Financial market volatility - the Austrian case

Richard Mader

Introduction

The origins of price movements in speculative markets have been at the centre of academic and market research for a long time. Excessive swings in financial asset prices - like the fall in stock prices in October 1987 and 1989 or the recent pronounced changes in bond prices - have caused market participants and regulators both to become concerned. Moreover, the dramatic growth of derivatives activity has set off a debate about the effects of derivatives on financial market volatility.

In recent years the Austrian financial markets have undergone profound changes in line with international trends. The international liberalisation and deregulation of the 1980s resulted in a number of important reforms also in Austria. The last remaining capital controls were lifted step by step between 1989 and 1991, accompanied by a fundamental revision of the system of foreign exchange regulations. Considering that in an environment of liberalised capital movements, a high quality standard of the financial market is the prerequisite for its development potential, the financial framework was adjusted accordingly. Moreover, a consistent policy of exchange rate stabilisation such as the one pursued for years by the Oesterreichische Nationalbank requires efficient financial markets. The legal framework has largely been harmonised to international standards and investor protection was reinforced by introducing comprehensive disclosure requirements. Issuing and trading techniques were improved on the bond as well as on the equity market. To cite an example, the sale-by-auction method, which is in line with international practice, was adopted for federal government bond issues.[1] The foundation of the Austrian Futures and Options Exchange (Österreichische Terminbörse (ÖTOB)) provided investors with new investment products and improved risk management options. Financial reform measures also had an impact on the volatility of asset markets, as will be discussed later in more detail.

Section 1 of the paper gives an overview of volatility movements on Austrian financial markets. In Section 2 the sources of volatility changes are discussed. The paper's main focus is on the stock and bond markets where the most important changes have taken place.[2] Section 3 of the paper analyses the impact of derivatives on financial market volatility since the establishment of the Options and Futures Exchange in 1991. In the final section the paper deals with the policy issues related to volatility movements on financial markets from an Austrian perspective.

1. Measuring Austrian financial market volatility

The volatility of financial market prices of stocks, bonds, foreign exchange and other securities is claimed to have increased since the 1980s. For the Austrian market the findings differ depending on the market segment.

The literature on econometric modelling of financial time series does not contain a standard and well-accepted definition of volatility measurement. Differences in approaches are based on the choice of frequency, the technical treatment of the mean and the use of overlapping or non-

1 The auction method has also been used for issues of Verbundgesellschaft, the state owned electricity company.

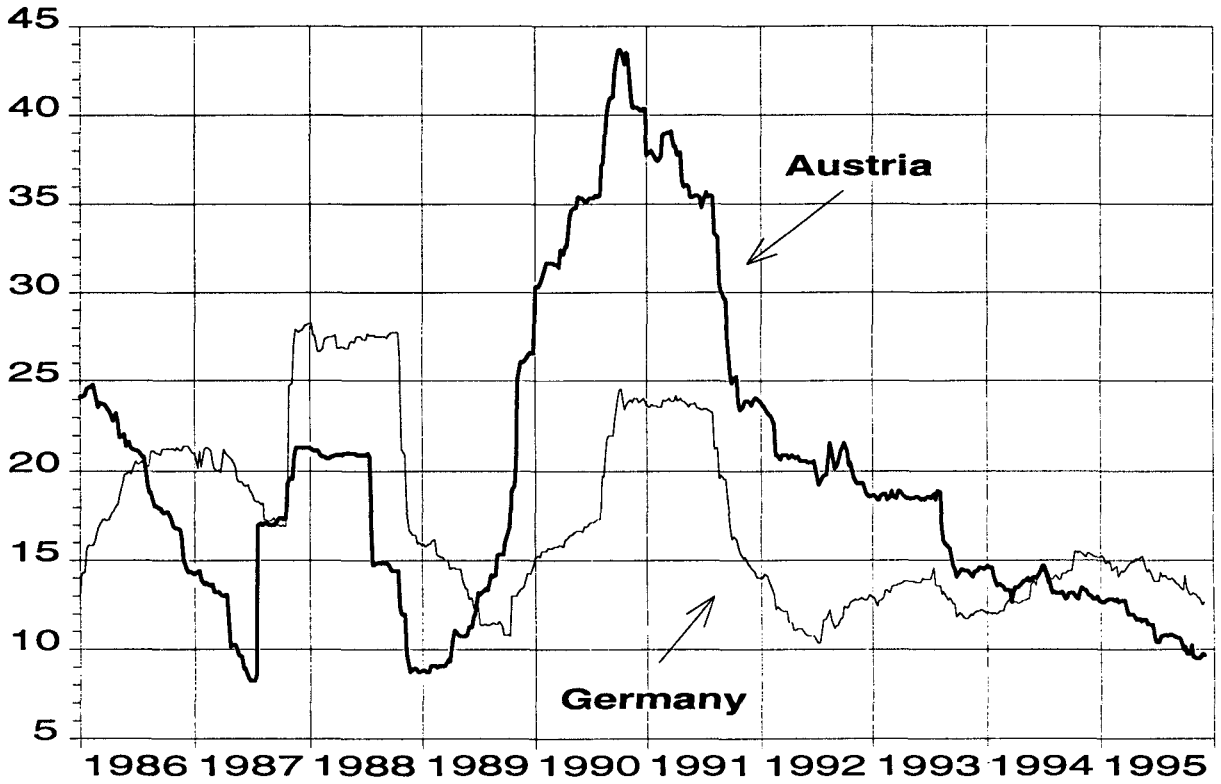
2 Although most of the analysis is based on descriptive statistical measures, the main conclusions should also hold true in an in-depth econometric analysis.

overlapping observations. For most of the analysis in this paper the traditional measure of the standard deviation was chosen to describe volatility. The main disadvantage of that simple approach is that it gives equal weight to all observations in the sample, thus neglecting the stronger impact of recent innovations. Hence, volatility clustering and "fat tails", for example, are not taken into account as is done with a more flexible approach like a GARCH (Generalised Autoregressive Conditional Heteroskedastic) model.[3]

The graphs exhibit the annualised standard deviation of week-to-week percentage changes. The estimated standard deviation is based on 52 weekly observations for each year. As quality data for longer periods are not available, the analysis is confined to the ten-year period starting in the mid-1980s. According to the simple weighting structure, the volatility level spikes up when a shock occurs, but does not decay slowly. Instead the volatility level falls abruptly after the observation of a large price or yield change leaves the 52 week sample. Since the mid-1980s **stock market volatility** (Chart 1) has been characterised by two big movements. The volatility of stock returns[4]

Chart 1

Volatility of stock market returns
(standard deviation, in percentages)



3 In the annex, stock and bond return volatility is calculated using a GARCH model (Charts 13 and 14).

4 Stock return volatility is measured as the annualised standard deviation of the returns on the Datastream total market index.

