The stock market and monetary policy

This article discusses the role of the stock market in the economy and in the monetary policy strategy of the ECB. Traditionally, stock markets play a less prominent role in the euro area economy than in the United States, for instance. However, there are some indications that they have become more important in the euro area over recent years.

In an efficient market, stock prices are determined by the discounted stream of expected dividends to be distributed to stockholders in the future. In this respect, stock prices are inherently forward-looking and quickly incorporate any new information that leads market participants to revise their expectations about stock price fundamentals. However, experience also suggests that investor sentiment may sometimes lead to stock price "bubbles", a situation when actual stock prices temporarily by far exceed fundamental values. Nevertheless, identifying such situations is inherently very difficult.

Stock prices may play a role in economic developments through cost-of-capital, wealth, confidence and balance sheet effects. Moreover, they may provide information about market participants' expectations for the future course of the economy. Thus, as they provide indications of aggregate demand and supply developments, stock prices need to be monitored by central banks in order to identify risks to price stability. Finally, while stock prices are not a suitable goal for monetary policy, a credible monetary policy oriented towards safeguarding price stability can make an important contribution to the efficient functioning of the stock market.

1 Introduction

The introduction of the euro in January 1999 acted as a catalyst for the increasing integration of euro area stock markets. At the same time, large swings in stock prices worldwide enhanced the interest of the general public and policy-makers in stock market developments. In the light of this, this article discusses the role of the stock market in the economy and in the monetary policy strategy of the ECB.

The article starts by briefly reviewing the role of the stock market in the financial system, presenting some evidence for the euro area. Next, theoretical issues regarding the valuation of stocks in an efficient market and possible reasons for temporary market inefficiency are discussed, with a special focus on stock market bubbles. After surveying the role of the stock market in the transmission mechanism of monetary policy, the article looks at why and how the stock market is taken into account in the monetary policy strategy of the ECB.

2 The role of the stock market in the euro area financial system

The financial system performs the essential function of channelling household savings to the corporate sector and allocating investment funds among firms. This allocation can be effected either through direct contact between borrowers and lenders on financial markets, via the issuance of securities (such as stocks or bonds), or indirectly through the use of financial intermediaries (such as banks, investment and pension funds, or insurance companies). The efficiency of the allocation of both financial means and implied risks determines the ability of households to shift consumption over time and firms' capacity to build up and renew the capital stock. Hence, long-term growth and economic welfare also depend critically on the efficiency of the financial system.

The general importance of the stock market within the financial system largely rests on how widely the corporate sector, households

and institutional investors typically use stocks as a financing and investment instrument. This generally follows from the motives and incentives of potential stock issuers and holders, which in turn are determined within a complex network involving market forces, economic policy, the legal and regulatory framework of the financial system as well as slowly changing traditions and conventions.[1]

Within this context, firms issue stocks and sell them either to the public (shares quoted and traded on stock exchanges) or in private placements (unquoted shares) to raise external funds to finance their activities.[2] In addition, they may issue or repurchase own stocks in order to adjust their capital structure. As equity competes with other sources of corporate finance, the relative cost of equity capital – i.e. the difference between the return on equity capital demanded by the market and the interest rate on loans or bonds, net of taxes, issuing costs and all other forms of costs – is one important determinant of the supply of stocks.

From a demand perspective, stocks usually pay a periodic stream of income to their holders in the form of dividends. Apart from dividends, stock returns also comprise capital gains or losses stemming from stock price changes. Furthermore, owning equities usually implies the right to participate in a firm's decision-making process. Sometimes this becomes the dominant motive for holding stocks, for example when a corporation seeks strategic participation in other firms. Private households, by contrast, use stocks mainly as a savings vehicle. They can hold stocks either directly or indirectly by purchasing claims on the assets of institutional investors that invest in stocks. The scale of financial wealth allocated by households to the stock market will depend on their motives for saving, the perceived risk and return characteristics of equity portfolios relative to other assets and on their attitude toward risk.

From a monetary policy perspective, it is vital to note that the overall importance of the stock market within the financial system, and

for the economy as a whole, is determined by long-term and cyclical factors affecting the supply of and demand for stocks. For example, differences in the taxation of equity capital and debt as well as the degree of government involvement in the pension system – a main motive for households' long-term saving is provision for old age – typically determine trends in stock market developments. By contrast, short-term factors such as swings in stock prices and interest rates – which may change the relative cost of equity capital and investors' expectations of stock returns – cause short-term cyclical variations in the importance of the stock market for issuers and holders. A central bank needs to monitor both sets of factors carefully, as they jointly determine how strongly corporate investment and private consumption typically respond to changes in stock prices. This link between stock prices and economic activity is part of the monetary transmission mechanism and will be discussed in more detail in Section 4. The remainder of this section briefly describes recent trends in the importance of the stock market within the euro area financial system.

