

The impact of financial market crises on the German securities markets

In recent years the international financial system has been shaken on various occasions by crises involving serious disruptions of price formation on many markets, liquidity bottlenecks and a reduced provision of funds. Against this background, the present article addresses the question of the extent to which the events of 1997 and 1998 affected the functionality of the German financial markets. On balance, it can be said that the impact on the German securities markets remained within bounds. Admittedly, some major and otherwise highly liquid market segments were temporarily hit by liquidity shortages. To make the markets less susceptible to crises, it appears that, above all, measures are required which will foster an appropriate appraisal of risks by market players.

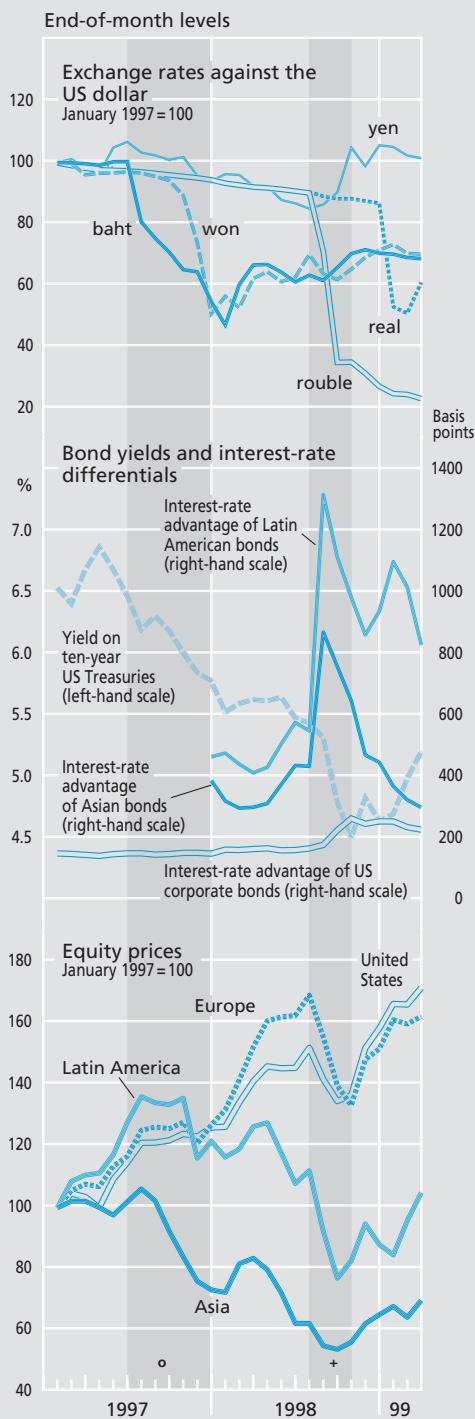
The financial market crises from summer 1997 to spring 1999

The course of the crises

From summer 1997 to spring 1999, some serious dislocations occurred in the international financial system. The upheavals began in south-east Asia, where substantial macro-economic disequilibria had emerged in a number of countries. In the first half of 1997, the Thai baht, which was actually pegged to

*Asian crisis as
from summer
1997 ...*

Developments in selected financial markets between 1997 and 1999



Source: IMF, Primark-Datstream, JP Morgan. — o Asian crisis. — + Russian crisis.

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the US dollar,¹ repeatedly came under pressure, and had to be floated early in July 1997. That triggered a further extension of the crisis, since doubts now arose as to the durability of exchange-rate links in other countries, too. Moreover, after the devaluation, financial sector problems came to light that had previously been masked by the high rates of credit-funded growth and by the stable external value of the currency. Finally, the devaluation led to competitive losses in neighbouring countries, and thus reinforced the devaluation pressure on those countries' currencies.

Immediately after the baht was floated, the exchange rate pegs of the Malaysian ringgit, the Indonesian rupiah, the Philippine peso and, in December, that of the Korean won likewise had to be abandoned (see the adjacent chart). Towards the end of the year, those currencies had lost about one-half of their value against the US dollar. The burden of foreign debt, which was immense anyway, rose steeply owing to the fall in the value of those currencies, and resulted in the insolvency of many non-financial enterprises and banks. In the autumn, the crisis spread to some countries outside south-east Asia. Russia and Brazil were particularly hard hit, as were Argentina and Chile, albeit less so. Signs of stabilisation first emerged in Thailand and Korea early in 1998, following extensive reforms of the financial sector.

... despite spreading to other regions ...

The impact of the Asian crisis on the financial markets of the industrialised countries re-

... has little impact on industrialised countries

¹ Strictly speaking, the baht was pegged to a basket of currencies, but that basket was dominated by the US dollar.

mained within strict limits until autumn 1997. In November and December, the bond markets registered a pronounced fall in yields, which primarily affected highly liquid government bonds. This widened the interest-rate differential of other fixed interest securities vis-à-vis government bonds, although that gap narrowed again to some extent early in 1998. The upswing in the equity markets faltered in the summer, and heavy price losses were recorded in October; ultimately, however, this turned out to be nothing but a short-lived episode on the road to ever-higher quotations. Only in Japan was there a more sustained adjustment of prices, against the background of persistent domestic economic problems.

