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Households, stock markets and the financial system

By Urban Bäckström

Urban Bäckström is the governor of Sveriges Riksbank. This article is based on a speech he made to the Share Promotion Association on 21 January, 2002.

In recent decades, public interest in investing in shares has spread. The number of people owning shares has also soared, especially over the past few years. This upswing has coincided with a historically very high return on shares. A more "normal" combination of stock market return and risk makes saving in shares more difficult than it has been for the past 20 years. The financial system will thus face newer and tougher challenges in helping households to handle the risks associated with investing on the stock market. As it is essential for a country that its stock markets function efficiently, there is good reason for a central bank to take a closer look at the functioning of the financial system.

Since the dismantling of controls over financial markets, central banks have become increasingly interested in the financial system's functions and institutions.

Since the controls over financial markets began to be dismantled in the 1970s and '80s, central banks around the world have become increasingly interested in the various functions and institutions of their financial systems. One reason for this is the central role played by financial systems in a country's economic infrastructure. Just as it is important that transport, electricity and telecommunication systems function properly, so is it essential that, for example, payments can be transacted, capital can be saved and channelled to the most profitable investment projects, and that both households and businesses get help in handling economic uncertainty and financial risk as well as means of spreading their consumption over time. Production and employment are liable to be hit to varying degrees if, for some reason, parts of the financial system do not work as they should or even break down completely.

Moreover, experience has taught us that the price of shares and other assets

plays a major part in the dynamics of economic growth. Rising share prices, for instance, tend to stimulate private consumption and business investment and vice versa. It follows that monetary policy also has to take the developments on the stock market into consideration.

Thus there are a number of good reasons why a central bank should take a closer look at and reflect on how the financial system functions. They are also the reason why, in the final analysis, the role of the central bank is to create and maintain financial and monetary stability.

In recent decades, the number of people owning shares has soared in our country, particularly over the past few years.

In recent decades, the financial systems in most western countries have undergone a far-reaching transformation. One feature of this development is dis-intermediation, a process whereby a growing proportion of the funds involved in saving and financing are channelled direct to the financial markets instead of being routed via the banks' traditional lending and deposit operations. The general public's heightened interest in share investment, either directly or through mutual funds, has been an important component of this process. Statistics show that in recent decades shares have accounted for an increasingly large proportion of households' financial assets. Moreover, in the same period, especially during the last few years, it is evident from the regular surveys conducted by the Share Promotion Association that share ownership in Sweden has spread very rapidly.

For the past few decades, the real return on shares in Sweden has been relatively high.

The stock market displays a number of interesting phenomena. In recent decades the real return on shares in Sweden has been almost three times higher than the long-term trend. In this period there were also a number of dramatic developments. I refer, for instance, to the stock market crash in 1987, the long bear market in the early 1990s, the mini-crash in 1998 and the IT bubble at the turn of the century.

Although all this raises a variety of interesting issues, I will confine my discussion to only a few that relate to the fact that shares now account for a far greater share of household financial portfolios than was the case thirty years ago, a development that has coincided with a historically high return on shares. Sooner or later, however, markets and yields will return to normal, more or less in line with what has happened in the past. This is so because the return on shares is ultimately determined by company profits, which are, in turn, dependent on economic developments in general. GDP represents the sum of all profits and incomes in the economy, and it is hard to see how an annual real growth rate of

around 2 per cent in GDP could eventually result in corporate profits rising so much that they can warrant a real annual return on shares that averages around 20 per cent.

A more "normal" combination of return and risk on the stock market makes saving in shares more difficult than it used to be during the past twenty years, when annual returns were so high. The financial system will need to do more than before to help households manage the risks associated with the stock market. The question is what the nature of this change might be.

A more "normal" combination of stock market return and risk makes saving in shares more difficult.

Greatly increased household saving in shares

One factor behind the growing interest in investing in shares in Sweden in the late 1970s may have been the low valuations at the beginning of that period. A relatively weak stock-market trend in the 1960s and '70s no doubt fed expectations that returns would be higher in the future. The fact that the real return on bank deposits was on occasion negative during the 1970s probably also played a role. Moreover, the introduction of mutual funds with tax incentives in the late 1970s and their subsequent replacement by a national savings system presumably drew many people's attention to the stock market. It is also conceivable that the rise of economic journalism in the 1970s and '80s helped to stimulate interest in the stock market, as did the formation of the Shareholders Association and the Share Promotion Association in the 1960s and 1970s respectively and the greater availability of knowledge and information.

However, increased saving in shares is just one part of a broader pattern in Sweden and other western industrial economies. Swedish consumers have transferred much of their traditional saving from banks to other instruments. Thirty years ago, bank deposits and other very liquid assets with little risk made up almost 60 per cent of their financial wealth. Today, this ratio is less than 20 per cent, showing that households have made radical adjustments to their financial portfolios. Although most of this adjustment took the form of a shift into equities, much of it now takes the form of insurance saving. New placement rules for insurance companies permitting them to buy relatively more shares for their portfolios have, if anything, accentuated the trend towards higher risk saving, even though it is arranged more indirectly. Similar tendencies can be

Increased saving in shares is one part of a broader pattern in Sweden and other western industrial economies.

found in other industrialised countries, which means that this shift away from traditional saving in bank deposits is not a specifically Swedish phenomenon.

Demographic changes are probably only *one* underlying factor.

One underlying factor is probably demographic. People traditionally tend to save more in the phase of life when their children start to leave home. When the baby-boomers of the 1940s reached this particular phase of their lives in the 1980s, they were very probably more interested in saving for the longer term in order to obtain a higher return. Moreover, people nowadays live longer on average than before. This increases the proportion of their lives away from the labour market, and so the higher return that often results from long-term saving can help them to maintain their living standards. Changes in tax, transfer and pensions systems are also tending to have the same effect. The fact that households now have more financial assets both as a result of higher living standards and a higher return may also have made them more inclined to take financial risks. Additional factors may be the decline in transaction costs, improved access to information and the simpler procedures for buying and selling shares by comparison with the situation twenty or thirty years ago. Many of these changes are a direct result of technical innovations, not least the arrival and widespread acceptance of the Internet.

During more "normal" yield trends, fluctuations in share prices over time are of greater importance for investors.

Long-term saving requires an ability to manage the risks it involves. Share prices fluctuate widely in response to changing trends on the stock market, in sharp contrast to the stability of bank deposits. If the fluctuations occur around a steeply rising yield curve, as they did at the end of the 1970s and during the 1990s, the problems may not be particularly serious. Even poor advice can be forgiven when everything is going well even so. But the time comes when stock-market yields fall back to a more "normal" trend and the fluctuations in share prices are then of greater importance for investors.

In the future, households will need professional assistance to determine the best way of investing their capital.

It follows that in the future; households will need professional assistance and support to help them arrive at the best and safest ways of investing their assets. This is a task for financial institutions, such as banks, securities companies and the like. Investing on the stock market is by no means easy when returns are fairly normal. If, for instance, inexperienced investors are enticed into buying shares with money they will soon need for other purposes, the outcome could be disastrous. The consequences can be just as dire if the stock market col-

lapses and undermines a person's pension savings just when they are most needed for retirement.