As the euro area financial system is still dominated by bank intermediation, stock markets play a far less prominent role in the euro area than in the United States, for instance, which traditionally relies more heavily on market-based financing. However, several developments may indicate that stock markets have assumed a somewhat more prominent role in the euro area over recent years. The overall importance of the stock market is quite often gauged by the ratio between the market value of domestic shares traded on a country's stock exchange (market capitalisation) and nominal gross domestic product (GDP). The chart shows the development of the capitalisation/GDP ratio for the euro area and the United States from 1990 to 2000. On the one hand, the

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1 See "The euro equity markets", ECB, August 2001.
2 On the different forms of equity capital, see Box 1 in the article "Characteristics of corporate finance in the euro area" in the February 2001 issue of the Monthly Bulletin.
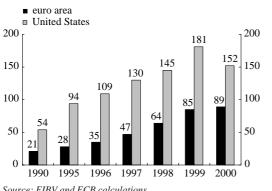
figures clearly show that the US stock market was about two to three times larger (in relative terms) than the euro area stock market. On the other hand, the euro area stock market grew at a more rapid pace than that in the United States. The ratio increased about fourfold from 1990 to 2000 in the euro area, compared with around threefold in the United States. However, much of this surge in market capitalisation was driven by stock price developments. Measured by broad market price indices, euro area stock prices increased by 320% between the end of 1989 and the end of 2000, while US stock prices increased by 240% in the same period.[3]

Looking at a different indicator over a more recent period, the number of domestic companies listed on euro area stock exchanges increased from 3,900 at the end of 1998 to 4,900 at the end of 2000.[4] Moreover, the amount of new capital raised on euro area stock markets increased from €130 billion in 1998 to €320 billion in 2000. While initial public offerings accounted for only one-third of the gross issuance of shares in the euro area in 1998, their share increased to 50% in 2000.[5]

The financial balance sheets and flows of non-financial sectors[6] in the euro area broadly confirm the stock market's gradually increasing role in the euro area financial system. In terms of amounts outstanding, the

percentage of quoted shares in non-financial corporations' main liabilities (quoted shares, domestic loans plus securities other than shares) increased from 42% in the fourth quarter of 1997 to 51% in the same quarter of 2000. The percentage of quoted shares in total financial assets held by all non-financial sectors increased from 14% in 1997 to 21% in 2000. The increased direct exposure of these sectors to equity markets is supplemented by larger indirect holdings of stocks via investment in mutual fund shares and insurance products. The share of investment in non-monetary mutual funds in the total assets of the non-financial sector increased from 8% in 1997 to 12% in 2000. Moreover, mutual funds substantially stepped up the proportion of equities in their total assets.[7] Although the non-financial sectors' investment in insurance products remained basically constant at around 21% of total assets between 1997 and 2000, it seems that insurance companies and pension funds have also increased the relative size of their equity holdings.

However, much of the increase in amounts outstanding of quoted shares reflects revaluation effects caused by sharply rising stock prices.[8] By using financial flows at transaction values, it is possible to check for such revaluation effects. According to such data, the total external financing needs of non-financial corporations increased by 27% between the fourth quarter of 1997 and the fourth quarter of 2000, while financing via the issuance of quoted shares only increased by 17% in the same three-year period. Hence, at transaction values, equity financing of firms

Chart

Market capitalisation of domestic shares as a percentage of GDP

■ euro area
▫ United States

Source: FIBV and ECB calculations.

actually became less important, relative to the other sources of external financing, between 1997 and 2000. As far as asset holdings are concerned, the non-financial sectors' investment in financial assets at transaction values increased by 21% between the fourth quarter of 1997 and the fourth quarter of 2000. Direct holdings of quoted shares increased by as much as 38% in that period, confirming the increased importance of stocks as an investment vehicle for the non-financial sectors.

3   What determines stock prices?

For the stock market to fulfil its economic functions sufficiently well, equity prices must not deviate systematically from their "fundamental" value. This value, generally speaking, depends on the future stream of income that corporations are expected to generate. If equity prices fully reflect all the available information that is relevant for valuing stocks, we say that the efficiency condition is met. If it is not met, stock prices might send the wrong signals to market participants about the true profitability and risks of certain companies, or even of the stock market as a whole. This, in turn, would lead to an inefficient allocation of capital in the economy, as some relatively unprofitable firms would tie up scarce financial resources that could have been invested in alternative projects with higher productivity or lower risk.

The following contains a discussion of the standard economic approach to valuing stocks – the dividend discount model – and possible sources of market inefficiencies, with a special focus on stock market bubbles.

Valuing stocks by the discounted present value of future dividends

In general, financial assets are valued according to the discounted present value of the future cash flow that investors expect to derive from holding the asset. The discount rates applied to future cash flows are the expected rates of return that investors demand for holding the asset in their portfolios. Applied to the valuation of shares, the discounted cash flow method corresponds to the dividend discount model.

If stock prices are efficient, they will equal the discounted present value of (rationally) expected future dividends (see annex).