*Russian crisis
as from May
1998 ...*

The stabilisation of conditions at the beginning of 1998 brought only a brief respite, however. As early as May, speculative attacks resumed, focusing particularly on the Russian rouble. On August 17, 1998 the Russian Government announced the widening – and, before long, the relinquishment – of the exchange-rate band against the US dollar, as well as a 90-day debt moratorium.

*... spreads to
the markets of
industrialised
countries*

After the Russian moratorium, the upheavals spread to the financial markets of industrialised countries. Even before that, rumours of considerable losses on the part of major market players were rife there. Moreover, the ongoing crises in Asia increasingly depressed economic prospects in the industrialised countries. Against this backdrop, the major equity markets – other than Japan – admittedly registered price gains until mid-July, but only a few securities were affected. From the

second half of July onwards, major price adjustments occurred; by mid-August, prices in the major stock markets were about 10% below their peaks in the previous month. Among many investors (who had apparently been counting on a bail-out by the industrialised countries), the Russian debt moratorium led to a far-reaching reappraisal of credit risks. The upshot was substantial shifts in assets, into securities that were regarded as especially low-risk and liquid. As a result, equity prices in the industrialised countries and the yields of liquid government bonds continued to fall, and the yield differential of the latter vis-à-vis other fixed interest securities widened dramatically.

Uncertainty in the international financial markets soared when heavy losses by a major hedge fund were announced at the beginning of September. Although its recapitalisation averted the risk of a collapse and of concomitant contagion effects, many market players nevertheless expected a rapid liquidation of that fund's open positions. In view of its size, correspondingly pronounced shifts in prices in the international financial markets were feared. In order to forestall such shifts, many market players liquidated substantial positions financed by borrowing. These moves were accompanied by a reduction in yen borrowing, through which US dollar securities purchases had previously been financed ("carry trades"). The upshot was a decline in the rate of the US dollar against the yen at the beginning of October, pronounced price uncertainty in the equity and bond markets and a drying-up of liquidity in major market segments.

*Losses
sustained by a
major hedge
fund and
liquidation of
"carry trades"*

*Final wave
of crisis leads
to Brazilian
depreciation*

A final wave of crisis in January 1999 led to the depreciation and, shortly afterwards, the full-scale floating of the Brazilian real; ultimately, however, the international impact remained within bounds. That may have owed something to the fact that players in the financial markets were running a much lower level of debt at that time than only a few months before. Although the turbulence in the capital markets of the industrialised countries largely subsided in the second half of October, the after-effects of the upheavals were felt until spring 1999. It was only when signs multiplied that many of the crisis countries had passed the lowest point that something of a return to normal occurred, reflected in globally rising bond yields and equity prices.

Financial market crises and securities market functionality

*Functions of
the financial
system*

In retrospect, it is particularly striking that disruptions emerged in some of the largest financial markets in autumn 1998. The question therefore arises as to whether the functionality of the financial system in Germany, too, was affected by the crises. Without a properly functioning financial system, efficient resource allocation in an economy is impossible. Financial markets and financial intermediaries ensure that savings are put to the most productive uses. At the same time, they enable economic agents to optimise over time their consumption plans or investment plans by means of corresponding financial contracts. Against this backdrop, the strength of crisis influences on securities markets can be gauged in terms of how far the bond and equity markets performed such functions

during the crises. Specifically, those functions include, besides the provision of funds proper, through the issuance of securities in the primary market, the transfer and management of risks (particularly credit risk, market-price risk and liquidity risk) by trading in the secondary market. In this context, the ongoing procurement, processing and aggregation of information and, on this basis, the formation of prices in the securities markets are of paramount importance.

Crises may affect the process of price formation in the securities markets in different ways. First, prices may overshoot or undershoot, i.e. differ from the fundamentally warranted values. Moreover, relative prices may be distorted. This may be reflected, firstly, in an unusually marked drifting-apart of the prices or yields of similar financial market instruments, such as an undue widening of the interest-rate differential between bonds with only a small difference in credit risk. Secondly, distortions in relative prices may also be mirrored in an usually close similarity in prices to those in other (foreign) markets. A further indication of disruptions in the price-formation process is, finally, pronounced uncertainty among market players as to the future movement of yields or prices, reflected, for instance, in an increase in implicit volatilities, calculated on the basis of option prices. Impairments of the provision of funds through the securities markets are mirrored in a decline in primary market activity, i.e. the issuing of securities. The actual provision of funds is indicated by net sales of securities – i.e. by the volume of issues, net of redemptions. Of particular significance for the ongoing trans-

*The influence
of the crises on
price formation
and resource
allocation*

fer of risks is, incidentally, the continuous tradability of financial contracts in the secondary market, and thus the liquidity of a market (see the box on page 22).

Impact of the crises on the bond market

Yield level, volatility and interest-rate differentials

*Decline
in yields ...*

In Germany, the upheavals in the financial markets since summer 1997 have been associated with a decline in bond yields to a historically low level. Between mid-1997 and early 1999, the yields on ten-year Federal government bonds fell by two percentage points to 3¾%. However, the crisis in eastern Asia has exercised a more significant effect only since the speculative attacks of October 1997, when a massive increase in demand for top quality paper and first-class liquidity (so-called "safe havens") became evident. During the period from July 1997 to December 1998, a total of about US\$ 75 billion flowed out of the countries particularly affected by the Asian crisis (Indonesia, Korea, the Philippines and Thailand), and ultimately gravitated to Europe and the United States.