I will start by giving a description – albeit a brief one – of the challenges and risks associated with investing in shares. Not even professionals on the financial markets find it particularly easy to invest on the stock market with any degree of success. There are plenty of situations when sharply falling share prices cause feelings of anxiety on the part of the ordinary stock market investor. What, then, should an ordinary investor do to avoid running into difficulties? In the next section, I will give an outline, perhaps a simplified one, of some of the ideas and theories that explain the behaviour of financial markets.

What governs share yields?

Investing in shares involves risks that can be reduced by not putting all the eggs in one basket.

Much of the time-honoured advice that is still being given on how to invest in shares with any degree of success is based on the conclusions reached half a century ago by Harry Markowitz, then a 25-year-old postgraduate student at Chicago University:[1] Buying shares involves risks that can be reduced by not putting all your eggs in one basket. Buying one particular share entails two types of risk: one related to the specific circumstances of the company in question, the other to the economy in general and factors affecting the stock market as a whole. Markowitz demonstrated that with a portfolio consisting of shares in a wide enough range of companies and industries, the company-specific risks would be virtually eliminated. The portfolio is still exposed to the risk inherent in the stock market's general fluctuations, but the total risk has been reduced.

The efficient-market hypothesis says that it is impossible to consistently outperform the market and earn a higher return than average.

This insight was soon followed by the efficient-market hypothesis, which became a central tenet in the literature and has far-reaching implications.[2] It implies, for example, that it is impossible to consistently outperform the market and earn a higher return than the average for all shares. As the market always knows best, active management or even individual analysis by the ordinary share investor is pointless. The optimum is invariably, therefore, a

[1] Markowitz (1952).
[2] Fama (1970).

passive portfolio that generally mirrors the market. In this way, the amateur can earn just as good a return as the professional.

The competition between rational and irrational investors and the existence of arbitrage mean that the financial markets will continue to be efficient.

The efficient-market hypothesis presupposes that investors are rational and base share valuations on fundamental factors. If their market behaviour is not rational, it is assumed to be random, which means that individual actions have no impact on financial prices. When irrational players nevertheless act in a similar way, any influence on financial prices is eliminated by other, more professional agents via arbitrage, which is assumed to be quick and effective.[3] The irrational investors consequently lose money and ultimately they are forced off the market. In this way, the competition between rational and irrational investors, combined with the existence of arbitrage, mean that the financial markets will remain efficient.

A new school of financial thinking aims to explain why price deviations occur and to develop tools for predicting them.

In the past two decades, however, the notion of the efficient financial market has been challenged,[4] which will hardly come as a surprise to the actively involved players. This is mainly because the possibility of arbitrage has proved much more limited than previously assumed. Recent studies have demonstrated that there can be periods when prices deviate quite widely from more fundamental levels. A new school of financial science, Behavioural Finance, has emerged, dedicated to explaining why price deviations occur and to developing tools for predicting them. Academics in this field have turned to experimental psychology and other disciplines to explain the mind-set of financial market players.[5]

By the early 1980s, a notable paper by professor Robert Shiller of Princeton University had already demonstrated that share prices are considerably more volatile than would be expected if they were determined by the current value of expected future dividends.[6] This was a remarkable finding, since according to the

[3] This point is made by Friedman (1953) and Fama (1965) amongst others.

[4] Perhaps I should point out that the academic discussion between advocates of the efficient market and those with somewhat different views is still unresolved. Despite the establishment of the Behavioural Finance school, the former are still able to give as good as they get.

[5] For an introduction to Behavioural Finance, see Shleifer (2000). See also Shiller (2001). The senior economist at FöreningsSparbanken has written an introduction to the subject that has also attracted attention (see Fromlet, 2001).

[6] See Shiller (1981).

efficient-market hypothesis, share prices are "only" affected by changes in fundamental factors like profits or dividends.

Further studies later in the 1980s indicated that future developments can be explained by historical price movements. If, for example, one compares the share prices of two categories of company – extreme losers and extreme winners – it turns out that the group of companies whose share are worst-performing generate a better return in the coming five years than the group of best-performing companies, and vice versa. The undervalued shares recovered to their fundamental value in the second period, and the overvalued one fell in a corresponding way. Studies carried out over shorter periods confirm that in the short term shares that have begun to rise or fall continue to move in the same direction. The intuitive explanation for these findings is that stock markets frequently over-react – both upwards and downwards.[7]

Stock markets frequently over-react – both upwards and downwards.

One event that without any doubt helped to challenge the explanatory value of the efficient-market hypothesis was the stock market crash of 1987, when the Dow Jones index plummeted 22.6 per cent – the largest-ever one-day fall in the United States. This dramatic event demonstrated that share prices can fall even in the absence of any new fundamental event; a thorough search has failed to detect any specific or unexpected development that might account for the crash. It also appears to be the case more generally that many price movements are not caused by new information; a study of the fifty largest one-day share price movements in the United States in the post-war period confirms this.[8] Moreover, a number of studies show that price movements have occurred merely as a result of the company in question being included in or excluded from the Standard & Poor's 500 Index, without there being any new information about fundamentals.

The stock market crash in 1987 demonstrated that share prices can fall even in the absence of any significant change in fundamentals.

One explanation for over-reactions on financial markets can be derived from research in experimental psychology that shows that people often perceive a wider pattern on the basis of just a few observations that are in fact entirely random. In the present context, this means that a series of optimistic forecasts of a company's

One explanation for over-reactions on financial markets can be derived from experimental psychology.

[7] See De Bondt & Thaler (1985). See also Jagadeesh & Titman (1993).
[8] See Cutler, Poterba & Summers (1991).

earnings may lead investors to project the trend well into the future and accordingly generate an over-reaction; if the share price then rises, this is seen as confirming the analysis. A period of good returns also boosts the investor's self-confidence, making her/him bolder and more prone to take risks. Bit by bit the over-reaction takes shape and, if the worst comes to the worst, it leads to a bubble.[9]

Psychological studies show that we tend to direct our attention towards whatever is attracting the attention of others.

The biggest speculative bubbles often seem to originate in some popular theory that is seen as being supported by authoritative figures or analyses.[10] Topical examples are such concepts as "the new economy" or "the new economic era". Although they may be highly exaggerated or even completely wrong, so-called theories of this kind easily become conventional wisdom. As pointed out more than a century ago by the American psychologist William James, attention is an important factor behind human behaviour; as also demonstrated by later psychological studies, we tend to direct our attention towards whatever is attracting the attention of others. And this is a process in which the media frequently play an important role. It should be kept in mind, however, that the media operate in a highly competitive environment that makes it difficult for them to take a position that differs from the conventional wisdom. But media can accentuate, and even modify to some extent, the prevailing consensus.