The discount rates can be broken down into a measure of "opportunity costs", which are the returns expected on investing in assets other than stocks, and a corresponding equity-specific risk premium. If investors did not care about differences in risk between the various assets, all assets would be expected, in equilibrium, to earn the same rate of return. In this case, the discount rate for stocks would equal this uniform rate of interest. Risk-averse investors, however, demand higher rates of return for holding riskier assets. The difference between the expected rates of return on a riskier and a safer asset thus constitutes a risk premium, and it reflects both investors' risk preferences and the perceived risk properties of asset returns. As stocks tend to be riskier than, for example, government bonds or bank deposits, investors demand a correspondingly higher expected rate of return for holding stocks. In fact, the equity (risk) premium, as empirically approximated by the long-term average of the margins by which observed returns on stocks exceeded those on either long-term bonds or short-term bank deposits, is generally found to be positive.

The main conclusion drawn from the dividend discount model is that stock prices are inherently forward-looking or, to put it differently, the stock market "trades the future". Moreover, changes in stock prices are mainly driven by "news", i.e. by incoming information that leads market participants to revise their expectations about stock fundamentals. These properties can be particularly useful for monetary policy, as stock prices can be used as indicators of

market participants' expectations regarding future economic activity (which is linked to future corporate earnings and dividends). This issue will be addressed further in Section 4.

Possible sources of stock market 'Inefficiency"

The fact that stock price fundamentals are not directly observable implies that any evaluation of whether stocks are efficiently priced requires a judgement as to whether investors' expectations about future dividends, interest rates and stock market risks are justifiable and correctly reflected in stock prices. What arguments may be put forward to arrive at such a conclusion? In general, such an assessment has to be based on both empirical and theoretical considerations.

In theory, the hypothesis of market efficiency rests on the assumption that investors have an incentive to use all available information when deciding at which price to sell or buy stocks. Even if investors do not all use the available information in a rational way, an effective arbitrage mechanism assures that rational investors push securities prices sufficiently close to their fundamental values. Arbitrage works perfectly when, for example, rational investors can sell (or sell short) an "overpriced" security in one market and simultaneously buy the same asset or a security with the same pay-off structure as a hedge in another market where it is correctly priced or underpriced. The effect of arbitrageurs' trades causes the prices on the two different markets to balance out quickly at the fundamentally justified level. This mechanism is effective in bringing about efficient prices even if investors do not all behave rationally, as long as stocks have close substitutes.

In real-world stock markets, however, no such perfect substitutes for stocks are readily available. As a consequence, fundamental arbitrage becomes risky, as it involves the use of imperfect substitutes. This implies the

risk that relative prices of the assets perceived as over and undervalued may widen even further within the investment horizon, due to the arrival of good or bad news concerning one of the securities (idiosyncratic risk) or due to the trading activities of uninformed investors (investors who trade on irrelevant information, or "noise traders").

Risky arbitrage meets limited risk-bearing capacities of arbitrageurs that may arise from borrowing constraints and short investment horizons. This limits their aggregate ability to bring stock prices into line with fundamentals. For example, a short-term orientation may result from delegated portfolio management and the corresponding agency problems. Mutual fund managers, for instance, may resist taking an arbitrage position if they do not expect asset prices to revert to fundamental values within the performance evaluation period, because the fund managers' pay usually depends on short-term performance measures. Moreover, they may fear that temporary losses from holding arbitrage positions may lead retail investors to sell their shares in the fund, which may force the fund to liquidate arbitrage positions before prices revert to efficient levels.

However, limited arbitrage is not sufficient to create market inefficiencies. It has to be compounded by some form of irrational behaviour on the part of at least some investors (investor sentiment). Theories of "investor sentiment" – based on evidence from experimental studies and psychological theories about belief formation – try to explain the motives behind investors behaving in a way that drives prices away from fundamentals. Most of them can be subsumed under "overreaction" and "positive feedback trading". Overreaction describes the view that, after a series of good earnings news, investors become overly optimistic that future earnings announcements will also be good, driving stock prices up to unduly high levels, or that, after a series of bad news, prices will be pushed down to unduly low levels. Positive feedback investors buy stocks after prices rise and sell after prices fall. Such

behaviour may result from, inter alia, extrapolative price expectations or technical trading rules.

Imperfections in real-world capital markets, combined with the potential threat of irrationality on the part of some investors, imply that the efficiency of stock prices remains an empirical question. However, empirical evidence with regard to the efficiency of stock prices is quite mixed, depending mainly on the theoretical framework chosen and the empirical methodology applied. As the fundamental value of stocks is not directly observable, it is impossible to decide with certainty whether stocks are efficiently priced at a specific point in time or not. Nevertheless, experience suggests that investor sentiment may sometimes lead to stock price "bubbles", a situation when actual prices temporarily by far exceed fundamental values.

Can stock price bubbles be detected?