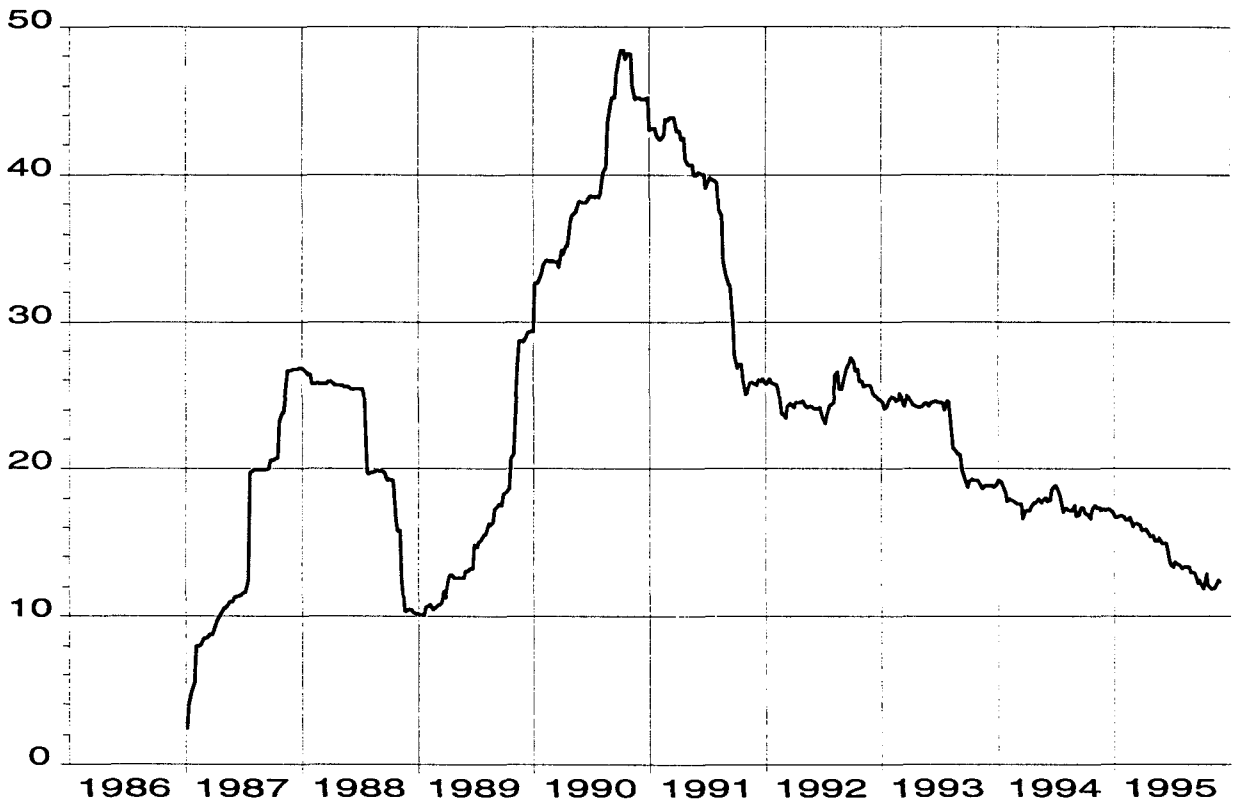
jumped in autumn 1987 in line with similar moves in international stock markets. In autumn 1989 stock return volatility rose and peaked in 1990 at a record level also compared to foreign stock markets. In the course of the 1990s return volatility came down continuously and has moved in a narrow band since 1994. The volatility of stock prices (Chart 2) - as measured by the Austrian Traded Index (ATX), which comprises the most liquid stocks, and the broader WBK (Wiener Börse Index) - showed similar volatility patterns.[5]

The **volatility of bond yields** (Chart 3) - as measured by the yield on ten-year benchmark government bonds - has remained remarkably stable over most of the period. This contrasts sharply with the experience of most important bond markets, inter alia that of Germany, which had to accept a higher level of bond yield volatility accompanied by pronounced swings. In 1994 bond yield volatility jumped to record levels. Unlike during most of the period under review, Austrian and German bond yield volatility has followed a similar pattern since 1992, in fact moving in tandem as of the beginning of 1994.[6] An observation to be pointed out is that the lower-yielding bond markets, such as the Austrian market, experienced much lower volatility. Moreover, it seems remarkable that yield volatility remained subdued during most of the period to 1993.

Chart 2

Austria: Volatility of stock market prices

(standard deviation, in percentages)

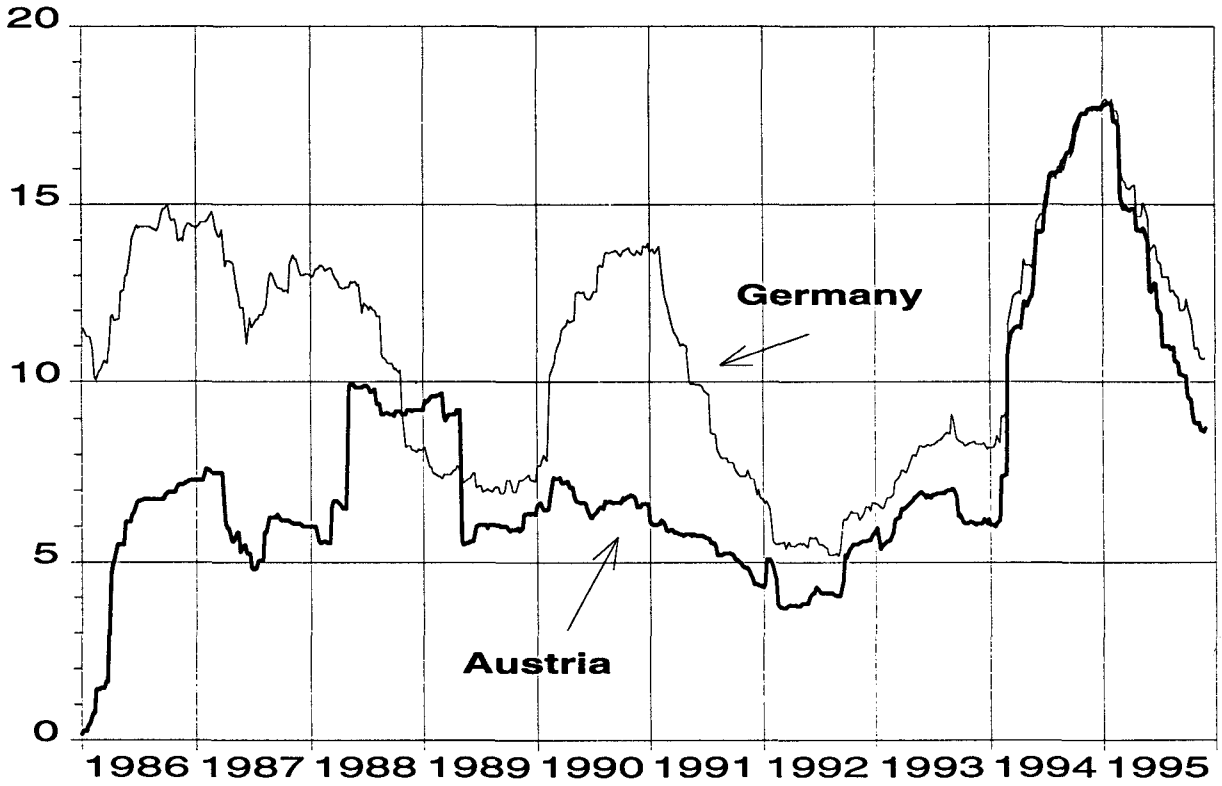


5 As of November 1995 a new performance index, the Wiener Börse Index (WBI), which covers the 30 most liquid shares will be published. In addition to the ATX, an ATX 50 and an ATX-MIDCAP will be available. The ATX 50 adds other liquid and attractive shares to the continuously traded shares contained in the ATX. The index represents about 85% of total market capitalisation and more than 95% of total stock exchange turnover. The ATX-MIDCAP currently comprises 30 attractive shares with lower market capitalisation. The volatility of the ATX 50 and the ATX-MIDCAP has generally been lower than that of the ATX over the 1992-95 period.

6 Bond price volatility showed a similar pattern, staying at a substantially lower level during most of the time.

Chart 3

Volatility of bond yields*
(standard deviation, in percentages)



* Ten-year benchmark government (Bund) bonds.

Since the 1970s Austrian monetary policy has focused on holding the exchange rate of the Austrian schilling stable against the Deutsche Mark. Overall, this reflects the substantial orientation of Austrian trade towards the EC. As a consequence, the **exchange rate volatility** (Charts 4 and 5) of the Austrian schilling vis-à-vis the Deutsche Mark has been extremely limited. The movement of the trade-weighted index fluctuated a bit more - albeit within a small range - and seems to be trending higher in the 1990s. This reflects the development of the US dollar's exchange rate and the adjustments within the European Exchange Rate Mechanism.The following remarks will concentrate on the stock and bond markets, as these two market segments seem to be the most interesting for the topic to be discussed from an Austrian point of view.

According to this analysis, shocks to stock or bond market volatility do not persist for long. The shocks to volatility decay rapidly and do not exercise a substantial influence on the level of prices. There is some evidence of mean reversion on the stock and bond markets tested within the framework of Fama's and French' s analysis. Stock returns deviate from the predictions of the model in the short run, but tend to move back towards the model prediction in the long run. The same is true for the foreign exchange market.