Another phenomenon studied in experimental psychology – and one that works against taking an independent stance – is groupthink. It is not easy to stick to an opinion that differs from the views that a majority of the group appear to support; "everyone else can't be wrong" is a common thought. People who go their own way are liable to be regarded as have-beens with little influence or significance.[11] We are also liable to succumb to wishful thinking. Supporters of a football club or a political party, for instance, are not infrequently over-confident about its chances of winning.[12] Another familiar example is our general reluctance to go into an empty restaurant, preferring instead a crowded one – we simply rely on the judgement of others.

Our inherent behaviour can generate both optimistic and pessimistic over-reactions.

In this way our inherent behaviour can generate both optimistic and pessimistic over-reactions. Investors who follow the herd will push share prices far beyond what is funda-

[9] See, for example, Tversky & Kahneman (1974).
[10] Shiller (2000).
[11] Janis (1982).
[12] Babad (1987).

mentally warranted. If things go really wrong, the result may be a financial bubble that – just like any bubble – sooner or later bursts, with dramatic consequences.

Those with practical experience of financial markets will readily find themselves at home in this new theoretical and empirical analysis. In the 1990s a number of bubble-like situations arose, where prices ceased to reflect fundamental values. The one that springs first to mind is perhaps the IT bubble. Another is the bond market; in the early 1990s bond yields in many parts of the world fell dramatically, and when the U.S. Federal Reserve then raised its prime rate at the beginning of February 1994, bond yields rose sharply in the following months.

In the 1990s there were a number of bubble-like developments, such as the IT bubble, where prices ceased to mirror fundamental values.

To sum up, new interesting theoretical and empirical arguments have been put forward in the past two decades against the notion that financial markets are efficient. They show that via increased or decreased demand, investors may well pull financial prices away from their fundamental level. Over-reactions can occur so that excessive euphoria drives prices unduly high, just as undue pessimism can push them down too far.

New arguments have been put forward in the past two decades against the notion that financial markets are efficient.

How can households benefit from stock market yields?

The combination of Markowitz' approach to risk diversification and the efficient-market hypothesis meant that for a long time the best advice for anyone thinking of investing in equities has been to build up a broad portfolio that more or less mirrors the stock market as a whole, and then to keep it. In that way, even an amateur could benefit from the relatively higher long-term return provided by the stock market, when compared with other financial investments. Diagram 1 shows that such a diversified share portfolio would earn an average annual real return of approximately 7 per cent, which is appreciably more than other financial investments.

The best advice for investors in equities has been to build up a broad portfolio, and then keep it.

Diagram 2 shows that whereas the level of this return has tended to remain stable at 7 per cent over long periods of time, it has also deviated markedly from

Diagram 1. Real return on shares, bonds and bank savings

Per cent

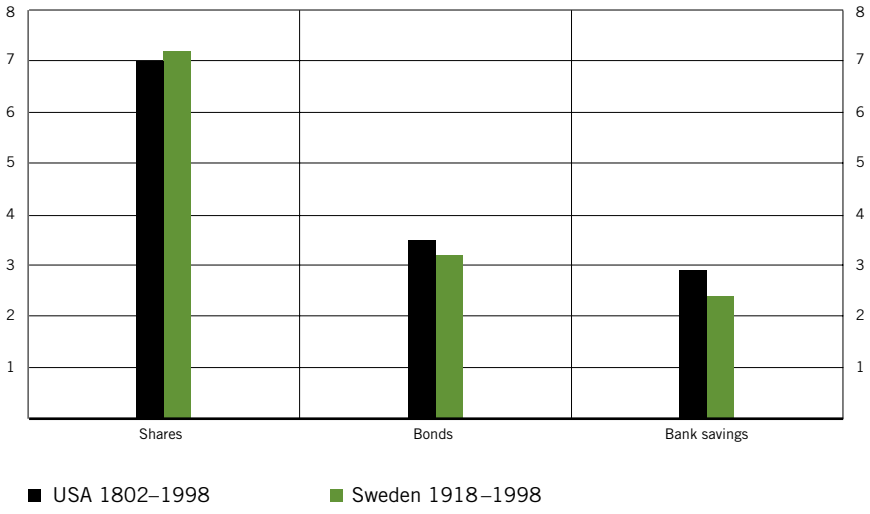
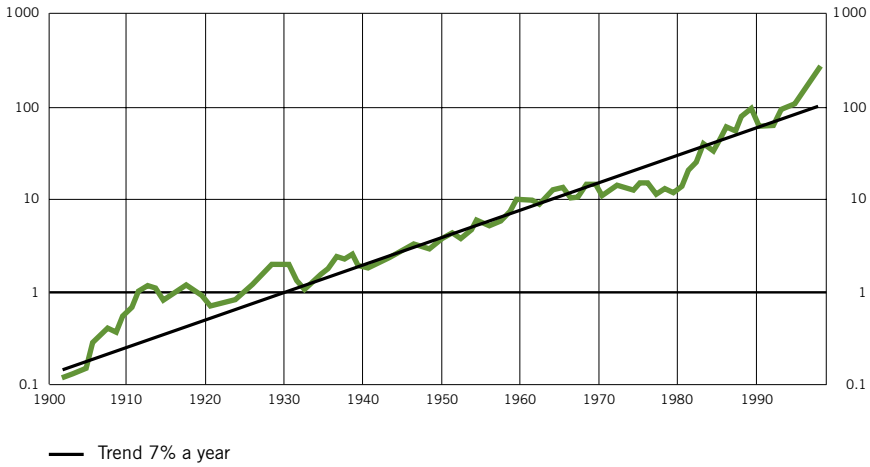


Diagram 2. Actual real return on shares and real return trend 1901–1998

Index: 1918=1



the trend during other periods. This raises the question of how long an investment horizon a diversified portfolio should have to yield a good return.[13]

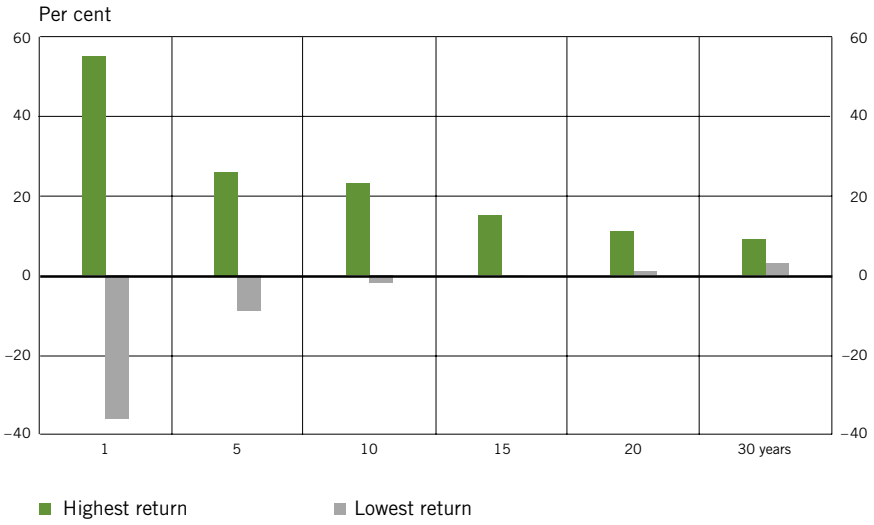
Diagram 3 plots the highest and lowest real returns for moving investment

[13] Diagrams 1-3 are taken from Bäckström (2000).

horizons of different durations between 1918 and 1996. It will be seen that with a five-year horizon in this period, the best average annual return was 26 per cent; with a badly timed initial purchase, however, the average annual return could be as poor as –9 per cent. The diagram also shows that such long horizons as twenty or thirty years did not guarantee a return on a par with the trend. The return was admittedly positive for all the moving periods but even for such a long horizon as twenty years the return on equity investments failed to match the return on bonds and bank deposits in 5 per cent of the cases.