As mentioned above, a bubble could emerge from investors overreacting to a string of positive earnings news, leading to overly optimistic earnings and dividend expectations ("intrinsic bubbles"). In addition, bubbles can result from positive feedback trading, i.e. from investors buying stocks with the expectation that observed price increases will continue, with the result that stock prices may in fact increase further on account of higher demand, thus giving rise to further expectations of future price rises, and so forth. In this case, self-fulfilling expectations are the main driving force behind a bubble that feeds itself once triggered by some extraneous event ("extrinsic bubbles").

Identifying a bubble empirically, however, is very difficult, in particular from an ex ante point of view. For instance, large price movements themselves do not necessarily indicate a bubble, as efficiently priced stocks also have an inherent tendency to react strongly to news about fundamentals.

A commonly used tool to assess the level of stock prices is to put stock valuation ratios, such as the dividend yield and price-earnings ratio, in a historical context. This is based on the idea that these valuation ratios should, over time, eventually revert to some long-run equilibrium level. According to the dividend discount model (in the form of equations 6 and 7 in the annex), this long-run equilibrium level is determined by the long-run growth potential of dividends or corporate earnings and the long-run levels of real interest rates and the equity risk premium.

Statistically, historical comparisons may be made in two ways. A simple method consists of comparing current valuation ratios with historical averages. Alternatively, a long-run equilibrium relationship between stock market valuation ratios and, for example, real interest rates and potential output growth (as a rough measure of long-term dividend growth) can be estimated, allowing the long-run equilibrium to vary over time. For both methods, a stock market over or undervaluation might be indicated when current valuation ratios are considerably out of line with the estimated long-run equilibrium level.

However, neither of the two approaches can provide sufficient proof of a stock market bubble. For example, extraordinarily high price-earnings ratios may be justified by correct expectations of extraordinary growth of corporate earnings over an extended future period of time. In this case, the initially high price-earnings ratio would be expected to decline towards its long-run average over time, driven mainly by the materialisation of earnings expectations, but not by sharp drops in stock prices caused by the bursting of a bubble. For an example of these difficulties, see Box 1 on the recent case of sharp price increases and subsequent declines in the market for high-technology stocks.

Hence, historical comparisons cannot solve the problem of diagnosing bubbles with an

Box 1

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Recent stock price developments in the high-technology sector

During the decade between the end of 1989 and 1999, equity prices in the United States, as measured by the broad Standard & Poor's 500 index, experienced extraordinarily large increases in both nominal (+315%) and real terms (+275%), compared with developments over the past 130 years. A number of possible reasons have been put forward to try to explain these spectacular price rises. Technological advances led some observers to claim that stock market developments reflected the entry of the US economy into a "new era", in which productivity growth had reached a permanently higher level. High-technology stocks, such as those with links to internet business, benefited most from this "new era" thinking. Others claimed that the equity premium had shrunk to very low levels as a result of financial innovation and the proliferation of institutionalised savings (both allowing households to better diversify equity risk) and demographic factors.[1]

One could argue that particularly stock prices in the high-technology sector were strongly inflated by market euphoria about the earnings outlook for such stocks over the more distant future. As more and more investors jumped on the bandwagon, stock prices surged to unprecedented high levels. This may have resulted from the combination of an initial overreaction to intrinsic factors and reinforcing factors stemming from the influence of positive feedback trading.

While the acceleration of stock prices was most pronounced in the United States, it also spilled over to euro area stock markets, although somewhat later. Price-earnings ratios in the euro area's booming high-technology sector increased sharply, in particular from November 1999 onwards. In March 2000, the monthly average price-earnings ratio of stocks in the technology, media and telecommunications sectors (TMT) peaked at 70, compared with an average of 13 between January 1973 and December 1998 (according to Datastream data). While prices of TMT stocks surged to such unprecedented levels, the price-earnings ratio of other stocks increased to a maximum of only 21 in January 2000, which compares with an average value of 13 – the same as in the TMT sector – over the period 1973 to 1998. This suggests that if stocks were indeed overvalued during the recent boom period, the phenomenon was mainly confined to high-technology stocks.

From April 2000 onwards, the prices of TMT stocks dropped sharply, reflecting investors' increasing concern as to whether these stocks could live up to the high earnings expectations. Between March 2000 and October

Price-earnings ratios of technology, media and telecommunications (TMT) stocks and non-TMT stocks in the euro area
(monthly averages)

Source: Datastream.

1   See International Monetary Fund, *World Economic Outlook, May 2000, p. 87.*

2001, stock prices in the TMT sector declined by about 70%, while non-TMT stocks fell by only 15% over the same period. As a result, the price-earnings ratio of TMT stocks had declined to 22 by October 2001, which was still above the historical average. By contrast, the price-earnings ratio of non-TMT stocks had fallen to 15, very close to its historical average.

