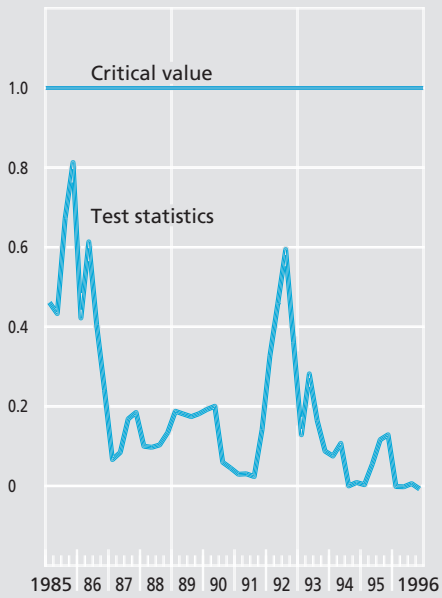
The gross domestic product is weakly exogenous with respect to the cointegration vector (test statistics = 0.48, marginal significance level = 0.49). If disequilibria appear through changes in any variable, the economic agents react accordingly by varying their real demand for money. The disequilibrium term is not significant in the explanatory equation for the real gross domestic product. Thus, the estimated vector can be interpreted as a money demand equation. The long-term income elasticity shows a value of 1.23. The adjustment coefficient of – 0.14 is significantly smaller than zero. The residuals fulfil the demands placed on the linear model.

A possibility of reviewing the stability over time is to estimate a partial model, taking into account the weak exogeneity of the transaction variable, for a limited period at first, and taking further observations into consideration on a stepwise basis in the following estimates. By incorporating additional observations, the estimated coefficients should not change "too much". A formal test was developed by Hansen and Johansen.[12]

The starting point is, in the present text, the subsample from the first quarter of 1975 until the fourth quarter of 1984, which is extended stepwise by a quarter. The cointegration vectors estimated recursively are compared to the vector of the full sample in the test procedure.

The adjacent chart shows the values of the relevant test statistics. Since the critical value of 1.0 is not exceeded, the null hypothesis of a stable money demand relationship cannot be rejected. According to these results, the policy of the Bundesbank, oriented towards a strategy of monetary targeting, continues to have an empirical foundation. In terms of content, these results do not differ from those of the analysis in July 1995.

Test of the stability of the money demand *



* Approach according to Hansen and Johansen.

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2. The leading indicator properties of the money stock

In order to serve as a leading indicator of inflation, the temporal course of the money stock should anticipate the future price trends in a stable manner. The connection between money stock and prices is generally analysed using the Granger causality tests as well as the P-star approach.

The concept of the Granger causality concentrates on predictability and not on causality in the economic sense. The question is whether the predict-

12 Hansen, H. and Johansen, S., Recursive Estimation in Cointegrated VAR-models, Preprint 1993, No. 1, Institute of Mathematical Statistics, University of Copenhagen.

ive quality of a variable on the basis of its own past values improves by taking additional variables into account. In this sense, the lead of the money stock over the prices exists if the current and past money stock trends improve the forecast of future price movements, yet conversely, taking the prices into account does not increase the predictive quality of the money stock equation. If the latter condition is not met, then a feedback relationship exists. Then there is feedback from the prices to the money stock which calls in question the indicator quality of the money stock.

Usually, such tests are performed for the bivariate case. Owing to a possible correlation of the two variables with a common third variable, the impression of a lead of the first variable over the second can therefore be created, although neither variable is directly connected to the other. In order to avoid so-called "spurious causalities", it is suggested that additional variables be incorporated into the analysis.[13]

If first differences of the variables are used in the Granger causality test to adjust for non-stationarity of the time series, then the level information is eliminated from the system as well. The levels, however, contain important information concerning the long-term equilibrium relationships between the variables. If they remain unaccounted for, then the equations are misspecified and the estimated coefficients of the short-term dynamics are distorted.

As an alternative, Dolado and Lütkepohl[14] recommend a Wald test in the context of a VAR model for level variables. The problem of the non-standard distribution of the estimators, even in large samples, is circumvented by increasing the "optimal" lag order of the system by one during the estimation and the test procedure. The usual critical values can thereby be used again. However, the fact that the power of the test decreases sharply with an increasing number of variables proves to be a problem here.

In the P-star approach, which is derived from the quantity equation, the money stock determines the price level over the long term.[15] In the short run, factors such as import prices, wage costs or indirect taxes also play a role in price movements. If the price gap – the difference between the equilibrium price level and the actual price level – is significant in the conditional equation for the inflation rate, causality will move from money to prices over the long term. For M3, this influence of the price gap on price movements continues to have a statistical foundation.[16] In the P-star approach, the reverse direction of causality is ruled out from the outset and is thus not tested.[17] Over the short term, however, a feedback relationship between these variables is conceivable. Since the velocity of circulation of money is showing a downward trend, the long-term income elasticity of the money demand is estimated by using an OLS regression in the calculation of P-star, which contains the inflation rate as an explanatory variable in the dynamics. The feedback relationship will then