Diagram 3 also shows that long investment horizons did not guarantee a return on a par with the trend.

Diagram 3. Highest and lowest real return on shares for different investment horizons 1918–1996



This raises the issue of timing, that is, when to start saving in shares. Doing this at a time – when stock market prices are high – may entail a long – in some cases very long – wait for a return that is anywhere near the trend. One popular way of coping with the problem of timing is to spread the investments over time. Saving regularly in particular shares or a mutual fund reduces the problem of timing, but experience shows that the investment plan should be spread over a long period. Another approach involves using various methods to assess when the stock market is high or low, and that is something of a challenge in itself.

One way of coping with the problem of timing is to spread the investments over time.

Even though many people adopt a strategy similar to this, basing it on proven experience, this is by no means the case for every household or individual. Some clearly aim for the "best bargain" and try in various ways to pick potential winners. This has been particularly evident in recent years. "Day trader" is a concept that has been coined to denote private investors who hope to make a quick profit from short-run trading in shares. IT and telecom shares became popular in the late 1990s as growing numbers of private investors were attracted by these categories, but less has been heard about these players recently, perhaps because falling share prices have led to losses.

A great many private investors have gone in for more risky strategies.

As can be seen, without a sufficiently diversified portfolio, investing in shares entails risks that are unnecessarily large in the sense that they are not commensurate with expected profits. Even so, a great many private investors have gone in for more risky strategies of this type.

According to American researchers, the IT boom induced new groups and inexperienced people to start investing in shares.

To my knowledge, there are unfortunately no studies that give a more systematic, detailed picture of how people in Sweden manage their saving in equities. A research paper from the United States points out that the IT boom, combined with markedly lower transaction costs as a result of new technology, induced many new groups and inexperienced people to start investing in shares.[14] Moreover, access to the Internet has led to a growing number of share transactions, but with poorer results. These new, less experienced players have tended to concentrate on the technology-oriented Nasdaq exchange. Whereas more professional and institutional investors account for 90 per cent of transactions on the New York exchange, approximately half of the transactions on Nasdaq are carried out by private individuals.[15] American investors are also becoming younger; the proportion who are under 35 and who carry out more than six transactions a year rose from 1.1 per cent in 1995 to 13.2 per cent in 1998. The same tendency applies to stockbrokers and financial consultants, more than half of whom began their careers in the 1990s. All this indicates that large numbers of inexperienced investors entered the market in the 1990s and, unfortunately, that a high proportion of their brokers and advisors unfortunately have relatively little experience, in the sense that they have been active on financial markets for only a short space of time. On the other hand, many of the newcomers working on

[14] D'Avolio, Gilder & Shleifer (2001).
[15] See also Blume (2000).

financial markets have had a thorough training that is often better and – perhaps more important – more up-to-date than that of many of their older colleagues.

Too many misdirected investments can be harmful for society in general when the economy and the stock market both turn down.

The fact that many inexperienced people have started investing on the stock market is not entirely a good thing. Besides the losses they may incur and the subsequent financial difficulties, there is a risk of the stock market functioning less efficiently because prices diverge widely from more fundamental levels. An example of this is the recent IT bubble. The ease with which firms attract capital in an over-valued market leads to misdirected investments which, if they become too prevalent, can be harmful for society in general when the economy and the stock market both turn back down. The behaviour of inexperienced investors can thus be a matter of concern for the entire economy.

According to the American study, corporations, analysts and banks all had incentives to persuade inexperienced people to invest in new enterprises.

The American study argues that there were incentives for firms, analysts and banks to persuade inexperienced people to invest in new enterprises on grounds that were not entirely sound. The new high-tech companies were often not generating a profit and had to rely instead on the issue of new shares as a means of paying wages and for equipment. For this to be feasible, stock markets need to be high. In this sense company boards had incentives to "doctor" their accounts and reports and earnings forecasts. At the same time, analysts and investment banks, whose income from handling share issues could be very high, lacked any incentive to take a closer look at these reports and forecasts. Inexperienced investors did not get the assistance and support they needed.

The paper also mentioned that in summer 2000, professional analysts were called to Washington for a congressional hearing on the quality of their investment advice. It turned out that in the period just before the Nasdaq index fell by no less than 60 per cent, fewer than 1 per cent of the recommendations had sell recommendations. The media caught on to the exuberant mood with reports of rapidly rising share prices, and the notion that there was easy money to be earned in the "new economy" became the conventional wisdom. In retrospect we know that while the prices of shares in IT and other new companies did rise rapidly for a number of years, they also fell very quickly. Could there be a better illustration of a financial market bubble?

At this point, I would welcome studies to throw more light on whether and, if so, to what extent, corresponding tendencies could be seen in Sweden. However,

One conclusion at present could be that certain tendencies that were evident in the United States may also have been present in Sweden.

for the time being we shall have to make do with casual observations and information of a more anecdotal nature. There is little doubt that sentiment on the Swedish stock market was also feverish in the late 1990s, with many inexperienced newcomers. The number of companies that were incurring losses and issuing shares nonetheless was, as far as I am aware, quite considerable. Nor did I detect a massive increase in sell recommendations before the IT bubble began to burst. So one tentative conclusion at present could be that certain tendencies that were evident in the United States may also have been present in Sweden.

How can households' risks be reduced?

It is essential for society in general that the stock market functions properly and effectively.

Besides the need for more facts about what actually happened while the IT bubble was growing, the course of events raises what is perhaps the more important question of what can be done to support households more effectively with their long-term saving in the future. It is essential for society in general that the stock market functions properly and effectively. At the same time, households need to earn an adequate return on their savings and should be in a position to identify and control different types of risk.

Modern technology has given us more information, which is not always synonymous with better information.

Basically it is a matter of education. Over the years, the Swedish Share Promotion Association and the Swedish Shareholders Association have done much to improve people's knowledge of these matters. Information that is prompt, up-to-date, correct and relevant is likewise crucial. Although modern technology is inundating us with information, more does not necessarily mean better, and so households must be helped to interpret the information and pick out that which is most important. Independent analysts and consultants, not to mention the media, have a key part to play in this respect, as they are able scrutinise and criticise corporate managements that are unduly optimistic or that provide only selective information.