Accordingly, it was not materialised earnings expectations that brought price-earnings ratios down closer to historical standards, but rather a correction of prices, which is more in line with a bubble interpretation of recent stock price developments in the high-technology sector. However, it is not the disappointment of investors' earnings expectations itself that supports the overvaluation hypothesis, but more the overall dynamics of recent developments in the high-technology sector and several indications of extraordinary market euphoria and excessive earnings optimism in the late 1990s.

adequate degree of certainty. They can only provide some weak indications of periodic market excesses pushing valuation ratios far beyond thresholds set by historical patterns. In general, there seems to be no alternative to a more eclectic approach using all available information and tools – from econometric models to anecdotal evidence – to attempt to infer whether a bubble exists or not.

4 Stock market fluctuations and economic activity

The process through which monetary policy may affect the economy in general, and the price level in particular, is known as the monetary transmission mechanism. It is a complex and long chain of causes and effects which describes the linkages between monetary policy, financial asset prices and the supply and demand conditions on markets for goods and services. The stock market is one element that may play a role in this transmission mechanism. Before discussing how stock price developments are related to the real economy, we briefly discuss whether and how monetary policy may affect stock prices.

Stock price reactions to monetary policy

The trend in real stock prices (i.e. stock prices deflated by a price index for goods and services) reflects the long-term growth rate of real corporate earnings. This, in turn, is linked to the long-run potential rate of real growth of the economy. Long-term real stock prices are also determined by the trend in real interest rates – which, in turn, is also related to potential economic growth – plus a long-term equity risk premium linked to investors' average risk preferences and the available opportunities to diversify stock market risks.

Monetary policy can, in the long-term, only control the trend in the general price level of goods and services, which, in turn, have an impact on nominal profits and therefore *nominal* stock prices as well. By contrast, the only long-term impact of monetary policy on *real* stock prices is linked to the fact that a stability-oriented monetary policy reduces inflation uncertainty, and thus also uncertainty about future nominal asset prices. This reduces corresponding risk premia in, for example, bond and stock prices, which helps to make the allocation of production factors more efficient and therefore raises the economy's potential rate of growth. Thus, a change in the monetary policy regime towards an environment of price stability can also be expected to have a positive impact on the long-term trend level of real stock prices. Apart from this, however, monetary policy can have no other persistent effects on real dividend growth, real interest rates, the equity premium, and thus real stock prices.

This notwithstanding, monetary policy may, in the short-term, have some impact on nominal as well as real stock prices through two different but inter-related channels. First, it may affect market participants' expectations about short-term economic growth (and thus short-term corporate earnings and dividends). Second, it may affect short-term discount rates via changes in short-term real interest rates in the money market. In practice, investors, and thus stock prices, often anticipate the effects of monetary policy decisions. The immediate reaction of the stock market to an anticipated monetary policy decision is typically rather small. By contrast, unexpected monetary policy measures may trigger some stock price changes after the announcement of the decision. As the effect on dividend expectations and the effect on discount rates tend to work in the same direction, stock prices usually fall in response to an (unanticipated) interest rate increase, and rise in reaction to an (unexpected) interest rate reduction.

However, there might be deviations from this "normal" reaction pattern. For example, if the central bank is perceived to be better able to assess future economic developments than the public, an unexpected interest rate reduction may be interpreted by the market as signalling forthcoming "bad news" about economic growth. As a result, stock prices may on occasion also react negatively to an unexpected reduction in the official interest rate. It is therefore very difficult to predict the direction of stock price reactions to changes in official interest rates.

Stock prices and economic activity

The stock market may play a role in economic developments through four main channels: cost of capital, wealth, confidence and balance sheet effects.[9] The first channel operates through the impact that stock prices may have on firms' cost of equity capital, and thus on their investment spending. An increase in stock prices may signal good opportunities for investment, as this investment can be financed at lower cost by new issues of stock. In fact, when stock prices rise, the market value of the firm relative to the replacement cost of its stock of capital (the so-called "Tobin's q") tends to increase. It follows that it would be profitable for the firm to expand its capital stock, leading to increased investment spending, aggregate demand and output. As the capital stock adjusts, gradually, to its higher long-term value, q will revert to a normal level.

Several factors may weaken this channel: uncertainty, adjustment costs and the irreversible nature of investment decisions. Uncertainty regarding the future profitability of an investment and the existence of sunk costs imply, first, that waiting may be valuable, which affects the timing of investment decisions, and, second, that there may be threshold effects, which mean that rates of return may have to move substantially for investment to be undertaken. However, there is also a cost to waiting. The longer one waits, the more likely it is that very profitable investment opportunities will be realised by other investors, so that the net effect of the value of waiting on investment is unclear.

The second channel operates through the impact of wealth on consumption. A permanent increase in stock prices implies an increase in financial wealth. Assuming that economic agents try to smooth their consumption over time, the increase in financial wealth leads to higher current and future consumption, stimulating aggregate demand and output. It should be noted that, for most households in the euro area, changes in stock prices seem to have modest direct wealth effects, since direct and indirect holdings of quoted shares are still relatively small. Thus there are reasons to believe that this transmission channel is currently not very important in the euro area, although its role may have increased somewhat over recent

9   See the article "Monetary policy transmission in the euro area" in the July 2000 issue of the Monthly Bulletin.

years, in line with the developments described in Section 2.