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13 This approach, for example, is taken into account in the test by Toda and Phillips (Vector Autogregressions and Causality: A Theoretical Overview and Simulation Study; Econometric Reviews, 1994, pages 259-285).
14 Dolado, J. J. and Lütkepohl, H., Making Wald Tests Work for Cointegrated VAR Systems, Econometric Reviews, 1996, 15, pages 269-386.
15 Deutsche Bundesbank, The correlation between monetary growth and price movements in the Federal Republic of Germany, Monthly Report, January 1992, pages 20-28.
16 See also Deutsche Bundesbank, *Makro-ökonometrisches Mehr-Länder-Modell,* November 1996, page 51 ff.
17 See Hansen, G. and Kim, J.-R., Money and Inflation in Germany: A Cointegration Analysis, Empirical Economics, 1996, 21, pages 601-616.

be due to the fact that over the short term there is no price homogeneity.

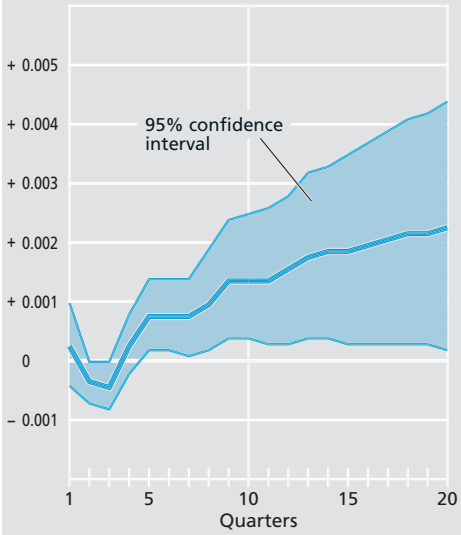
For impulse-response functions, which in this case are formed on the basis of a multi-dimensional error correction model (VEC model), the limitations of the approaches described above do not apply. For one thing, the impulse-response functions bring together all direct and indirect correlations among the model variables, since the information from all system equations is incorporated. For another, they also take account of the non-stationarity and the existence of long-term equilibrium relationships. However, there is very little experience of the application of this method of analysis to the money-price correlation in Germany, which means that the reliability of the results cannot be definitively assessed.

In the impulse-response functions on the money-price correlation presented below, the money stock M3, the GDP deflator, import prices, the yield on bonds outstanding, the three-month money market rate, and the real GDP were used as variables. The time series are not seasonally adjusted. Therefore, seasonal dummies are taken into account in the estimation of the VEC model.

The lag order (4) is determined in such a manner that the residuals are white noise. The trace test shows the existence of two long-term relationships between the variables.

Since the number of estimated coefficients is relatively high given six variables and four lags, the variant adjusted for the loss of degrees of freedom[18] is calculated in addition to the usual trace statistics.

Reaction of the price level to a shock in the money stock M3 *



* Price level measured in terms of the GDP deflator; impulse-response function based on the vector error correction model; shock on a scale similar to a standard error.

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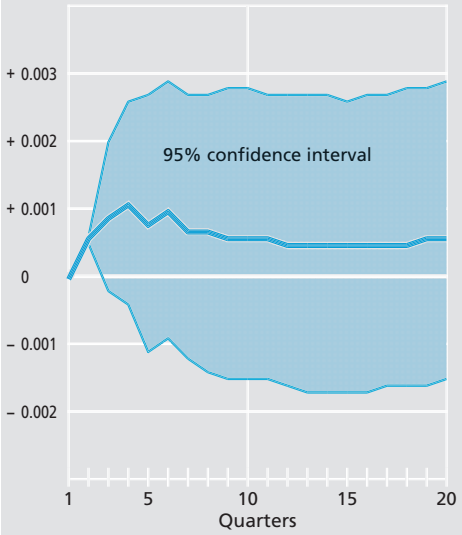
The determination of the impulse-response functions relies on an estimate of the VEC model. Subsequently, the variables of the model are shocked for a period in the magnitude of a standard error. The impulse-response functions reflect the courses of the reactions to these shocks on the different variables in the model. One can observe how the adjustments of the system proceed all the way to a new equilibrium.

In the case of a shock in the money stock, the price level initially shows no reaction (see chart on this page). Over the medium and long term, the reactions are as theoretically expected. For the money stock, however, only very short-term changes resulting from price shocks are detectable

18 See Reimers, H.E., Comparisons of Tests for Multivariate Cointegration, Statistical Paper, 1992, 33, pages 335-359.

Reaction of the money stock M3 to a shock in the price level *



* Price level measured in terms of the GDP deflator; impulse-response function based on the vector error correction model; shock on a scale similar to a standard error.

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(see chart on this page). Thus, the evidence is in favour of a causality from money to prices. Feedback relationships only appear on a short-term basis. After three quarters, the effect of prices on the money stock disappears. The corresponding impulse-response function no longer varies significantly from the zero line.

The results of this test thus suggest that the longer-term trends in M3, as in the past, provide important information for the assessment of future rates of inflation. The money stock-price correlation can no longer be proved unambiguously on the basis of simple bivariate correlation analyses, owing to long and variable lags. More comprehensive methods of analysis which take account of interdependence with other macroeconomic variables, however, speak for the fact that this correlation still exists.