But all this is already available. It can, of course, be claimed that if everyone simply became better at obtaining knowledge, information and critical assessments, more households than at present could possibly earn a decent return on

their stock market investments than is currently the case. Unwarranted euphoria could be avoided and share prices could become more stable.

At the same time it can be said that the problems go deeper than this and have to do with how the financial system functions today.

To a growing extent households face what are sometimes very difficult risk-management decisions.

In recent decades, the deregulation of financial markets, new financial products, market developments, improved data and telecommunication technology and the development of financial theory have led to unique and in its way remarkable growth and transformation of the financial system in many parts of the world. Even so, households are now facing what are sometimes very difficult risk-management decisions that were not called for or even possible earlier. Many people still lack the requisite knowledge for this and it may be asked whether people in general can be expected to have such knowledge in the future. Not everyone can be a specialist in risk management and financial theory.

One reason why households face a more difficult situation than before is, of course, the significantly greater exposure to the risks associated with stock market investments that stems from dis-intermediation. And this tendency has, if anything, been accentuated by the new pension system. It is now up to the individual to decide how some of the capital invested in her/his pension is to be placed. Moreover, the problems with complex risk management are exacerbated in that perhaps the most important component available to an individual is human capital, with all the types of risk associated with its management and yield. In addition, households come up against complicated decisions in other areas of life, some of which have to do with insurance products.

The financial system has already changed spectacularly and become increasingly sophisticated. But it will not stop there. It may therefore be asked whether banks and other financial institutions will start to focus more on consumers in the future, and move away from their current focus on products. One academic who believes they will is Robert Merton, a Harvard professor who predicts that banks and other financial institutions will either concentrate on producing financial products and services or mainly on distributing these financial services and remain close or move closer to consumers.[16] Banks today often provide both of these functions.

Merton considers that in such a new consumer-oriented financial system, individual households will need help in constructing well thought-out, individu-

[16] Merton (2000).

In a consumer-oriented financial system, individual households may need help in working out tailor-made plans for the life cycle that allow for all the risks.

alised plans for the life cycle that allow for all the potential risks. One type of risk that needs to be considered is stock market fluctuations, with the key parameters in this regard being investment horizons, how buying and selling is handled, and the degree of diversification across companies and geographical regions. Another parameter is, as indicated, the life cycle; the ability to save for the distant future is constrained by how much capital is likely to be needed in the more immediate future. The risk profile's co-variation with the return on human capital also has to be considered; perhaps a stockbroker, for example, should be wary of exposing her/his personal financial savings to the stock market as well as his job. Other risks lie in fluctuations in the price of a home that one either owns or is saving up for, as well as in the financing costs and, not least, the cost of refinancing; even if the mortgage rate is fixed, interest rates may be unacceptably high when the time comes to renew the loan. The risks inherent in price fluctuations apply to other capital goods, too. It is also necessary to consider the risks in any saving plan for children's education or for personal supplementary health insurance and life assurance. Perhaps it would even be advisable to allow for the risks that are covered today by insurance against fire, theft and accidents.

Controlling all these risks requires not only professional advice but also tailor-made financial products.

Merton's point is that there is a composite package of risks that is specific to each person and which needs to be identified and laid off. Controlling all these risks calls not only for professional advice in the preparation of such a plan but also for tailor-made financial products. The plan can include a variety of financial instruments but these must be easy for the individual household to understand in order to grasp and decide how to manage the potential risks. However, the actual construction and provision of composite financial products that are easy for consumers to understand may be extremely complex. The new producers of financial services therefore face considerable challenges.

Institutions are better equipped to manage risks than the individual household.

Let me illustrate all this with one of the examples Merton offers. Assume that a family wants to save for the children's university education. Even if the education is free, there may be costs for textbooks, food, lodging, travel and so on. And if it is a matter of studying abroad, the education itself may also have to be paid for. Relevant questions are what amount needs to be saved, the likely return on the savings, and the

total cost when the education is ultimately complete. One solution might be for the sophisticated financial institution to draw up a contract whereby the institution will finance all the specified costs from a given date and for a given period thereafter. The family gets a payment plan that specifies all the savings needed. In this example it is the bank or other financial institution that carries the risks, not the individual household. So besides obtaining advice about how to behave in order to save up for an education, the bank has also drawn up a contract – a tailor-made financial instrument – that specifies payments and deliveries. The institution is better equipped to control the risks involved than the individual household and therefore performs this function.

Innovations that households can use to reduce long-term risk exposure include financial products related to an index of property prices.

Another example of financial innovations that households can use to reduce long-term risk exposure is financial products related to an index of property prices. Given a well-established measure of this kind (with a status equivalent to that of the consumer price index, for instance), financial products ranging from futures that can be traded on markets to loan agreements with terms linked to a property-price index would enable households, for a reasonable sum, to reduce their exposure to the risk of a steep decline in property prices.

Perhaps one could claim that the process of becoming more consumer oriented has already begun.

This process is already under way. Banks have made varying degrees of progress in their customer orientation. Independent financial consultants are also beginning to emerge. More and more composite financial products are being designed and offered on the market. Banks now offer mutual funds that are managed by other fund managers than the bank's own. So perhaps one can say that the trend towards greater consumer orientation has already begun, but that the decisive steps still lie ahead.

It is clear that the rules regulating the financial system will need amending, perhaps accompanied by changes in the tax regulations, to get things moving in the direction outlined by Merton. New structures in the financial system will also be needed. Another requirement is appreciably more knowledge about how, for example, the system's productive components can identify and diversify the risks that may have to be taken. However, this opens up new and truly interesting perspectives for the future in many elements of the life cycle as well as for the development of the financial system itself.

Such a process might also lead to some savings finding their way back to the

financial institutions and to markets being dominated by more professional players. Perhaps it would also give financial markets greater stability. Individual households that wish to invest in shares but are uneasy about the risks could welcome it. That I believe is the case for many of those who succumbed to the exuberance in the late 1990s and subsequently lost the bulk of their savings. At the same time, a great many people in Sweden will no doubt want to go on investing directly in shares.

In order to reduce the risk of financial market imbalances, it is important that we have a well thought-out infrastructure that functions properly.

Let me conclude by presenting the perspective of a governmental body on this matter, in which the Riksbank, Finansinspektionen (Sweden's financial supervisory authority) and the Ministry of Finance all play a significant role. In order to reduce the risk of financial market imbalances, it is important that we have a well thought-out legislative, regulatory and supervisory infrastructure that functions properly and is capable of responding to any changes in the rest of the world. This is a constant challenge that requires the participation and commitment of all concerned.

References

Babad, E., (1987), "Wishful Thinking and Objectivity among Sport Fans", *Social Behavior: An International Journal of Applied Social Psychology*, No. 4, s. 231–240.

Blume, M., (2000), "The Structure of the U.S. Equity Markets", Rodney L. White Center for Financial Research Paper 17-00, The Wharton School, University of Pennsylvania.

Bäckström, U., (2000), *Tankar om aktiesparande*, Ekerlids Förlag, Stockholm.