*... in the "safe
haven"*

Towards the end of 1997 and in summer 1998, the German bond market registered heavy net inflows of funds from abroad, whereas previously outflows had predominated (see the chart overleaf). However, this was attributable not only to heavy foreign purchases – in August 1998 alone, non-residents invested DM 27½ billion net in German bonds – but also to the fact that domes-

tic investors showed little inclination to leave the "safe haven", and thus were reluctant to invest funds abroad. On balance, this probably resulted in a fall in the risk premia included in the capital-market rate, and temporarily also perhaps in a "safety discount" on yields. At all events, this conjecture is consistent with the decrease in the long-term real interest rate, to the unusually low level of 2%, and its rapid re-ascent after the termination of the crises. Furthermore, given the increasing duration and depth of the crises, expectations of inflation and growth in the industrialised countries were likewise revised downwards. However, this factor assumed noticeable significance only in 1998, when, for instance, average inflation expectations over the next ten years declined from 2¼% to 1¾% in Germany in the course of the year.

The relatively relaxed state of the German bond market right up to autumn 1997 was also reflected in the interest-rate differentials between bonds of the same maturity. For instance, in the third quarter of 1997, ten-year bank debt securities yielded a maximum of 20 basis points more than comparable Federal bonds. This suggests that market players were not demanding any particularly high premia at that time for the lower quality and liquidity of bank debt securities, and the incomplete hedging opportunities through the futures markets. In the fourth quarter of 1997, the interest-rate differential rose to up to 30 basis points, although it fell back to about 20 basis points in spring 1998 in the light of the improvement in conditions in eastern Asia. This picture changed fundamentally, however, after Russia's debt mora-

*Widening
interest-rate
differential of
bank bonds
vis-à-vis Federal
bonds*

Developments in the bond market between 1997 and 1999



1 Yield on ten-year Federal Government bonds less inflation expectations derived from opinion polls (Consensus Forecast). — 2 Net purchases of domestic bonds by non-residents less net purchases of foreign bonds by residents. — 3 With residual maturities of ten years. — o Asian crisis. — + Russian crisis.

Deutsche Bundesbank

torium. The yield spread of ten-year bank debt securities widened from 30–35 basis points during the first half of August to over 50 basis points in the weeks after the moratorium. This increase in the interest-rate differential primarily reflects the lower liquidity and hardly higher credit-risk premia relative to Federal bonds. Hence the interest-rate spread of public mortgage bonds and of securities issued by specialised credit institutions owned by the public sector vis-à-vis Federal bonds widened distinctly, even though such paper is not subject to a much greater risk of default. Even after the upheavals subsided, the interest-rate differential remained comparatively large. At the start of April 2000, ten-year bank debt securities were yielding about 50 basis points more than Federal bonds. That may be rated a sign of a sustained reappraisal of risks in the wake of the financial market crises.

The implicit volatility of Bund futures, as calculated on the basis of option prices, which serves as a yardstick of market players' price uncertainty, underlines the fact that the Russian crisis in summer 1998 resulted in a highly unsettled bond market in Germany, too. This contrasts with developments during the Asian crisis one year earlier, when implicit volatility rose only marginally during the speculative attacks in July/August and October/November. Such volatility reached its peak during the tensions in the dollar-yen market early in October 1998. Thereafter it diminished again, but remained distinctly above its level prior to the crisis.

Greater price uncertainty after Russia's moratorium

*International
correlations
and contagion
effects*

Investment decisions are affected not only by yield differentials between different categories of securities but also by differences in expected risks and in the correlations between them. If, for instance, a market player holds securities whose yields normally have little correlation with each other (i. e. the yield correlations are low, or even negative), he can push the entire risk presented by his portfolio below the level of the lowest individual risk. At times of crisis, though, such diversification advantages can be realised only if the correlations between the rates of return remain stable even in such periods. However, this condition normally seems not to be satisfied.² For example, in the bond markets of the G-3 countries, the correlations between daily bond-price changes actually increased, albeit only slightly, in a rough definition of the recent crises. The correlation between the daily returns on German and Japanese benchmark bonds with residual maturities of ten years rose from under 0.1 to almost 0.4 after the onset of the Asian crisis, and increased from under 0.2 to 0.3 during the Russian crisis. The traditionally closer correlations between Germany and the United States widened in both cases by about one-fifth, to 0.5 or 0.6.³ These findings, which can be generalised, are compatible with the hypothesis that financial market crises provoke similar responses by market participants in different countries, and therefore trigger "contagion effects".

Market liquidity

In an up-to-date financial system, the liquidity of the secondary market plays an ever-more-important role. Any temporary "drying-up"

of liquidity greatly curtails market players' ability to manage risks, since positions can be neither assessed nor traded in the short run (see the box overleaf). This may result, within a short period of time, in heavy losses by the institutions concerned.

The upheavals in summer and autumn 1998 adversely affected liquidity even in the market for Federal bonds – the most liquid market segment during periods of calm, on account of the large volume of issues and the futures-market instruments available. After Russia's debt moratorium, massive portfolio shifts caused turnover in the three Federal bond issues deliverable at the time for Bund futures contracts to expand to roughly twice the usual volume on some days (see the chart on page 23). The market thus approached the limits of its absorptive capacity; this was reflected in sharp price fluctuations and an increase in trading costs (measured in terms of the effective bid-ask spread) from less than 1 basis point in July and the first half of August to approximately 2 ½ basis points.