Chart 4

Austria: Exchange rate volatility - Austrian schilling/DM

(standard deviation, in percentages)

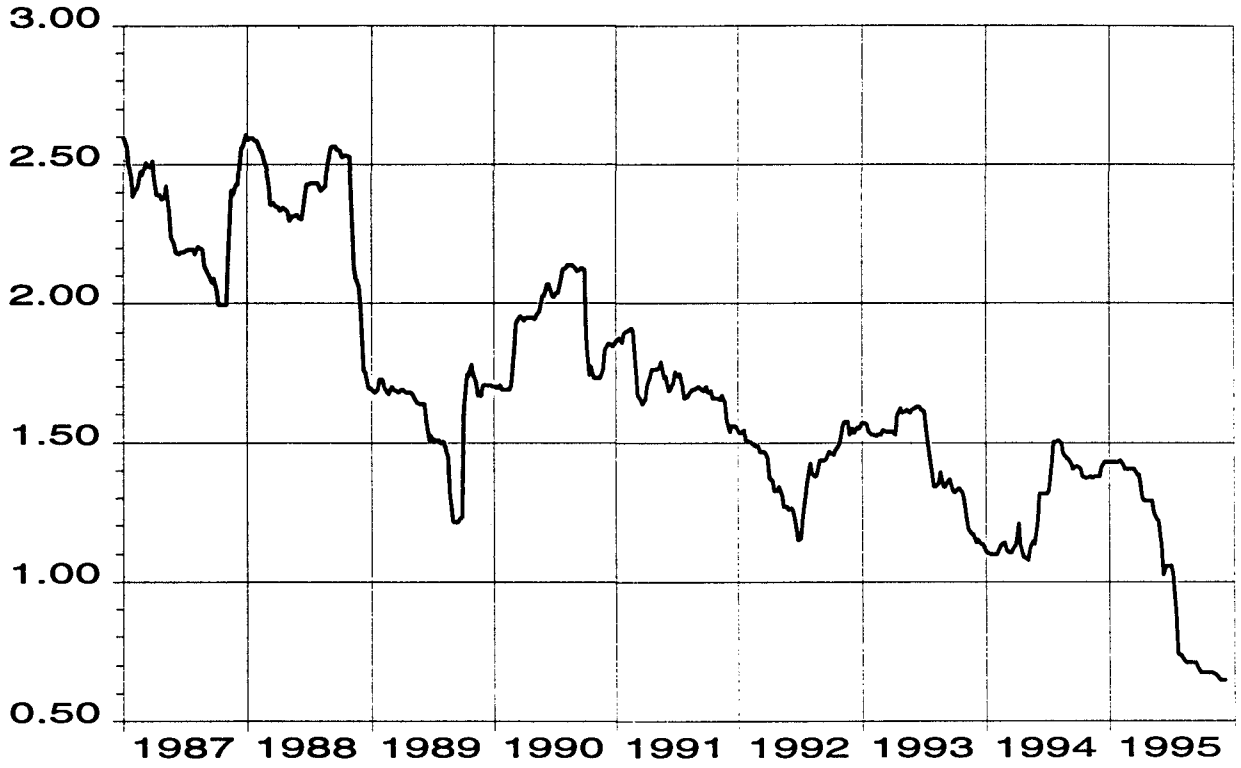
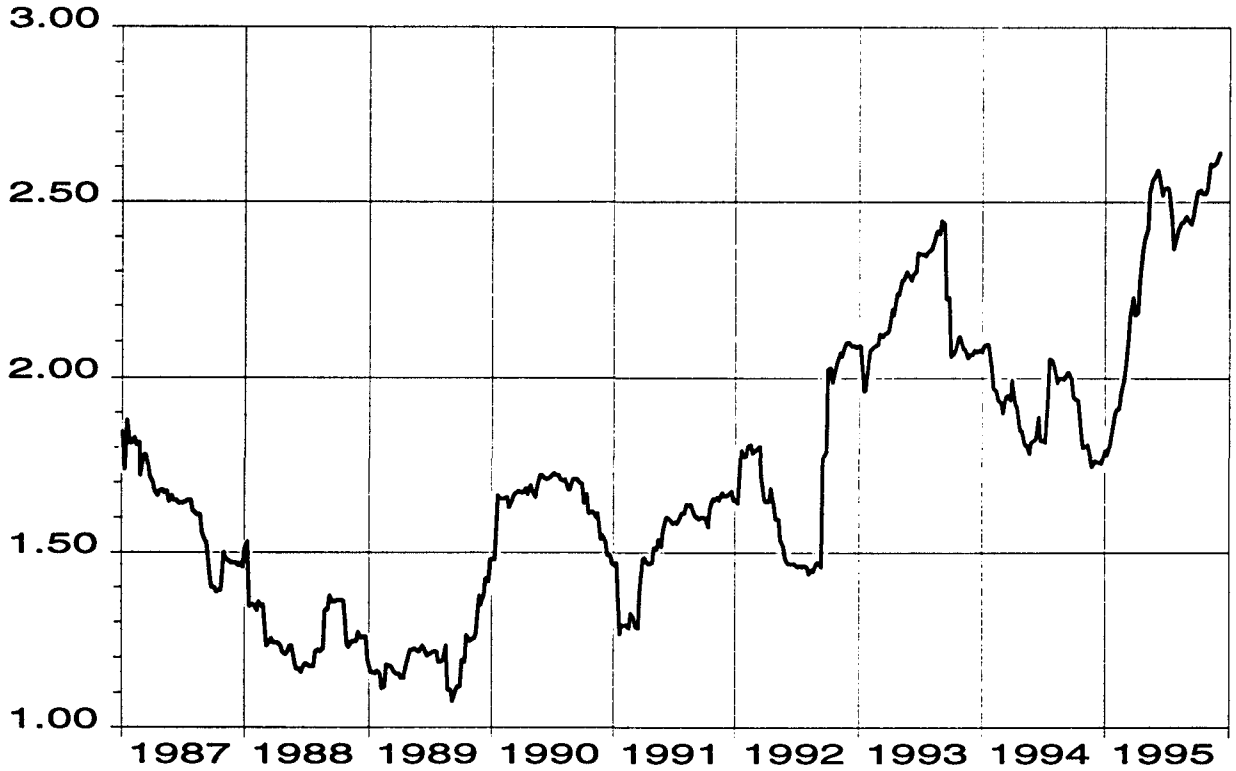


Chart 5

Austria: Exchange rate volatility - trade-weighted index

(standard deviation, in percentages)



2. Sources of financial market volatility

2.1 Stock market

Causes of volatility changes have been a hotly debated issue in the financial literature for years. The attention of academic circles and the general public both has been repeatedly directed to this topic in the wake of pronounced movements in asset price volatility, such as the episodes of high stock market volatility in October 1987 and 1989. Financial research - such as the major contributions of Shiller (1988, 1991) and Schwert (1989, 1990) - has not been able to explain the causes of volatility changes of financial prices very well. In fact the understanding of the factors that drive financial market volatility seems limited. Efficient market theory maintains that prices in speculative markets are driven by fundamentals - i.e. there exists a relation between volatility in speculative markets and volatility of macroeconomic variables. However, empirical evidence shows that financial market prices can deviate widely and frequently from fundamental valuations. To explain stock price variations Schwert compared, inter alia, stock price volatility with other macro and microeconomic variables. He found that stock market volatility is not closely related to the volatility of other economic variables, such as inflation, money growth or industrial production. Moreover, while financial leverage and trading activity seem to be related to stock price volatility, they can only explain a small proportion of the change in stock volatility over time. Similarly, Shiller (1988) - who examined the volatility patterns of dividend payments, industrial production, short-term interest rates and the producer price level for the United States - found little relation to the volatility in stock and bond markets.

Within the last ten years on Austrian financial markets, the volatility of financial and macroeconomic variables has changed substantially, but has not followed a clear trend. In the period reviewed stock market volatility showed the largest jumps in 1989 and 1990. In general, evidence of a relation to volatility changes of economic variables is weak. Whereas industrial production volatility (Chart 6) follows a similar path, the pattern of wholesale prices - as a proxy for producer prices - and short-term interest rate volatility is somewhat different.[7] Wholesale price volatility (Chart 7) started to increase with a time lag, while the rise in short-term interest rate volatility (Charts 8 and 9) preceded the upward movement in stock return volatility. The rise in stock return volatility in 1987 and in 1989/90 respectively did not correspond with periods of weak economic activity (and rising corporate leverage).[8]

Overall, evidence does not seem to confirm a reliable relation of stock return volatility with the volatility of macroeconomic variables. It has to be kept in mind that the Austrian market was a rather illiquid and dormant market until the end of the 1980s.[9] Interest in Austrian shares grew rapidly at the end of the 1980s, in particular with foreign investors investing heavily in the Austrian market. The number of initial public offerings and capital increases among companies that were already listed on the Vienna Stock Exchange rose substantially.[10] Share turnover increased almost fivefold in 1989 and nearly tripled again in 1990, thus contributing to the rise in stock return volatility. The big jumps in volatility in 1989/90 reflect a special period in market development, with investors "discovering" the market. After this initial phase, which showed strong characteristics of an emerging market, the Austrian stock market entered a more normal period of market development in

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7 The analysis is based on the overnight rate.