Cutler, D., Poterba, J. & Summers, L., (1991), "Speculative dynamics", *Review of Economic Studies*, 58:520–46.

D'Avolio, G., Gildor, E. & Shleifer, A., (2001), "Technology, Information Production and Market Efficiency", Paper presented at the *Federal Reserve Bank of Kansas City Symposium* in Jackson Hole, August.

De Bondt, W.F.M. & Thaler, R., (1985), "Does the stock market overreact?", *Journal of Finance*, 40:793–805.

Fama, E., (1965), "The behavior of stock market prices", *Journal of Business*, 38:34–106.

Fama, E., (1970), "Efficient capital markets: A review of theory and empirical work", *Journal of Finance*, No. 25, s. 383–417.

Friedman, M., (1953), "The case for flexible exchange rates", In *Essays in Positive Economics*, Chicago: University of Chicago Press.

Fromlet, H., (2001), "Behavioral Finance – Theory and Practical Application, Business Economics, July, s. 63–69.

Janis, I.L., (1982), *Groupthink*, Second Edition, Houghton Mifflin Company, Boston.

Jegadeesh, N. & Titman, S., (1993), "Returns to buying winners and selling losers: implications for stock market efficiency", *Journal of Finance*, 48:65–91.

Markowitz, H.M., (1952), "Portfolio Selection", *Journal of Finance*, Vol. VII, No. 1 (March), s. 77–91.

Merton, R.C., (2000), "Finance and the Role of Financial Engineering in the 21st Century", unpublished, Harvard University.

Shiller, R.J., (1981), "Do stock prices move too much to be justified by subsequent changes in dividends", *American Economic Review*, 71:421–36.

Shiller, R.J., (2000), *Irrational Exuberance*, Princeton University Press, Princeton New Jersey.

Shiller, R.J., (2001), "Bubbles, Human Judgement and Expert Opinion, *Cowles Foundation Discussion paper No. 1303*, Yale University.

Tversky, A. & Kahneman, D., (1974), "Judgement under uncertainty: Heuristics and biases", *Science*, 185:1124–31.

Shleifer, A., (2000), "Inefficient Markets", *Clarendon Lectures in Economics, Oxford University Press*.

The Riksbank's foreign exchange interventions – preparations, decision and communication

By Lars Heikensten and Anders Borg
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On 31 January 2002, the Executive Board of the Riksbank decided to issue a clarification of its procedures regarding the preparations for, decision on and communication of foreign currency interventions. The purpose of this article is to present the new system and clarify some of the considerations that lie behind it. The system for interventions shall be characterised by openness and clarity and based on the preparation and decisions being handled in the same way as other monetary policy measures. Interventions are primarily a means of signalling changes in monetary policy motivated by price stability. They will continue to be used with restraint.

Interventions and their management

In connection with the transition to the new Sveriges Riksbank Act in 1999, the Executive Board chose to publish a clarification of the system and application for monetary policy decisions.[1] This mainly dealt with issues related to the inflation target and to how decisions on the repo rate would be made under the new system. The focus of this clarification was natural given the fact that the repo rate was the most important instrument for achieving the objective of price stability set by the Riksdag and given that the new legislation entailed new forms for decisions on the repo rate.

During 2001 the Riksbank intervened on the foreign exchange market for the first time under the new legislation. In the light of the experiences from this, the Executive Board made a decision on 31 January 2002 to issue a clarification

Claes Berg, Villy Bergström, Jörgen Eklund, Kerstin Mitlid, Javiera Ragnartz, Staffan Viotti and Anders Vredin, amongst others, have contributed with views on the system for interventions on the foreign exchange market.

[1] Heikensten (1999) and Sveriges Riksbank (1999).

On 31 January 2002 the Executive Board decided to publish a clarification of the procedure for preparing and deciding on interventions on the foreign exchange market.

of the preparation and decision processes regarding interventions on the foreign exchange market.[2] This clarification partly fulfils the same function as the earlier clarification regarding the repo rate. The aim is to explain how the Riksbank views interventions on the foreign exchange market and how these should be handled both internally within the Riksbank and when they are communicated externally. As far as we are aware, there are no corresponding documents available externally from other central banks. However, certain other countries' fundamental central bank legislation contains regulations of the type established here.[3] This article presents the clarification and provides further details on some of the arguments behind it.

Firstly, there is a discussion of how interventions affect the exchange rate and then of the motives for making interventions on the foreign exchange market. This is followed by a run-through of the arguments in favour of openness with regard to the preparation and decision-making processes in this field. Finally, we describe the rules of procedure for the preparation, decision-making and implementation of the interventions and how minutes of meetings regarding interventions will be designed and published in future.

The Riksbank's most important tasks are to maintain price stability and to promote a safe and efficient payment system.[4] At present, the Riksbank primarily influences the development of price stability by determining the overnight rate. In theory, it would also be possible to use other instruments, such as operations directly on the bond market or a cash requirement for the banks, but in the experience of the Riksbank and other central banks, steering of the overnight right is the most effective means of implementing monetary policy.

The Riksbank can thus take many different measures, including sterilised interventions in the foreign exchange market. However, it is made clear in the rules of procedure established that interventions will continue to be used with

[2] Sveriges Riksbank (2001e).

[3] See for instance the Bank of England Act (1998), Humpage (1996), Nelly (2001) or the Reserve Bank of New Zealand (2000).

[4] The Riksbank has the task, pursuant to Chapter 1, § 2 of the Sveriges Riksbank Act, of maintaining price stability. The Riksbank shall also promote a safe and efficient payment system. Its monetary policy is formulated with the aim of limiting the annual rate of price increases to 2 per cent, measured as CPI inflation, with a tolerated deviation interval of ±1 percentage point. According to the preliminary work (Government Bill 1997/98:40) for the Sveriges Riksbank Act, the Riksbank should also, without prejudicing the price stability target, support the objectives for general economic policy with the aim of attaining a sustainable level of growth and high employment (the secondary objective of monetary policy). Pursuant to Chapter 7, § 3 of the Sveriges Riksbank Act, the Riksbank may buy, sell and mediate foreign currency, etc. for foreign exchange policy purposes.

restraint. The Riksbank's actions are normally guided by an assessment of inflation outlook over the coming years. Short-term exchange rate fluctuations are of little significance in this context.

The rules of procedure that have been established make it clear that interventions will be used with restraint.

The system for interventions decided upon by the Riksbank is designed for a regime with a floating exchange rate and inflation targeting. If this regime should change, for instance, if Sweden were to join EMU, there would be reason to reconsider the procedures for interventions on the foreign exchange market.

The system for interventions decided upon by the Riksbank is designed for a regime with a floating exchange rate and inflation targeting.

One cannot rule out the possibility of situations arising that have not been foreseen in the Riksbank's rules of procedure. It is therefore stated in the rules of procedure that the Riksbank will in such a case take the measures deemed appropriate to fulfil its objectives.

Effects of interventions[5]

An intervention means that the Riksbank buys or sells quantities of Swedish kronor in the foreign exchange market with the aim of affecting the development of the exchange rate.[6] The effect of the intervention on domestic liquidity is neutralised via the bank's normal market operations.