The bottlenecks in the spot market also owed something to the fact that distinctly more Bund futures – the most important hedging instrument for interest-rate risk – were traded in August than in the preceding months. At the end of that month, almost 900,000 open con-

*Lower liquidity
during the
Russian crisis ...*

*... accompanied
by very heavy
turnover in
the futures
markets ...*

² This point is analysed in more detail in the sections dealing with the equity market.

³ For more general findings on the dependence of international correlations in the bond and equity market on different volatility regimes, see: Domanski, D. and M. Kremer: The dynamics of international asset price linkages and their effects on German bond and stock markets. Bank for International Settlements, Conference Papers, Vol. 8, March 2000, pp. 134–158.

*The significance
of market
liquidity*

Market liquidity – concept and measurement

The liquidity of a market is synonymous with the “ease” with which securities can be traded there. It depends on the tightness, depth and resilience of a market, and on the immediate executability of orders. A market is tight if enough limited buying and selling orders are on hand for new orders to be executed without triggering major price movements. It is deep if those orders reach a volume which suffices to execute even large orders without exerting marked price effects. In a resilient market, price movements triggered by excess demand or excess supply attract new orders which soon offset such imbalances.

The liquidity of a securities market is often measured in terms of indicators of trading activity, such as the number of transactions or the turnover. Although such indicators are fairly readily available, they are not directly related to the above criteria of market liquidity. Market liquidity is only one – and not necessarily the principal – determinant of trading activity. For instance, a strong hedging need on the part of market participants may lead to heavy turnover, even though the market is relatively illiquid.

In a market with a central order book (for example, in electronic trading), the tightness may be gauged by the bid-ask spread and the depth by the total volume of buying or selling orders. This is not possible, however, in OTC trading, which accounted for the bulk of the transactions in the German bond market until 1999. In this case, information on the tightness and depth of the market can be obtained only from effective bid-ask spreads calculated from transaction prices. The figures given in the main text were derived, using Roll's method,¹ from the autocovariance of the transaction prices, which arises because transactions are executed alternately at the ask and bid prices.

¹ See Roll, R.: A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market, *Journal of Finance* Vol. 39, 1984, pp. 1127–40.

tracts (“open interests”) with a face value of roughly DM 225 billion – roughly three times the face value of the underlying Federal bonds – were in the books of Eurex (the Financial Futures Exchange). Although open futures positions are normally closed by means of counter-trades, rather than by the delivery of bonds, this led to fears that, on the next maturity of a futures contract in September, insufficient bonds would be available in the market to satisfy all delivery wishes. The consequent buying pressure in the spot market did not slacken until early in September, when it became apparent that many investors had already closed their positions by means of counter-trades.

Whereas the recapitalisation proper of the major hedge fund in September had had virtually no direct impact on the German bond market (except for an increase in price uncertainty), the liquidation of “carry trades” and the general reduction, at the beginning of October, in positions financed by borrowing triggered a steep rise in yields and caused the bid-ask spread to widen to a record extent of about five basis points. In contrast to the episode in late August, this increase did not reflect tensions due to heavy turnover, but rather a distinct reduction in market liquidity, attributable to profound uncertainty and corresponding restraint on the part of market players. However, that period lasted for only two days; thereafter, trading costs went back to about one basis point, and fluctuated around that level until the end of the year.⁴

... and a thinning-out of the market early in October

⁴ On trends in liquidity in the market for Federal bonds, see: Upper, C.: How safe was the “Safe Haven”? Financial Market Liquidity during the 1998 Turbulence, Discussion paper 1/00, Economic research group of the Deutsche Bundesbank, February 2000.

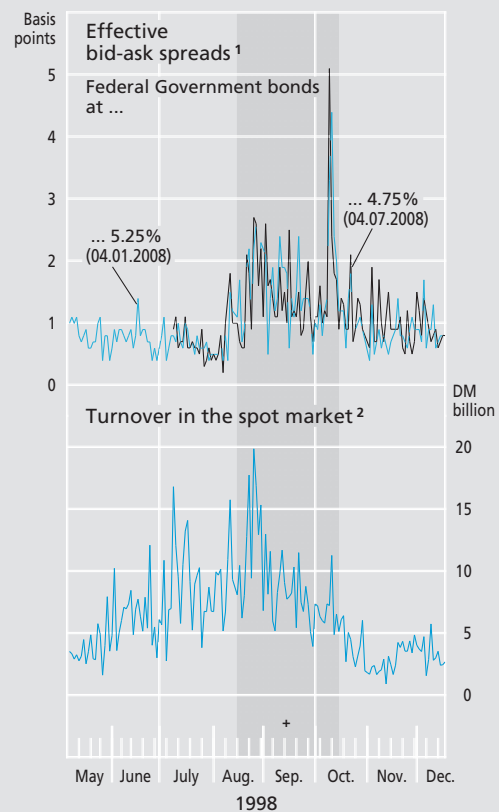
Issuing activity and funds raised

Decline in funds raised

Both the Asian crisis in summer and autumn 1997 and the turbulence in the following year were associated with a decline in the amount of funds raised in the German bond market. After the devaluation of the baht in July 1997, net issuance of domestic bonds fell from an average of almost DM 30 billion a month in the first half of the year to DM 1½ billion in October. A similar picture presented itself one year later after the devaluation of the rouble, when the volume of funds raised dropped from a peak of DM 56 billion in July to as little as DM 11 billion in September. In both cases, all three categories of securities (public sector bonds, bank debt securities and industrial bonds) were involved.