As a third potential channel, stock prices may affect investment and consumption via confidence effects. For example, a decline in stock prices may signal increased downward risks to future economic activity and employment, which may hurt consumer confidence and actual consumption spending – even of households that do not own stocks. Likewise, a general fall in stock prices may lead even firms that have not issued quoted shares to revise their profit expectations and investment plans downwards.

The fourth channel is the possibility that stock prices affect consumption and investment through a balance sheet effect. Because of asymmetric information in credit markets, the ability of firms and households to borrow depends on the value of the collateral they can offer. As the value of the collateral increases, the ability to borrow and invest increases. This process, known as the financial accelerator, suggests that initial financial conditions (i.e. the risk attached to and the value of collateral) are essential to determining the magnitude and duration of the effects of equity price changes on investment and consumption.

Leading indicator properties of stock prices

In order to understand the leading indicator properties of stock prices for future
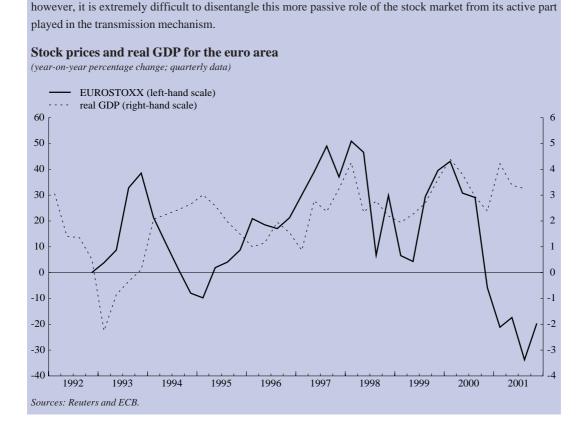

What can stock prices tell us about future economic growth?

Stock prices reflect – among other factors – market participants' expectations of future corporate earnings and dividends. Hence, they should have some predictive content for earnings and dividends if these expectations tend to materialise. This implies that stock prices should also be a reasonable predictor of future economic growth in general, as economic activity and corporate earnings are closely related. This box contains empirical evidence that largely confirms the leading indicator properties of stock prices for real economic activity in the euro area.

First, the chart below depicts annual percentage changes in quarterly stock prices and real GDP of the euro area. In this case, the leading indicator property of stock prices is suggested by the fact that most of the turning points in the time series for the annual changes in stock prices appear earlier than the turning points in year-on-year GDP growth. However, there are exceptions, for example in 1999. Second, a simple correlation analysis of lead and lag patterns between quarterly percentage changes in the two variables reveals that the highest correlation is obtained for stock price changes and real GDP growth two quarters ahead. Third, simple econometric analysis suggests that, in the euro area, a one-off 10% increase in stock prices predicts a 0.3% increase in real GDP over the long term. With regard to the time profile of this estimated reaction pattern, GDP starts to pick up by around 0.18% two quarters later, and the total impact will be reached after around one and a half years.

It should be borne in mind that the methodologies applied neglect all other possible factors that may influence either stock prices or economic activity. In fact, the inclusion of other variables in the analysis may change the quantitative results reported. Hence, the investigation should be viewed as illustrative only of the leading indicator property of stock prices for real GDP growth (see the article entitled "The information content of composite indicators of the euro area business cycle" in the November 2001 issue of the Monthly Bulletin).

It must be emphasised that the leading indicator property does not imply that stock prices are causing real GDP growth in an economic sense. Stock prices can have forecasting power for GDP growth as long as correctly anticipated earnings of the corresponding corporations move in line with general economic activity. Empirically,

however, it is extremely difficult to disentangle this more passive role of the stock market from its active part played in the transmission mechanism.

Stock prices and real GDP for the euro area
(year-on-year percentage change; quarterly data)

EUROSTOXX (left-hand scale)
- - - - real GDP (right-hand scale)

Sources: Reuters and ECB.

economic developments, it is useful to refer again to the dividend discount model. For example, the model suggests that stock prices rise if investors expect higher future dividends, and fall if they expect lower dividends. It follows that changes in stock prices may reflect a reassessment by market participants of the short-term prospects for economic growth, as corporate earnings, and thus dividends, are closely related to economic activity. If market participants' expectations tend, on average, to be confirmed by later economic developments, stock prices can be used as a predictor, or leading indicator, of real economic growth (see Box 2).

However, given that stock prices may also rise if investors apply a lower discount rate – which can result from lower expected real interest rates, an increased appetite for risk or lower perceived equity risks – it is not easy at any given moment in time to identify which factor is driving the change in stock prices.