It is natural for the system used for interventions to be based on how the Riksbank perceives the measure to affect the exchange rate and the possibilities of attaining the objectives for monetary policy. The academic literature in this field has emphasised several channels through which sterilised interventions can affect the exchange rate.

[5] The Jurgensen Report (1983), which was the first study based on extensive access to actual intervention data and was compiled at the initiative of the central banks and governments within G7, came to the conclusion that the effects of sterilised interventions are not systematic and enduring. Edison's (1993) summary of studies from the 1970s and 1980s is in line with the Jurgensen Report ("The results overwhelmingly suggest that (…) it remains difficult to find empirical evidence showing that intervention has a long-lasting, quantitatively significant effect" [p. 55]). However, surveys by Dominguez & Frankel (1993) and Sarno & Tylor (2001) provide a more complex picture, as well as some support for the idea that interventions may have greater effects than has previously been assumed. Sarno & Tylor claim that studies in recent years indicate a "significant effect of official intervention on both the level and the change of exchange rates" (p. 862). Other reviews, for instance, Ballie, Humpage & Osterberg (1999) or Ragnartz (2001), assert that the main conclusion is nevertheless that the effects are uncertain and difficult to judge.

[6] The Riksbank has also implemented currency exchanges with Swedish kronor in certain other contexts. This includes exchanges on behalf of the Swedish National Debt Office.

Influence via signalling[7]

The most important reason for interventions in the foreign exchange market having a more durable effect on the exchange rate is that they give a signal regarding future monetary policy.

The most important reason for interventions in the foreign exchange market having a more persistent effect on the exchange rate is that they give a signal regarding future monetary policy.[8] The implementation of the interventions and communication in connection with this enable the Riksbank to show what its intentions are with regard to monetary policy, e.g. if a change in the interest rate is considered necessary.[9] The influence on the exchange rate then comes through a change in the market's pricing of the future interest rate policy.

There is no simple means of evaluating the effects of the interventions with the aid of their immediate effects on the exchange rate.

In this context, it is important to point out that although the standard text book models in this field indicate that monetary policy has a clear effect on the exchange rate, the relationship between the interest rates decisions and the exchange rates is ambiguous and the impact is uncertain.[10] The exchange rate is affected by a large number of factors that are not dependent on monetary policy, such as commodity prices, portfolio flows and relative productivity growth. An exchange rate is a relative price

[7] See Mussa (1981).

[8] When interventions are made with the aim of signalling the direction for future monetary policy, the distinction between sterilised and non-sterilised interventions becomes less important, as the interventions will have effects on the overnight rate, when the interest rate decisions that were being signalled are implemented.

[9] The empirical literature on the signalling channel is relatively new, but growing rapidly, and provides some support for the idea that interventions from a credible central bank, which are followed by interest rate decision, do affect the exchange rate (Ballie, Humpage & Osterberg [1999], Edison [1993], Dominguez & Frankel [1993], Sarno & Taylor [2001]). One example where the purpose of the interventions has been to signal the direction for future monetary policy is the measures taken by the Riksbank in June 2001 (Sveriges Riksbank 2001a, 2001b, 2001c and 2001d). A difficulty with empirical studies is distinguishing the effects of interventions and the interest rate decisions they signal (Edison [1993]). Another complicating factor is that central banks often do not have full control over the interventions, as in many countries these are made in consultation with the government. If the party sending the signal does not have full control over the signalling or the ensuing decisions, it is difficult to evaluate the measures. A survey made by Neely showed that few central banks regarded interventions as a means of signalling future monetary policy or of attaining an inflation target (2001). Some studies also show that interventions have not comprised a signal of future interest rate decisions, or even that interest rate decisions and interventions have moved in opposite directions (for instance Kaminsky & Lewis 1996). Lindberg (1994) finds some support in Swedish data from the fixed exchange rate regime period for the theory that sterilised interventions can have an effect through the signalling channel. Aguilar & Nydahl's (2000) study of interventions – after the Riksbank had moved over to a floating exchange rate regime – provides some support for the theory that the exchange rate has been affected on some occasions, but the results are vague.

[10] It is normally assumed that an increase (decrease) in the interest rate contributes to appreciation (depreciation) of the exchange rate (for instance, Dornbusch [1976]). Although the relationship between steering interest rates and the exchange rate is not unambiguous, some studies indicate that such an effect exists (for example, Bonser-Neal, Roley & Sellon [1998]).

between two countries' currencies and expectations of the future exchange rate as well as of future monetary policy in both countries have an effect on the exchange rate now. In addition to the direct effect of a change in the interest rate – via the return on interest-bearing assets with a short time to maturity – there is also an indirect effect, through underlying economic conditions such as inflation expectations, resource utilisation and asset prices denominated in the currency. As the impact of the interest rate on the economy has a considerable time lag and varying strength, it is not likely that the effects on the exchange rate will be immediate, either. This also means that interventions aimed at signalling changes in the future direction of monetary policy may affect the exchange rate over a longer period of time. There is thus no simple means of evaluating the effects of the interventions with the aid of their immediate effects on the exchange rate.[11]

The change in the assessment of future monetary policy achieved through intervention could normally also be achieved through other methods, such as statements by prominent representatives of the Riksbank or information published in the Inflation Reports.[12]

Influence via the method of functioning of the foreign exchange market

Interventions can also have effects on the exchange rate connected with market inefficiencies. The exchange rate can deviate during longer or shorter periods from the level that is motivated by economic fundamentals.[13] This can be the case even when the assessment of what is fundamentally motivated is shared by certain foreign exchange market participants. The deviation could be due to the functioning of the market, for instance elements of herd behaviour. In this type of situation, it is conceivable that interventions could contribute to a correction of the pricing.[14]

[11] Schwartz (2000).

[12] When making an intervention, a central bank takes a certain financial risk (see Mussa [1981]). The probability of a financial loss increases if the interest rate decision signalled through the interventions is not implemented. The interventions strengthen the incentive to act in accordance with the signals.

[13] See, for instance, Flood & Taylor (1996).

[14] The majority of the operators on the foreign exchange market attach little importance to underlying economic conditions when they operate in the short term (see, for example, Cheung & Chinn [1999], Cheung & Wong [2000] or Dominguez [1999]). Instead, most of them are governed by simple rules of thumb, for instance, technical analysis. Although there are no studies for the Swedish market, it can be assumed that the pattern is the same there. As trade of this nature can strengthen market fluctuations, it could contribute to the exchange rate deviating from fundamental factors. In such a situation, interventions could provide support to and co-ordinate the minority operators acting on the basis of more fundamental economic conditions (Dominguez & Frankel [1993] and Sarno & Taylor [2001]). One example of this is how the dollar interventions in the mid-1980s contributed to, or triggered, a correction of the dollar rate, although this has been questioned (Feldstein [1986]). Another is the interventions made by the Reserve Bank of Australia in autumn 1998. However, there is little empirical support for this mechanism in the academic literature.