However, these figures are affected by strong monthly fluctuations in the net issuance and by seasonal factors. To be able to distinguish between “normal” fluctuations and “exceptional” movements, a statistical model is therefore required. The findings analysed in the annex indicate that the sums raised in the German bond market during the Asian crisis and during the upheavals in 1998 decreased by about DM 7½ billion a month and DM 10 billion a month, respectively. However, only bank debt securities were affected by the decline; the net issuance of public sector bonds during that period did not differ from the figures to be expected as a result of normal movements.⁵

Liquidity in the market for Federal Government bonds in 1998



¹ Calculated on the basis of the autocovariance of transaction prices. — ² Federal bonds deliverable for Bund futures contracts calculated on the basis of transaction data. The turnover in the Federal Government bonds issued on October 30 is not included in the figures. Source: Calculations by the Bundesbank based on data supplied by the Federal Supervisory Office for Securities Trading. — + Period of crisis.

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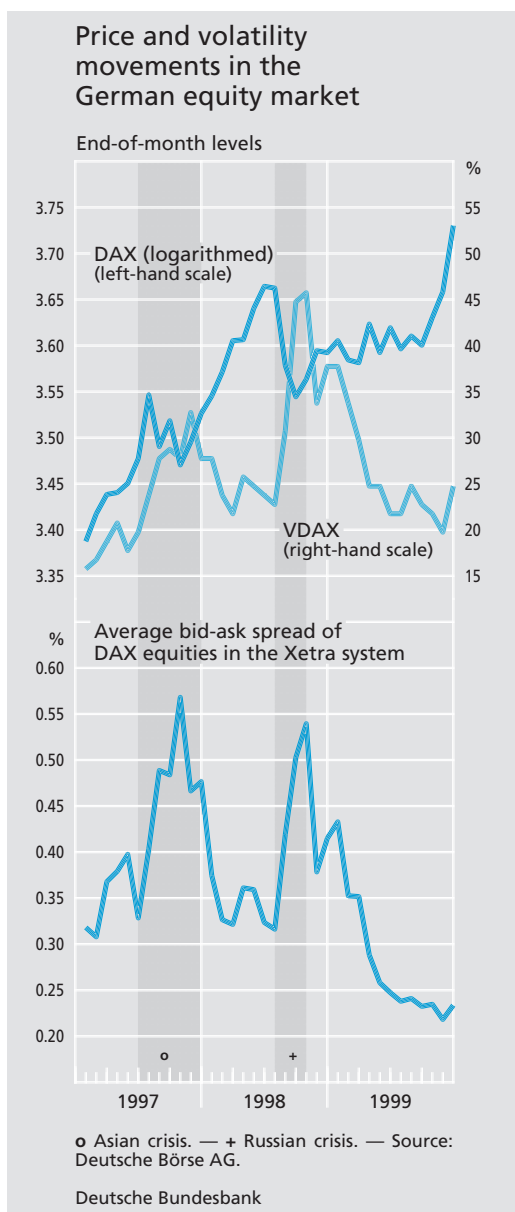
Impact of the crises on the equity market

Price movements and volatility

Taking a longer-term view, the financial market upheavals of 1997 and 1998 appear to have curbed the price rise in the German

Price rise curbed only briefly...

⁵ It was not possible to estimate a model for industrial bonds since the small number of such issues makes the time series for sales too erratic.



equity market only briefly; even during the crisis years, German equities on balance showed strong price gains. At 39% (measured in terms of the broad CDAX price index), the highest annual price gain since 1995 was recorded in 1997, and in 1998, too, the increase came to as much as 14%. However, price movements within those two years were determined by the upheavals, although the crises impinged on the equity market, re-

sulting in heavy price losses, only in the second half of each year (see the adjacent chart). In both cases, however, the bear markets only lasted a few months, and were succeeded by lengthy periods of rising prices.

The price rises in the equity market owed much, up to the beginning of 1999, to the continuous decline in long-term interest rates, which lowered the opportunity cost of equity investments and raised the cash value of future dividends. Given the prospects of an early economic recovery in Europe, enterprises' profit expectations likewise initially improved. That influence reversed, however, in the second half of 1998, when fears arose that the financial market crises might exert a dampening effect on global economic activity after all.

However, a review focusing on price movements alone obscures the fact that the situation in the German equity market during the crises was characterised by a high degree of market uncertainty, and was correspondingly tense. The DAX volatility index (VDAX), which measures the magnitude of the percentage price fluctuations expected by market players as an average of DAX equities, rose steeply, particularly in 1998. Measured in those terms, the anticipated price risk increased dramatically during the crises. Although implicit volatility fell again as the crises subsided, it remained relatively high even afterwards.

It comes as a surprise that the valuation level in the equity market continued to be high notwithstanding the pronounced price uncertainty. That is an indication that the risks asso-

... against the backdrop of extended periods of favourable macroeconomic conditions

Pronounced market uncertainty at times ...