8 These empirical findings are supported by an in-depth econometric analysis.

9 In 1988 the total market capitalisation was Sch. 110 billion with a total yearly turnover of Sch. 22 billion.

10 Many of the initial public offerings resulted from privatisation and public share issues by young innovative companies.

Chart 6

Austria: Volatility of industrial production (manufacturing)
(standard deviation, in percentages)

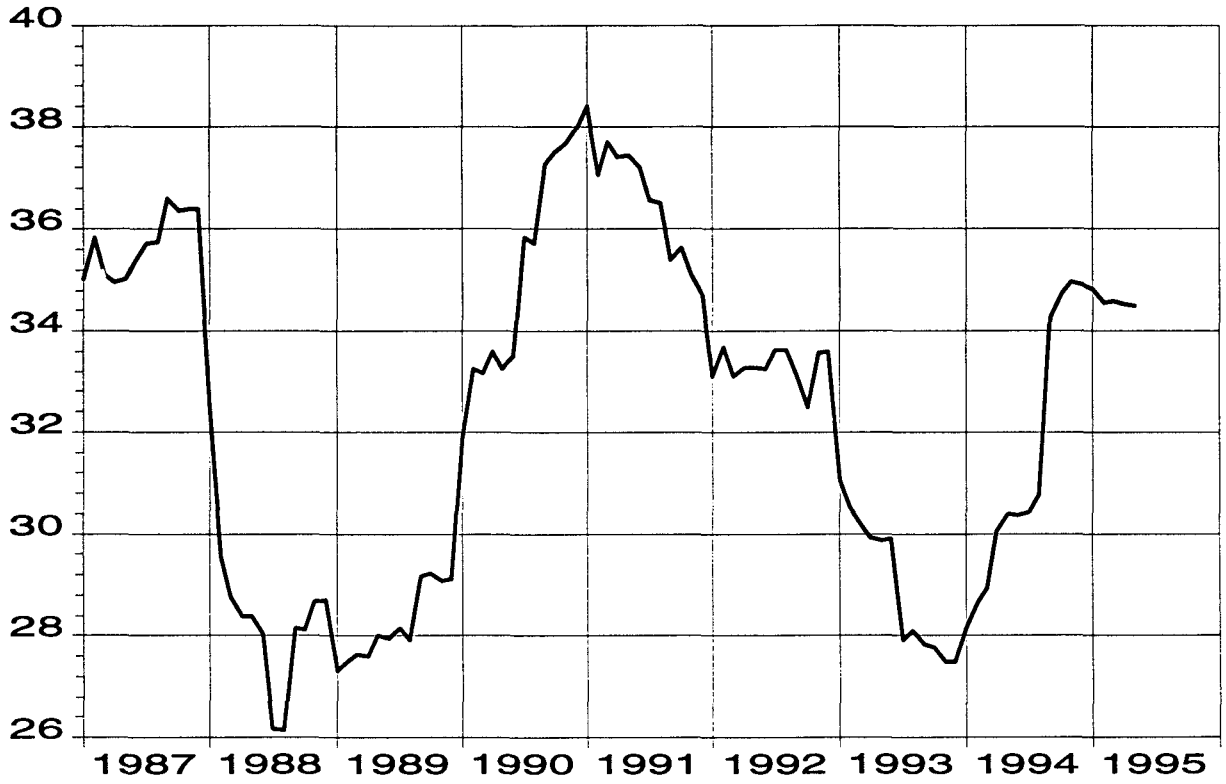


Chart 7

Austria: Volatility of wholesale prices
(standard deviation, in percentages)

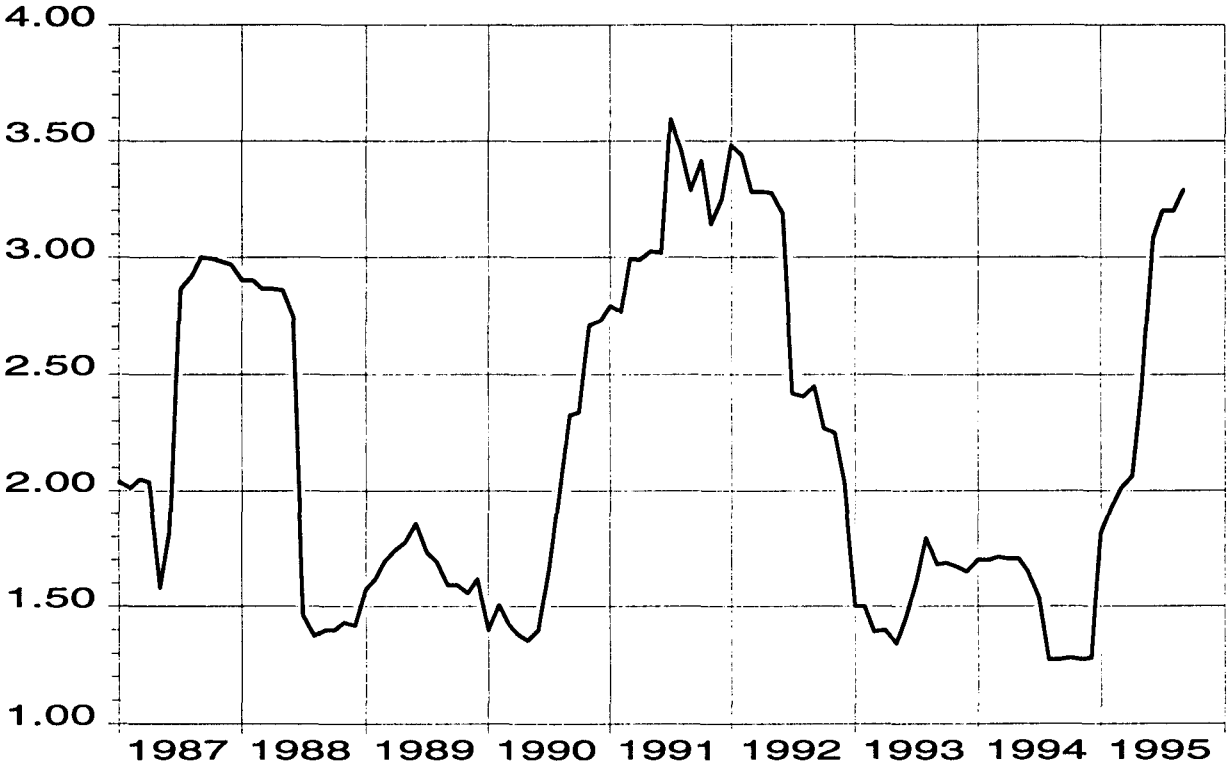


Chart 8

Austria: Volatility of short-term interest rate - overnight money

(standard deviation, in percentages)