In general, it is extremely difficult, if not impossible, to distinguish between movements in stock prices justified by economic developments that are expected to occur in the future and movements based on other factors or unrealistic expectations about the future growth of dividends, and thus output. For example, expected developments in technology may or may not materialise. If they do not, expectations will be disappointed and there will be a correction in stock prices that might be observationally equivalent to the "bursting" of a bubble where stock prices had been out of line with fundamentals.

The conclusion is that, even though stock prices quite often have useful leading indicator properties for economic developments, their information content has to be carefully assessed in conjunction with other economic data and analyses.

5 The role of the stock market for monetary policy

Recent worldwide stock market volatility has enhanced interest in the possible role of asset prices in monetary policy. This section explains how the stock market is taken into account in the monetary policy strategy of the ECB and also discusses why monetary policy should not regard stock prices as its objective.

The role of the stock market in the monetary policy strategy of the ECB

Maintaining price stability is the primary objective of the ECB. Price stability has been defined by the Governing Council of the ECB as a year-on-year increase of below 2% in the Harmonised Index of Consumer Prices (HICP) for the euro area. In the framework of its strategy, the ECB takes stock price movements into account because these are relevant for assessing economic conditions, and thus the risks to price stability.[10]

As mentioned in Section 4, stock prices can be seen as leading indicators of economic activity, either because they reflect market expectations of economic developments (passive role) or because of their impact on real economic developments (active role). Insofar as they provide information about the evolution of aggregate demand and supply in the euro area, stock prices may help in identifying shocks hitting the economy and the source and the degree of persistence of price pressures in the euro area. However, stock prices are very volatile and may at times deviate from levels that reflect fundamental or "equilibrium" values. Therefore their information content is typically more uncertain and difficult to assess than that of other economic indicators.

Stock prices are one of the many economic and financial variables which are monitored under the second pillar of the ECB's monetary policy strategy. In addition, there are synergies, on occasion, between an analysis of stock market developments and the monetary analysis under the first pillar of the ECB's monetary policy strategy. For example, a combination of high money and credit growth and quickly rising stock prices might occasionally signal that stock price developments might not be sustainable. In this sense, monetary aggregates may be useful as indicators of stock market "bubbles". Conversely, stock price movements may help in identifying special factors that temporarily distort the information content of monetary aggregates.

Stock prices are not a suitable goal for monetary policy

The above notwithstanding, it should be stressed that stock prices are not a suitable goal for monetary policy.

First, monetary policy cannot control stock prices over the long term. In fact, whereas the trend in the prices of goods and services is ultimately related to an excessive supply of money, the trend in real stock prices is mainly driven by underlying real factors – e.g. technological developments and preferences – which cannot be controlled by monetary policy. Second, while monetary policy might have some short-term impact on stock prices, it is impossible for monetary policy to control stock prices in any precise manner over the short term, not least because it is very difficult to predict how stock prices react to changes in official interest rates. Third, a more fundamental argument is that it is very unlikely that monetary authorities have better information on equilibrium stock prices than the market as a whole. Finally, if monetary policy were focused on stock market developments, the public's perception as to the commitment of the central bank to its primary objective of

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10 For further reference on the monetary policy objective and strategy of the ECB, see the articles "The stability-oriented monetary policy strategy of the Eurosystem" in the January 1999 issue and "The two pillars of the ECB's monetary policy strategy" in the November 2000 issue of the Monthly Bulletin.

maintaining price stability could become blurred.

Even a monetary policy that tried to stabilise stock prices only occasionally could lead to moral hazard problems if the markets expected this to become a more systematic policy response. Were the central bank expected to react in an accommodating way to a perceived emergence of financial fragility, it would effectively provide the financial markets with insurance against large losses. This could actually reinforce risk-taking by the private sector, supporting stock price bubbles and thereby also raising the probability of subsequent large corrections in asset prices.

Obviously, the moral hazard issue does not imply that monetary policy should not be concerned with the impact of sharp movements in stock prices. However, it should be clear that stock prices are not an objective, but merely one among many indicators which should be assessed and taken into account in the conduct of monetary policy.

6   Concluding remarks

Despite its recent growth, the stock market in the euro area plays a less important role in economic developments than in the United States. However, this does not imply that euro area stock markets are not relevant to monetary policy. Notably, stock prices may provide complementary information about market expectations for the future course of the economy. Moreover, stock price movements seem to have a moderate, though discernible, impact on aggregate demand and supply in the euro area economy. In addition, stock market developments are interrelated with developments in money and credit.

The information that stock market developments may provide is taken into account in the assessments under both the first and second pillars of the ECB's monetary policy strategy. However, monetary policy does not react to stock prices as such, but only to the extent that they may add incremental information signalling risks to price stability in the euro area. At the same time, a credible monetary policy, oriented towards safeguarding price stability, and thus reducing uncertainty about nominal prices in the economy, contributes to an efficient functioning of the stock market.

Annex

Stock valuation according to the dividend discount model

According to the dividend discount model, stocks can be valued by the discounted present value of the future cash flow generated from holding them. The cash flow consists of dividends and capital gains. This method can be applied to any investment horizon. The following paragraphs show, step by step, how the model can be derived.