... accompanied by fluctuations in the appraisal of equity risks

ciated with equity investments were generally perceived to be lower, as a result of which, in turn, the market price of the risk, and thus the general equity-risk premium, tended to fall. Yet the risk premium probably rose distinctly for a while during the two crises, and was thus mainly responsible for the heavy price losses observed. Such losses were particularly marked, at a maximum of almost 35%, in summer and autumn 1998, when market players showed a distinct aversion to price risks, as well as to risks of default and liquidity risks. The fact that liquidity risks also played a role can be inferred from the strong temporary increase in the bid-ask spreads for DAX instruments traded in the XETRA system (see the chart on the opposite page).

Correlation and market liquidity

To permit a more comprehensive assessment of the impact of the crises on the functionality of the equity market, the price and volatility movements due to the crises must be considered in a national and international portfolio context. Thus, the decision of a German investor on the size of his equity holding will depend not only on the expected level and volatility of the returns on domestic shares, but also on their relationship to the earnings/risk characteristics of alternative investments at home and abroad. In this connection, the correlations between the rates of return on different categories of securities are likewise of significance, because they determine the extent to which the risk posed by an investor's entire portfolio can be lowered by diversification.

International price and yield correlations can be described in the form of a number of stylised facts (see the table overleaf), which may apply not merely to the crises considered here. According to this approach, short-term price fluctuations were mostly synchronous, so that the correlations between short-term returns on shares were mostly positive in a national cross-section, even though the medium-term price trends differed considerably in specific regions and countries. The connection was particularly marked in the case of major price movements, so that a rise in volatility was normally accompanied by closer correlations. Finally, crises in global equity markets hit the less liquid markets of smaller countries, especially the emerging economies, particularly hard. For example, the daily volatility of returns on shares in the entire German equity market rose from 1¼% to over 3% during the Asian crisis, and thus more than doubled; in the Asian emerging economies it actually almost quadrupled. As a rule, during such periods of turbulence the observed international correlations likewise increase distinctly. This pattern of correlations implies that the diversification advantages of an internationally diversified equity portfolio may be severely curtailed at times of upheavals. That is relevant to the risk management of institutional investors, in particular, and involves the risk of snowballing effects if market players, in response to the outbreak of a crisis, simultaneously all try in a similar way to run down their share portfolios in accordance with the changed earnings/risk ratings.

Viewed from this point of view, it is likewise significant that the individual segments of the

*Equity-price
movements
in the global
context*

*Impact
of the crises
on portfolios*

Coefficients of equity-price movements between 1997 and 1998

International comparison	Asian crisis 1		Russian crisis 1	
	before	during	before	during
Price change (volatility) in % 2				
Germany (D)	28 (1.2)	0 (3.1)	33 (3.3)	-20 (3.8)
United States	19 (1.2)	5 (1.7)	13 (1.7)	-1 (1.9)
Japan	5 (1.7)	-17 (1.4)	-8 (4.3)	-17 (2.0)
Asien EM	7 (0.4)	-25 (1.6)	-39 (3.9)	2 (1.5)
Latin American EM	36 (0.8)	-9 (4.3)	-25 (4.7)	-12 (7.1)
Eastern European EM	38 (1.0)	11 (1.4)	-6 (6.9)	-33 (3.6)
Correlations				
D/United States 3	0.52	0.68	0.35	0.40
D/Japan	0.12	0.44	0.29	0.36
D/Asia	0.06	0.33	0.36	0.26
D/Latin America 3	0.36	0.44	0.33	0.29
D/Eastern Europe	0.16	0.62	0.55	0.68
Comparison between German market segments	Asian crisis 1		Russian crisis 1	
	before	during	before	during
Price change (volatility) in % 2				
DAX 4	26 (1.0)	-2 (3.5)	31 (3.4)	-19 (3.8)
MDAX 4	27 (0.3)	-5 (1.6)	15 (1.3)	-20 (1.5)
SMAX 4	25 (0.2)	-7 (0.6)	9 (0.8)	-23 (0.7)
NEMAX 4	46 (8.1)	17 (5.1)	97 (13.3)	-24 (6.5)
Correlations				
DAX/United States 3	0.57	0.68	0.34	0.39
MDAX/United States 3	0.42	0.70	0.41	0.49
SMAX/United States 3	0.46	0.69	0.43	0.72
NEMAX/United States 3	0.20	0.54	0.19	0.62
DAX/MDAX	0.78	0.91	0.79	0.84
DAX/SMAX	0.43	0.72	0.49	0.68
DAX/NEMAX	0.39	0.62	0.45	0.88

Source: Primark-Datastream; Bundesbank calculations. — 1 Before the Asian crisis: January 1 to July 1, 1997; Asian crisis: July 2 to November 5, 1997; before Russian crisis: November 6, 1997 to August 16, 1998; Russian crisis: August 17 to October 15, 1998. — 2 Sum and variance, respectively, of daily changes in logarithmed MSCI price indices; EM: emerging markets. — 3 Correlations with previous days' values for American countries. — 4 DAX, MDAX, SMAX and NEMAX are price indices for various equity-market segments of the Deutsche Börse AG.