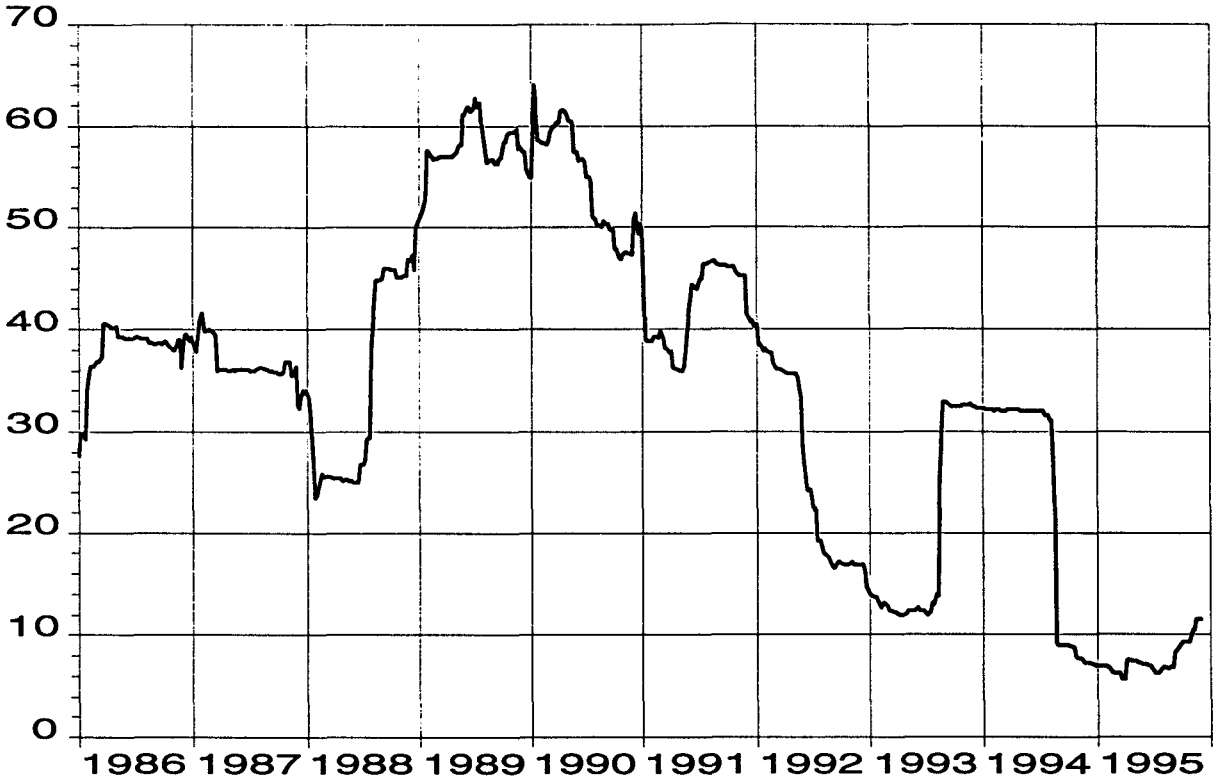
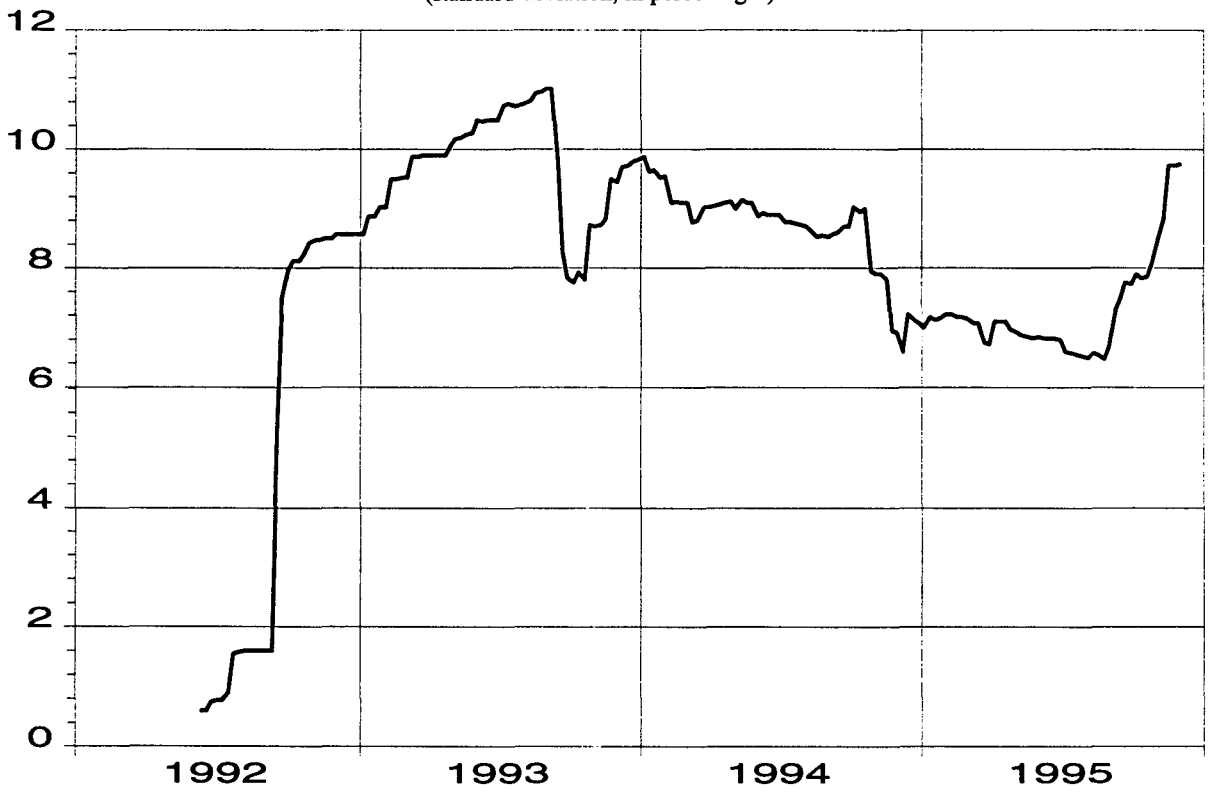


Chart 9

Austria: Volatility of short-term interest rate - three-month VIBOR

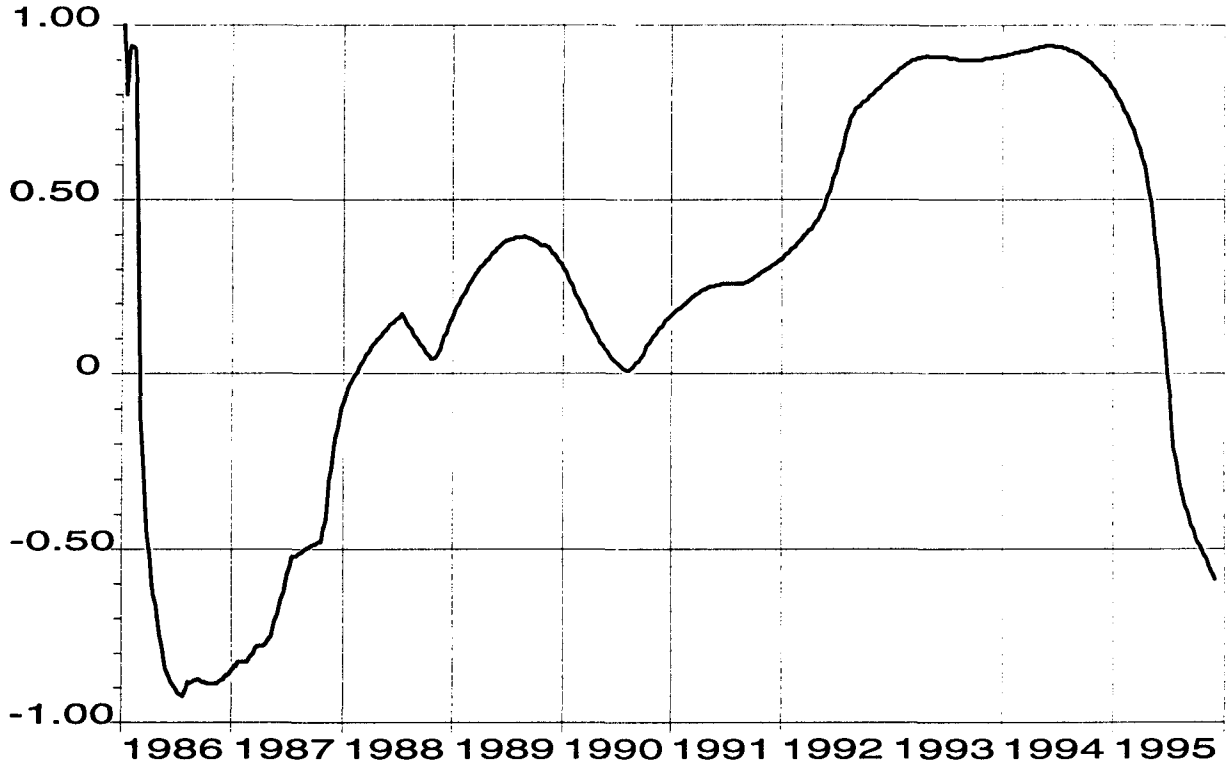
(standard deviation, in percentages)



1992/93. Since then a continuously strong issuing activity, inter alia of companies in the public utilities, steel as well as pulp and paper sectors, resulted in rising market liquidity. The going public of Vienna Airport (1992), VA Technologie (1994) and VA Stahl (1995)[11] as well as new listings of large private firms such as Mayr-Melnhof (1994) and Wolford (1995) represent good examples. Considering this market development, the data available do not seem to be comprehensive enough to form the basis for a reliable analysis of the relation between stock return volatility and volatility of macroeconomic variables. Finally, it should be kept in mind that, in spite of its revival, the Austrian market remains a small market, the six shares with the largest market capitalisation representing more than 60% of the weighting of the Austrian Traded Index (ATX). Thus, increased investor interest in a few liquid shares can be reflected in big moves of the market index indicating a substantial rise in volatility. There is some evidence for a cross-country relationship between Austrian and German equity market volatility (Chart 10) during most of the first half of the 1990s. In particular, in 1993 and 1994 the correlation between the two markets was high and positive, as it has been during most of the period. However, the link between the two markets is unstable and varies over time. In 1995 the correlation weakened considerably, which might, inter alia, reflect a different judgement of underlying market fundamentals by investors. In principle, the link between the volatility of the Austrian and German equity markets seems to be far weaker compared to the link between bond markets. Moreover, there is some evidence of a relationship between the volatility of Austrian bond and equity returns, though the correlation is weaker.