Let $E_t h_{t+1}$ be the expected and required return on holding a stock over the coming period (with h denoting the rate of return and E_t

indicating rational expectations based on information available in period t). The length of the period corresponds to the frequency at which dividends are paid out. The holding period return consists of two components: a dividend (D_{t+1}) plus a capital gain or loss ($S_{t+1} - S_t$), both as a percentage of the stock price S at the end of period t:

$$E_t h_{t+1} = E_t D_{t+1}/S_t + (E_t S_{t+1} - S_t)/S_t. \qquad (1)$$

Solving for the current stock price S_t yields:

$$S_t = (E_t D_{t+1} + E_t S_{t+1})/(1 + E_t h_{t+1})$$
$$= \delta_{t+1}(E_t D_{t+1} + E_t S_{t+1}), \qquad (2)$$

with $\delta_{t+1} = 1/(1 + E_t h_{t+1})$ as the discount factor ($E_t h_{t+1}$ being the discount rate). Equation 2 states that the current stock price equals the present value of the next period's expected dividend and stock price, discounted by the expected rate of return. The stock price expected for period $t+1$ can be obtained by taking equation 2 one period forward, as $E_t S_{t+1} = \delta_{t+2}(E_t D_{t+2} + E_t S_{t+2})$. Substitution into equation 2 gives:

$$S_t = \delta_{t+1} E_t D_{t+1} + \delta_{t+1}\delta_{t+2}(E_t D_{t+2} + E_t S_{t+2}). \quad (3)$$

By recursive substitution and assuming, for ease of exposition, that investors discount at a constant rate h, the standard formula for the dividend discount model is obtained:

$$S_t = \sum_{i=1}^{\infty} \delta^i E_t D_{t+i} + \lim_{T \to \infty} \delta^T E_t S_{t+T}, \quad (4)$$

$$S_t = \sum_{i=1}^{\infty} \delta^i E_t D_{t+i},$$

if $\lim_{T \to \infty} \delta^T E_t S_{t+T} = 0$.

The current stock price is uniquely determined if the second component – the discounted present value of the stock price in the infinite future – becomes zero. This condition is equivalent to ruling out stock price bubbles. It is met if stock prices are not expected to grow faster than the discount rate, which is guaranteed as long as investors discount at expected holding period returns. The model predicts that stock prices will rise if investors expect higher future dividends and/or if they apply a lower discount rate, and that they will fall in the opposite case. To facilitate analysis further, assume that dividends are expected to grow at a constant rate g which is smaller than the discount rate h. In this case, the solution of equation 4 approaches the limit:

$$S_t = \sum_{i=1}^{\infty} \frac{D_t(1+g)^i}{(1+h)^i} = D_t \frac{1+g}{h-g}. \quad (5)$$

This form of the dividend discount model is known as Gordon's growth model. By rearranging equation 5 and assuming that a constant fraction ϕ of earnings G is paid out as dividends (i.e. $D_t = \phi G_t$), the model can be solved for the dividend yield (D_t/S_t) and the price earnings ratio (S_t/G_t), two widely used stock market valuation indicators:

$$\frac{D_t}{S_t} = \frac{h-g}{1+g}, \quad \frac{S_t}{G_t} = \frac{\phi(1+g)}{h-g}. \quad (6)$$

The discount rates are usually determined by modelling the behaviour of risk-averse investors under uncertainty about stock returns. The simplest way of dealing with uncertainty in the dividend discount model is by breaking down the discount rates into an interest rate r, measuring the opportunity costs, and an equity risk premium ρ. However, this breakdown is a mere identity and thus not operational. To make it operational, a model of the risk premium is needed. The capital asset pricing model (CAPM) is one possibility. Assume that the range of assets comprises a one-period risk-free asset (that yields the interest rate r_t, which is usually approximated by a short-term interest rate) and the market portfolio of stocks. In this case, the expected one-period return on the stock portfolio and the corresponding risk premium can be specified as:

$$E_t h_{t+1} = r_t + \rho_{t+1} = r_t + \lambda_{t+1} E_t \sigma_{t+1}^2, \quad (7)$$

with λ_{t+1} as the "market price of risk" and $E_t \sigma_{t+1}^2$ the expected variance of one-period returns on the market portfolio of stocks (measuring non-diversifiable stock market risk). The market price of risk reflects the investors' degree of risk aversion, and it increases with investors' risk aversion. Hence, the CAPM in the variant of equation 7 predicts that investors demand a higher rate of return for holding stocks if the opportunity costs r_t increase, the investors' degree of risk aversion increases and/or the expected stock price volatility increases.

Using equations 6 and 7, the following information content of, for example, the price-earnings ratio is obtained: the ratio increases when investors expect higher long-term dividend growth, a higher dividend pay-out ratio, lower interest rates and/or a lower equity risk premium.