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German equity market behaved quite differently during periods of calm and bouts of turbulence. It was presumably above all differences in market liquidity that were responsible for that. Before the outbreak of the crises, liquid DAX instruments showed higher (Russian crisis), or at least equally high (Asian crisis), price rises than less liquid MDAX and SMAX instruments; moreover, during the crises they suffered lower price losses (see the adjacent table). But that advantage had to be paid for with certain drawbacks. Firstly, DAX volatility is several times higher than that of the less-actively-traded MDAX and SMAX instruments, which meet with little interest abroad.⁶ Secondly, in the event of financial market crises, the correlation pattern between the individual market segments changes, with all the correlations rising – some of them steeply – during the periods of turbulence. These relationships, too, may have the effect that portfolio risks increase unexpectedly strongly during periods of crisis.

Conclusions

Viewed as a whole, the financial market crises of the recent past have affected the German securities markets to only a limited extent. There were, however, temporary disruptions of the price-formation process in the bond and equity markets, which were primarily attributable to very high volatility at times

⁶ The instruments of the New Market – which are combined in the NEMAX overall index – do not altogether fit into this pattern on account their specific character as high-tech or growth equities. After all, although their liquidity is distinctly higher than that of MDAX and SMAX shares, the equities of the New Market exhibit by far the highest volatility (and also the highest yields).

Crisis responses of different segments of the German equity market

Crisis have limited impact

and to short-lived liquidity bottlenecks – the latter even occurring in market segments which are usually highly liquid. Although the crises resulted in a short-lived decline in the volume of funds raised (at least in the case of bank debt securities), that had no discernible impact on the availability of loans. Overall business activity is most likely to have been affected by the sharp drop in capital-market rates. This crisis-induced “undershooting” of yields was, however, favourable, inasmuch as it formed something of a counter-weight to the dampening foreign trade effects of the crisis on business activity. Even so, the upheavals showed that even large and liquid markets are susceptible to disruption. Hence the question arises, from the German point of view as well as internationally, as to how the functionality of the securities markets, and of the financial sector as a whole, can be improved.

*Proper
appraisal
of risks ...*

In particular, the abrupt fundamental re-appraisal of the risks posed by financial assets after the Russian debt moratorium and the near-collapse of a major hedge fund turned out to be a problem for the functionality of the financial markets. Against this background, the general starting point for strengthening the stability of markets is market players’ awareness of financial risks. For one thing, suitable conditions must be created for assessing risks more realistically, and for taking them into account in prices. During the recent financial market crises, market players have often failed to gauge correctly the risks posed by financial assets, and especially the correlations between the different risk categories. In particular, the liquidity risks

that arose on a massive scale after the outbreak of the crises caused enormous disruption. Attempts to mitigate such risks by selling affected paper dramatically depressed the relative prices of such instruments, compared with the liquid “benchmarks”. The consequent misjudgements of market-price risk in turn lessened the effectiveness of those risk-management systems that are based on stable patterns of financial market prices and the correlations between them. In a number of cases, this actually led to an enhanced risk of default, especially if specific counterparties were holding sizeable credit-funded positions.

The prerequisites of circumspect behaviour on the part of financial market players include, on the one hand, the availability of adequate information on counterparties and market conditions and, on the other, a sophisticated internal risk-management system. It is against this backdrop, for instance, that the recommendations elaborated by the Financial Stability Forum on the improvement of credit-risk management in business with “highly leveraged institutions” must be seen.⁷ Moreover, it is essential to take the interdependencies between individual risks into account, because they do not arise in isolation from one another, especially at times of crisis. The consideration of such crisis scenarios is of particular importance when conducting stress tests to evaluate risk-management models.⁸

*... thanks to
improved risk
management ...*

⁷ See Financial Stability Forum, Report of the Working Group on Highly Leveraged Institutions, March 2000.

⁸ See “Banks’ internal risk-management models and their prudential recognition” Deutsche Bundesbank, Monthly Report, October 1998, p. 65 ff.

*... and clear
responsibilities*

In addition, financial market players must account for their mistakes themselves; it cannot be a function of public authorities, at the national or international level, to accept responsibility for ill-considered behaviour by investors. The fact that interest-rate differentials and implicit volatilities continue to be comparatively high, despite the subsiding of the crises, suggests that market players are now assessing risks more cautiously, and are on a learning curve. This no doubt also owes something to the fact that no bail-out occurred after the Russian debt moratorium.

*Stability
improved
by diversity
of opinions ...*

The individual incentive structures and methods of risk evaluation must be supplemented at the macroeconomic level by measures calculated to minimise risks of contagion in the event of a crisis. What makes this particularly important is that the more complex and more closely interlinked international financial markets are transferring turbulence faster and reinforcing it. The increasing professionalisation of the financial community is an additional factor. If institutional investors are inclined to pursue similar trading strategies, the diversity of opinions required for the smooth functioning of the markets is impaired, above all at times of crisis. In this context, steps to improve market transparency are essential – steps that permit a more realistic assessment of one's own actions in the market environment, and that foster the shaping of an opinion of one's own. In the broader sense, such steps also include measures to strengthen market infrastructure, such as harmonised – and therefore more

transparent – standards for the documentation or collateralisation of financial market transactions.