Chart 10

Austria: Stock market return volatility - correlation with German stock market return volatility



11 VA Technology raised Sch. 6.9 billion and VA Stahl Sch. 9.8 billion, thus representing the largest privatisations of state-owned industries to date.

The modification of stock exchange regulations also affected stock price volatility. In 1988 daily fluctuation limits were widened, as the 5% limit appeared to be too tight. Subsequently limits were raised to +/- 10%. Over time a number of Austrian blue chips, which form part of the Austrian Traded Index, exhibited higher volatility, but few came close to the new limit. As of February 1996 fluctuation limits were further increased to +/- 15%, when the Vienna Stock Exchange's new fully-automated screen-based stock exchange trading system, called EQOS (Electronic Quote and Order Driven System), went into operation. The new system is based on the market-making principle. The first securities traded on EQOS are the most liquid stocks which underlie the options trading at ÖTOB.

At present, mark-to-market accounting is not a widely practised accounting principle in the Austrian market, so that its influence on volatility seems to be very limited. However, with the pressing need of reliable risk management systems, important market players are likely to adhere successively to mark-to-market accounting. Implementation of the capital adequacy guideline will accelerate this process.

2.2 Bond market

In the late 1980s and at the beginning of the 1990s bond price and bond yield volatility respectively were fairly stable over time - with the exception of a jump in 1990 - and generally lower than that of German bonds reflecting, inter alia, low inflation and stable inflation expectations. This corresponds to the high credibility of the Austrian monetary policy of holding the Austrian schilling stable vis-à-vis the Deutsche Mark, earned over the years by a firm commitment to its strategy.

However, Austrian bond yields are influenced by German yields more than by other factors. In 1994 Austrian bond market volatility jumped substantially. This cannot be attributed to a change in inflation expectations, as Austria along with Germany and the Netherlands belonged to those ERM countries with the lowest interest rates and the best inflation performance and outlook. Moreover, Austria's EU membership is likely to have positively influenced inflation expectations. In addition, there was no evidence that foreign investors, who have invested continuously in Austrian bonds in recent years, have rapidly withdrawn from the market. The fall in bond prices may by itself have contributed to the rise in volatility. In Austria - like in several other markets - volatility has been higher in bear markets. There is no evidence that uncertainty about monetary policy has affected bond yield volatility through its influence on short-term rates. In fact money market volatility, which shows no strong positive correlation with bond yield volatility over time, fell in 1994. In the Austrian case strong transmission effects seemed to have played a dominant role. In general, Austrian bond yield volatility has exposed a strong positive correlation with German bond yields over time. Since 1994 the correlation has risen to reach a correlation coefficient of about 0.95.[12] In recent years the international integration of the Austrian bond market has increased, in particular since Austria's membership of the EU. In 1993 the Austrian government bond market was included in international bond indices, such as the Salomon Brothers' World Government Bond Index, which made the market even more attractive for foreign institutional investors. Foreign investment in the Austrian bond market has risen substantially in recent years, in particular since 1993.[13] In view of the close link between the Austrian schilling and the Deutsche Mark and the positive spread over the German Bunds, the Austrian market has been very attractive. Foreign investors have started to consider Austrian schilling investments in their asset allocation decisions and to include Austrian schilling bonds in their portfolios. Market liquidity has increased, with daily turnover in the secondary market growing from Sch. 1.8 billion in 1990 to more than Sch. 14 billion in the first half of 1995, and spreads have narrowed substantially. Since the late 1980s the Ministry of Finance has deregulated the

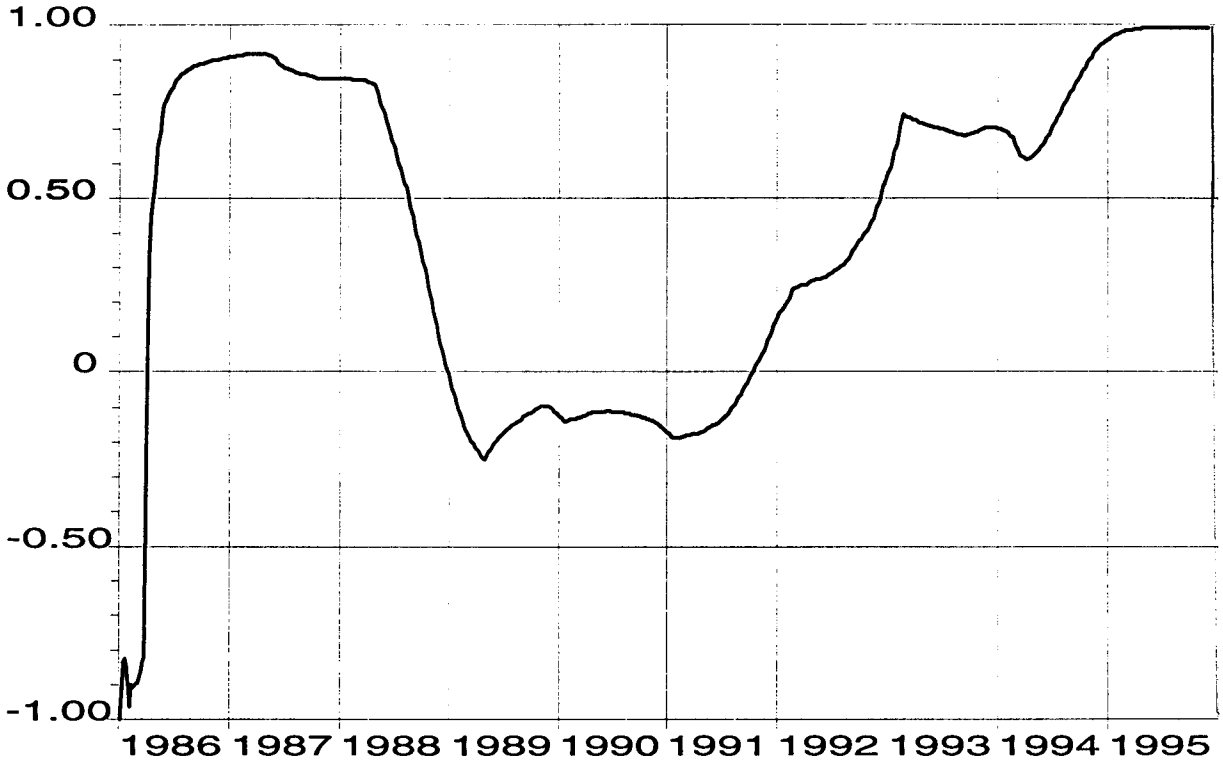
12 The correlation coefficient is calculated over a 100-week sliding window.

13 The stock of Austrian schilling bonds held by foreign investors grew from Sch. 74 billion in 1992 to Sch. 119 billion in 1993.

market progressively to bring it in line with international standards. Among the numerous reform measures taken only a few important steps will be described in more detail below. On the primary market federal government bonds were issued by a banking syndicate until 1987 (with fixed underwriting shares and uniform conditions). Later the issuing procedure was changed step by step to correspond more closely to actual market conditions. Since 1991 all federal government bonds have been offered for sale using a US type auction. The Österreichische Bundesfinanzierungsagentur (Austrian Federal Financing Agency), as the issuer's representative, announces target size and maturity five working days prior to the date of issue. The auction members make competitive offers, i.e. they name the yield at which they are willing to buy a specific volume. Each of the 14 primary dealers must make an offer for at least 1/14th of the total issuing volume and may buy a maximum of 30% of the issue size. This is to ensure enough liquidity for the bonds while at the same time preventing a new issue from being cornered. The amounts allotted to the auction members correspond to the actual bids. Regular intervals between auctions (10 auctions per year on a monthly basis) are geared to increasing the market's liquidity. Presently 14 banks act as primary dealers. In the last two years three foreign banks were allowed to participate in the auction, Caisse des Depots Paris, CSFB London and most recently JP Morgan Frankfurt. Standardising issues by focusing on 5 and 10-year bonds has also helped to stimulate interest among foreign investors, inter alia by providing for two common benchmark maturities for international government bonds. Thus the investor has the choice between two highly liquid benchmarks that are both directly comparable with foreign benchmarks. Moreover, the repeated flotation of government bonds in the form of new tranches of outstanding issues has also contributed to secondary market liquidity. The banks participating in the auction must act as market-makers on the secondary market. They are obliged to quote a maximum of a 15 basis point spread on Sch. 50 million for all government bonds for two years from issuance. This procedure increased liquidity and made these bonds qualify as benchmarks by making them comparable to other financial markets. Moreover, the introduction of an Austrian Government Bond Future on the Austrian Futures and Options Exchange (ÖTOB) in 1993 enhanced market efficiency and liquidity.

Chart 11

Austria: Bond yield volatility - correlation with German bond yield volatility



In general, the structural measures which were implemented to develop the bond market in line with international standards fostered international integration and the liquidity of the Austrian bond market. Total turnover in bond trading has grown sharply since 1993. Overall, this might have contributed to the rise in volatility. In particular, the correlation between the Austrian and German bond market volatility (Chart 11) has increased in recent years. Thus the markedly lower volatility in 1990/91 in comparison with the German market may, inter alia, also reflect the lower degree of integration and development of the Austrian market displaying, at that time, strong characteristics of a local market.

2.3 Foreign exchange market

In the period reviewed the volatility of the Austrian Trade Weighted Index and, even more pronouncedly, the Austrian schilling/Deutsche Mark rate, has moved in a remarkably tight range. Subdued volatility changes result from the Austrian policy of holding the Austrian schilling stable against the Deutsche Mark. The volatility of the Austrian schilling/Deutsche Mark rate, which over most of the period has moved within a very narrow range and has trended downwards, has declined even more since 1994 to become practically negligible. This is likely to reflect the Austrian membership in the EU and the participation in the EMS respectively. However, the Austrian schilling has shown - in line with the Deutsche Mark - marked volatility movements vis-à-vis currencies outside the EMS, such as the US dollar or the yen. Volatility vis-à-vis these currencies shows signs of mean reversion tested within the framework of Fama's and French's analysis.

3. Effects of derivatives on financial market volatility

Concern has been expressed that derivatives activity may increase financial market volatility. However, the vast majority of studies support the view that options trading - on stock market indices or single shares - has not changed or even reduced stock market volatility. In particular, dynamic hedging of option positions by market-makers is said to have reduced volatility. By the same token most research concludes that the introduction of futures trading on stock indices did not result in an increase in the volatility of the underlying stocks, apart from short-term volatility. The same finding holds true, for example, for the introduction of futures on Treasury bonds, which have generally led to a decrease in volatility.

In Austria the Austrian Futures and Options Exchange (ÖTOB)) started operation in 1991. The options offered comprise options on the Austrian Traded Index (ATX)[14] and on seven underlying stocks.[15] Besides the ATX Future, the Austrian Government Bond Future[16] was introduced in 1993 to complement the product range. Trading on the ÖTOB is based on the market-maker system with at least three market-makers quoting buying and selling rates for each security.

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14 The Austrian Traded Index (ATX), a real-time index that reflects the movements of the primary share league (Fließhandel stocks), was developed and introduced in 1991 as part of the process of establishing the market for derivatives (ÖTOB). ATX is a blue-chip index weighted according to market capitalisation.

15 The seven stocks account for more than 50% of the total capitalisation of continuously traded stocks at the Vienna Stock Exchange and for approximately 60% of turnover in this market segment.

16 The underlying is a synthetic bond with 10 years to maturity, a coupon of 7% and a volume of Sch. 1 million. Deliverable bonds are Austrian government bonds with a remaining life of 8 to 10 years on the delivery day and a minimum outstanding principal amount of Sch. 5 billion per issue.

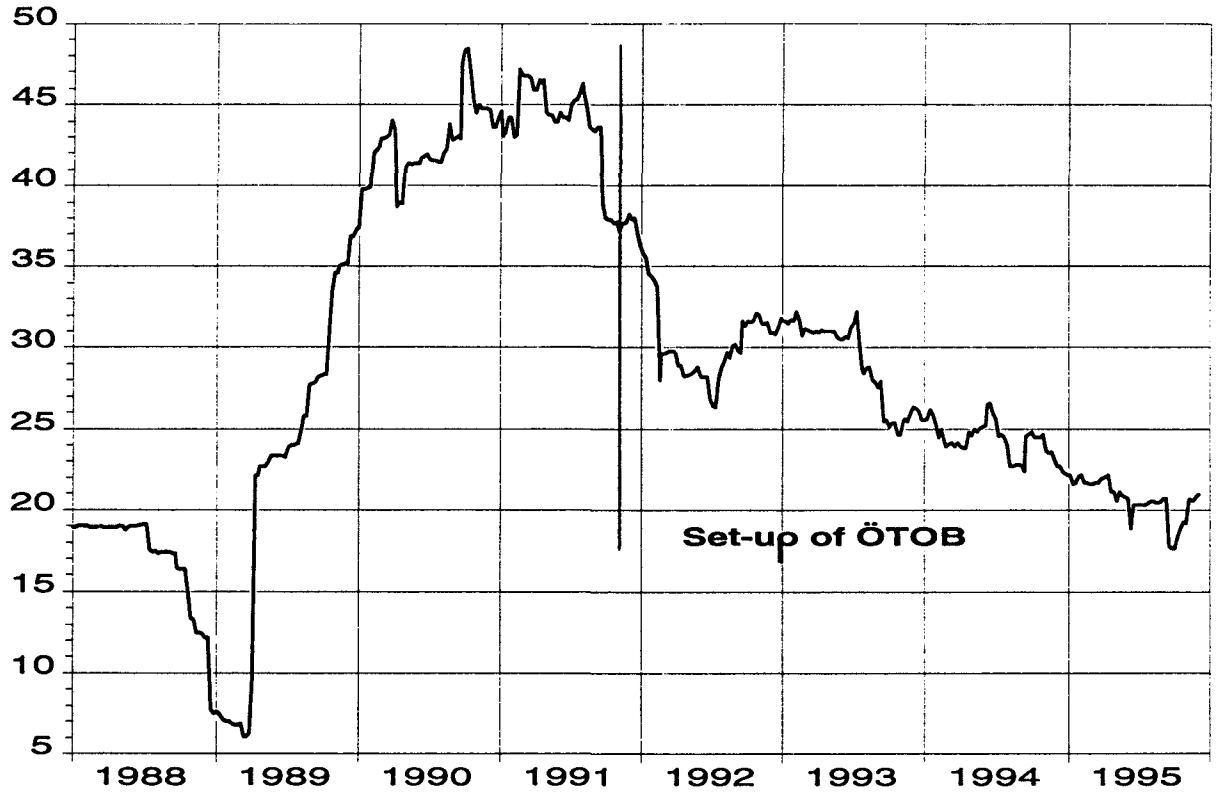
In the first three years (from 1992 until 1994) the derivatives market developed rapidly, with the volume of traded contracts increasing by 16% per year. With a daily volume of 12,000 traded contracts,[17] the ÖTOB has successfully positioned itself among the European Options and Futures Exchanges. Stock options have represented the most liquid market segment up to date, with ATX options and CAV options accounting for the bulk of traded contracts. Within the two years of its existence the Government Bond Future has developed satisfactorily and has prevailed against stiff international competition. Since the establishment of ÖTOB, the contract value doubled each year, with the Austrian Traded Index and the Austrian Government Bond Index contributing heavily to growth. In 1994 index products represented more than 80% of the contract value.

The introduction of a derivatives market increased market transparency. Liquidity and trading volume in underlying asset markets have increased considerably, and the bid-ask spreads have been reduced substantially.[18] The effect of derivatives on market volatility is difficult to evaluate. First, the start-up phase of a market has to be treated as a transitional and therefore special period. Secondly, the data available are, in particular for the bond market, not sufficient to allow a profound analysis. However, the volatility of the most liquid stock, CAV, did not change significantly following the introduction of options trading (Chart 12).