Finally, a certain institutional diversity in the financial system – especially the coexistence of sophisticated securities markets and a stable banking sector – may likewise exert a stabilising effect. For one thing, at times of crisis, stable banks are rather better able to cope with losses due to defaulting on loans, and thus to act as stabilising buffers. For another, enterprises which normally raise finance direct in the market can fall back on banks to meet their financial needs in the event of liquidity drying up in the primary market. For instance, the decline in demand for high-yield bonds in the US market in August and September 1998 was not accompanied by a slump in such enterprises' investments because the firms involved were able to raise funds by stepping up their bank loans. In a number of cases, such credit lines were set up even before the upheavals.

*... and
institutional
diversity*

Measures applied direct to financial market players and institutions are a necessary, but not a sufficient, condition for safeguarding financial market stability. The right appraisal of, and a responsible attitude to, financial risks on the part of private players are possible in the final analysis only if the systemic risks associated with financial market investment remain calculable, on account of stable macroeconomic conditions and a foreseeable economic policy geared to the long term.

*Macro-
economic
stability as a
prerequisite
of financial
market stability*

Annex

The estimation of a model for the issuance of bonds

Object This annex is concerned with the estimation of an econometric model for the issuance of securities in the German bond market. The aim is to test whether the decline in the amount of funds raised during the Asian crisis and after the currency devaluation in Russia actually exhibited exceptional proportions, or whether it was in line with "normal" fluctuations.

Approach For this purpose, an ARMA model for the net issuance of domestic bonds is estimated. This univariate approach, in which the variable to be explained is modelled entirely on the basis of its own history, was chosen because additional explanatory variables, reflecting, for instance, financing conditions or expectations regarding economic activity, may for their part be influenced by the crises, and therefore hamper the identification of their impact. The effects of the crises in Asia and Russia on the amount of funds raised in the bond market are captured by means of dummy variables, which assume the value one during the relevant episode and otherwise are equal to zero. A coefficient which – statistically speaking – is significantly negative means that there was an exceptionally sharp decline in the volume of funds raised during the relevant episode. In addition, a deterministic time trend is included in the estimation to offset long-term changes in saving and investment decisions, which are not the focus of interest here.⁹

Dating the crisis episodes ...

The approach chosen entails dating the crisis episodes in order to be able to define the dummy variables. While the start of the crises is related to specific events – such as the devaluations of the baht

or the rouble (which are generally regarded as the causes triggering the crises) – dating always involves a certain discretionary element, since the devaluations did not occur "out of the blue", but only after several months of speculative attacks. The ends of the episodes are much more difficult to determine; dating is therefore left to a large extent to the individual researcher's discretion.

Below, it is assumed that the Asian crisis lasted throughout the second half of 1997, i. e. from the devaluation of the Thai baht and the devaluations of the currencies of neighbouring countries to the floating of the Korean won. The dummy variable D_{Asia1} therefore assumes the value one between July and December 1997. As an alternative, a second dummy variable D_{Asia2} was defined, which equals one in October 1997 alone – the only month in which the Asian crisis led to major price movements in the financial markets of the industrialised countries. This specification essentially leads to the same results; however, the significance level of the Asian crisis is reduced. Hence only the results derived using the variable D_{Asia1} will be analysed below.

In contrast to the ending of the Asian crisis, the ending of the turbulence in the summer and autumn of the following year can be dated more easily, as most price indicators stabilised again in the second half of October. The corresponding dummy variable D_{RUSS} therefore assumes the value one between August and October.

... after the Thai devaluation ...

... and the Russian moratorium

⁹ For the long-term changes in the bond market, see: "The relationship between bank lending and the bond market in Germany", Deutsche Bundesbank, Monthly Report, January 2000, pp. 33–47.

Model for estimating the amount of funds raised in the bond markets

Estimation results of an ARMA model ¹

Endogenous variables	Net issuance of domestic bonds		
	Bonds, total	Public sector bonds	Bank debt securities
AR ²	1.2	1.2	1.3
MA ³	3,6,9,12	12	12
Dummy for Asian crisis			
Coefficient	-7.47	-2.84	-6.11
T-statistic ⁴	-2.23	-0.65	-1.94
Dummy for Russian crisis			
Coefficient	-9.90	1.17	-13.01
T-statistic ⁴	-2.86	0.22	-2.80
Corr. R ²	0.36	0.26	0.37

¹ Estimation period for monthly data: April 1991 to January 2000. — ² Significant autoregressive coefficients. — ³ Significant moving-average coefficients. — ⁴ Critical value for one-sided test: -2.36 (99% confidence interval).

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Estimation results

The dynamics of securities issuance, which are sometimes rather complicated, were generally reflected satisfactorily by the ARMA models. The optimum numbers of time-lags and of moving aver-

ages were ascertained on the basis of the information criteria defined by Akaike and Schwarz. In order to minimise the number of parameters to be estimated and to avoid an overfitting of the data, insignificant terms were deleted as far as possible. The presence of MA(12) terms in the final specification reflects the significant seasonal fluctuations, while the autoregressive terms suggest the persistence of the series. Only for industrial bonds could no adequate specification be found, since the net issuance of such paper is subject to very large swings because of the small number of such issues. The results for this category of securities are therefore not presented here.

It is evident from the estimation results shown in column a) of the adjacent table that the amount of funds raised in the bond market declined exceptionally sharply both after the devaluation of the baht and after the Russian moratorium. The coefficients of both dummy variables are significantly negative. Columns b) and c) show that this was due to a decline in bank debt securities, whereas the net issuance of public sector bonds did not change significantly.

Significant decline in the amount of funds raised