Chart 12

Austria: Volatility of stock market prices - CAV (preferred)

(standard deviation, in percentages)



17 1992-95 average.

18 In addition, ÖTOB constantly strives to improve market liquidity and efficiency. For example, as of the end of 1994, the attractiveness of the market for AGB futures was enhanced by the halving of the bid/offer spreads to 15 basis points, the substantial increase of the minimum contract size (to 50 contracts) and a reduction in transaction costs.

In Austria, evidence of widespread use of derivatives for hedging purposes, possibly in the wake of complex portfolio management strategies, seems to be weak and effects on volatility thus very limited. Among institutional investors, insurance companies are considered to be very conservative, largely avoiding derivatives. In addition, pension funds have not grown to a size to be regarded as important investors. Investment funds are important market participants, mainly in the bond market. In 1993 the amendment of the Investment Fund Act for the first time permitted the use of derivatives within strict limits. Subsequently investment funds have increasingly included derivatives in their investment strategies, above all for hedging purposes. However, up to date the use of derivatives by investment funds does not seem to be widespread. In recent years foreign institutional investors, as mentioned above, have started to invest part of their portfolios in Austrian bond and equity markets. Since foreign investors, in particular those from the English-speaking world, tend to incorporate derivatives in their investment strategies, future potential impacts on volatility cannot be excluded. But more important, the participation of foreign institutional investors in Austrian capital markets, which has increased substantially in the last two years, might result in higher volatility, reflecting a more pronounced and faster reaction to fundamental news in a still narrow market.

4. Effects of volatility and policy response

In principle, a strong increase in volatility on stock markets can affect the economy through its influence on consumer spending. However, even the sharp drop in stock prices of October 1987 had a much weaker impact on economic growth than expected. In Austria this relationship might be even less pronounced, also taking into account that only 4% of the population owns shares. In addition, movements in stock and bond price volatility might reduce economic growth through their negative impact on business investment (as investors shift their funds into less risky assets, which results in increased funding costs for firms). However, in the light of the importance of credit financing for an enterprise sector dominated by small and medium-sized firms, the economic repercussions of this effect might be limited, but must not be neglected. Austria's monetary policy of holding the Austrian schilling stable against the Deutsche Mark has the advantage of avoiding or diminishing some potential negative effects of increased exchange rate volatility, such as those on business investment. Moreover, adverse effects on international trade, as firms add a risk premium to export and import prices, and on cross-border capital flows, reflected in a shift towards destabilising short-term capital flows, might be largely avoided.

In general, in the light of the Austrian experience, a monetary policy firmly aiming at price stability within a framework of stable macroeconomic policies is also the best contribution to financial market stability. Over the years, Austrian monetary policy has earned high credibility - in spite of recent problems with budget consolidation - on financial markets, which has resulted in strong non-inflationary expectations. However, as financial market integration grows, financial institutions should be prepared to cope with increasing financial market volatility. In this respect a strong equity capital base should be an important means to serve as a cushion against pronounced volatility movements.

Chart 13

Austria: GARCH volatilities - stock market returns

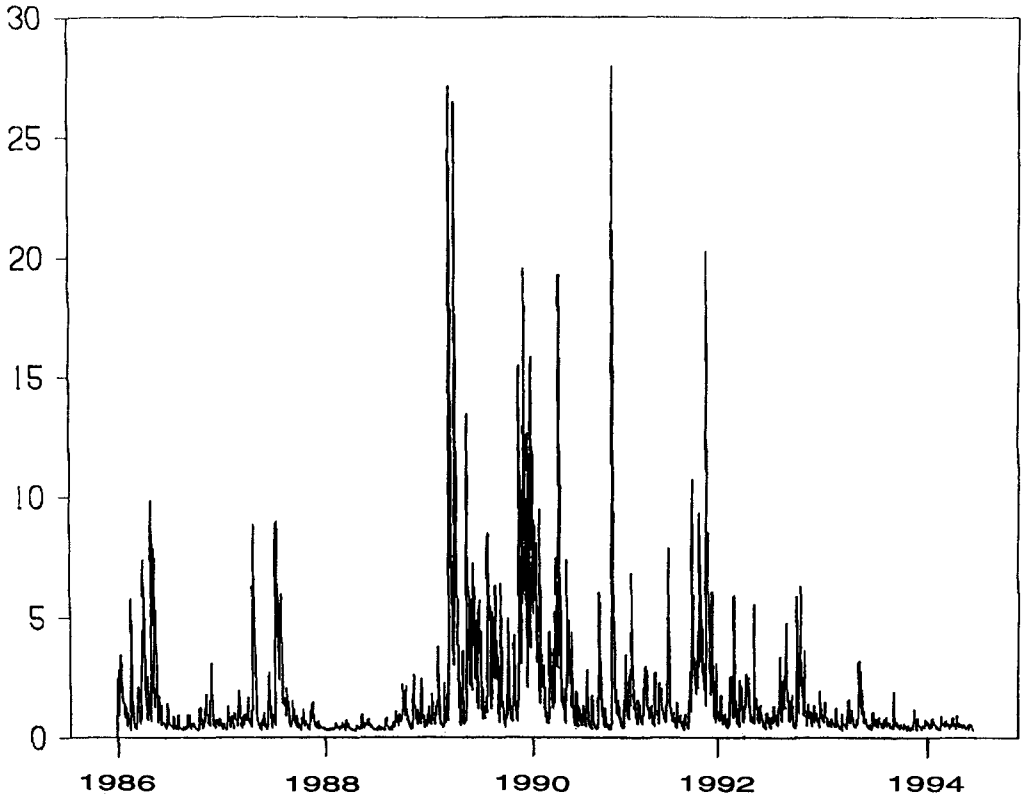
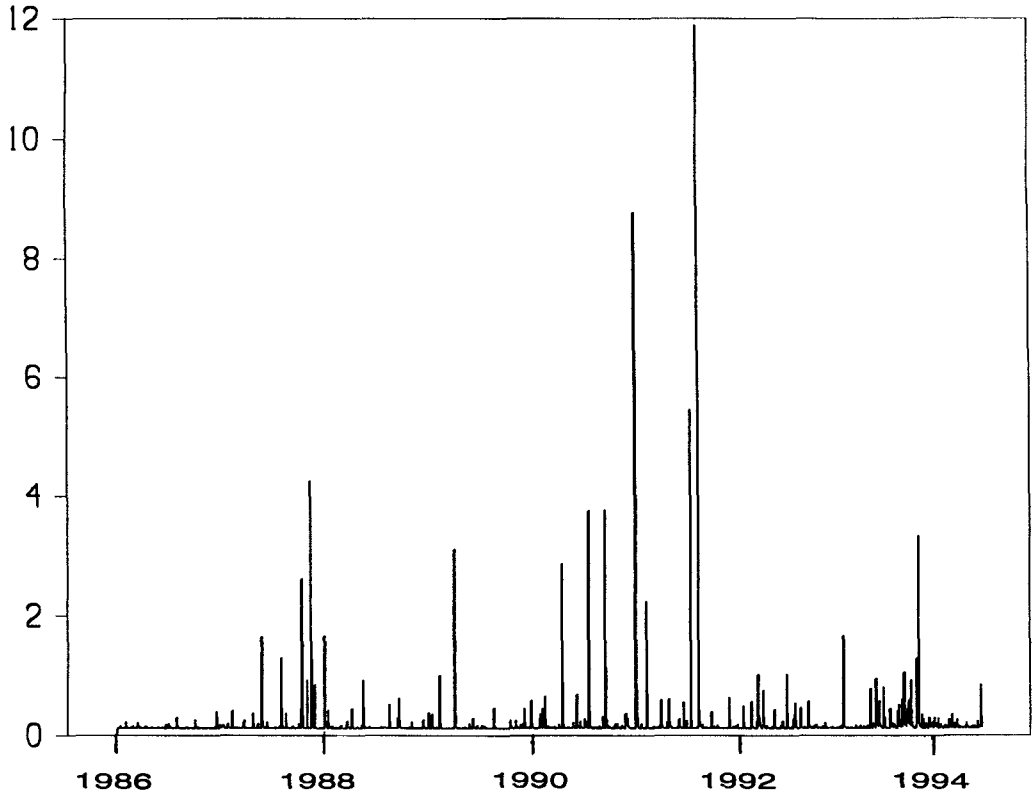


Chart 14

Austria: GARCH volatilities - benchmark bond returns



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