There is some empirical support for the theory that orders on the foreign exchange market can have some sustainable effect on the exchange rate.

It is also conceivable that some orders as a result of the microstructure of the market could have an effect on the pricing.[15] A central bank operates on the foreign exchange market via different banks, which set prices in its currency. The way in which these banks normally act tends to reinforce the effect. There is also some empirical support for the theory that orders on the foreign exchange market can have some sustainable effect on the exchange rate. There could be reason to assume that this order effect from interventions will be particularly tangible in situations were liquidity on the foreign exchange market is low (thin trading).[16]

Historically, it has been common to assume that central banks can affect the exchange rate through the relative supply of domestic and foreign assets, what is normally termed the portfolio-balance channel.[17] It is the experience of the Riksbank and other central banks that this mechanism is currently of little importance.[18]

Conclusion

Experience indicates – as does the research carried out – that it is very difficult to assess the effects of foreign exchange interventions.

One reason why interventions can affect developments in the exchange rate is that they can signal a change in the future direction of monetary policy. Interventions can also affect the exchange rate more directly if the foreign exchange market, for various reasons, does not function well. The conditions for this type of influence are probably better in situations with a liquidity shortage. The effects of interventions that are not perceived to be a complement to interest rate decisions and in line with monetary policy as a whole, can be assumed to be feebler. The experiences of the Riksbank and other central

[15] Evans & Lyons (2000) and (2001).

[16] Fatum (2000) also finds some support for the theory that interventions affect the exchange rate in the short term. It should be pointed out that few studies have examined the order effect in an empirical manner.

[17] Given that actions on the financial markets are assumed to be characterised by risk aversion and that assets denominated in different currencies are imperfect substitutes, investors will not be indifferent to a change in the currency composition of their portfolios in the event of interventions. As the interest rate cannot be assumed to change, the exchange rate must appreciate to compensate investors for the increased holding of assets in the intervention currency.

[18] Most of the studies have not shown that interventions have a significant and lasting effect on the exchange rate through the portfolio-balance channel (Edison [1993]), which has also reduced interest in studies focussing on this field in recent years. Rogoff (1984) and Lewis (1988) even find effects that are the opposite of what was expected. Rogoff's study, which was one of the first to be based on actual interventions and short-term data, was a subreport to the Jorgensen Report and laid the foundations for the conclusions reached in that report. The studies that do find a connection also indicate that the effect is very weak and short-lived, for instance Ghosh (1992).

banks indicate, as does the research in this field, that it is very difficult to assess the effects of interventions in the foreign exchange market.

Motives for interventions

It is the Riksbank's task to maintain price stability and to promote a safe and efficient payment system.[19] According to the preparatory work for the Sveriges Riksbank Act, the Riksbank shall also support objectives for general economic policy if this can be done without neglecting the price stability target.

The inflation target as a motive

Monetary policy is aimed at achieving the inflation target. The Riksbank's main instrument for influencing inflation is the repo rate. This is normally adjusted so that the assessment of inflation for the coming years lies in line with the Riksbank's target. In addition to adjusting the interest rate, the Riksbank can resort to interventions in the foreign exchange market and a number of other measures for the purpose of maintaining price stability.

In addition to adjusting the interest rate, the Riksbank can resort to interventions in the foreign exchange market for the purpose of maintaining price stability.

The most obvious case for a central bank with an inflation target considering interventions is when the interest rate instrument no longer functions effectively. One such situation is when the steering interest rate is zero and the real interest rates are nevertheless unjustifiably high as a result of the economy being in a deflation process, with a general and persistent fall in prices.[20] Interventions with the aim of achieving more expansionary monetary conditions through a weakening of the exchange rate would be a possible measure here. The fact that there is a possibility, which is not negligible, of getting into a situation where the interest rate is zero and thereby constitutes a restraint for monetary policy, is a strong reason for having interventions in the monetary policy arsenal. It is also a reason for establishing firm principles for how interventions should be used.

The most obvious case for a central bank with an inflation target considering interventions is when the interest rate instrument no longer functions effectively.

It is theoretically conceivable to try to stabilise inflation in the short term by

[19] For a review of the goals of interventions stated by central banks, see Neely (2001).

[20] For instance, Bernanke (1999), Meltzer (1999) and Svensson (2001) have discussed how the problems of zero interest rates and deflation in Japan can be managed through interventions on the foreign exchange market.

influencing the exchange rate and import prices. Changes in the exchange rate can, if they are perceived as durable, have a direct and relatively rapid effect on the prices of at least some imported consumer goods. Effects may also come with a longer time lag through resource utilisation, partly because the demand for Swedish export products is affected. In practice, all central banks pursuing inflation targeting have made the assessment that monetary policy should not rely on such mechanisms.[21] This is partly connected to the fact that it is difficult in practice to have a durable effect on the exchange rate.

Interventions could be regarded as a means of contributing to the exchange rate developing in future in such a way that inflation remains in line with the Riksbank's target.

As monetary policy's direct effects on the exchange rate are not unambiguous and as the objective for monetary policy is to stabilise inflation in a medium-term perspective, there is normally no motive to intervene on the foreign exchange market to counteract short-term fluctuations in the exchange rate. However, the issue is complicated by the fact that substantial deviations from the expected exchange rate path on which monetary policy is based can increase uncertainty as to whether the monetary policy target will be achieved. Interventions in the foreign exchange market could from this point of view be regarded as a means of contributing to a future development of the exchange rate that aided the inflation rate to develop in line with the Riksbank's target in the relevant time perspective. The motive for resorting to interventions in this type of context could be that they are estimated to contribute to attaining the inflation target with less negative real economy side-effects than other alternative measures.

A schematic description of how a central bank with an inflation target can use foreign exchange interventions in a situation of this nature can provide an illustration here. If we assume that the exchange rate weakens or strengthens in a manner that cannot be considered fundamentally motivated, and the central bank also estimates that this "exaggerated" exchange rate change will lead to a risk that the inflation target is not met, there is motivation for monetary policy measures to bring inflation back in line with the target. The actions are then based on an assessment of whether the market conditions are such that the scope of the intervention will be sufficient to affect the exchange rate (the order effect) and/or that certain market operators can be assumed to realise that the exchange rate is deviating from underlying economic conditions (co-ordination effect). In this situation it is possible that a foreign exchange intervention could provide a

[21] See, for instance, Apel, Nessén, Söderström & Vredin (1999), Heikensten & Vredin (1998) or Svensson (1999).

better balanced development in the economy than if the interest rate alone were adjusted. This is because the interest rate does not merely affect the exchange rate and in this case it is the inflation impulses arising from the exchange rate that the central bank wishes to influence. If the interventions have some effect, but do not succeed entirely in eliminating the threat to the inflation target caused by the development of the krona rate, interest rate changes may also prove unnecessary. However, they do not need to be as great as if interventions were not used. If the interventions have no effect at all, the interest rate change signalled will be implemented.

The exchange rate as a motive

As long as monetary policy is conducted with a floating exchange rate, the Riksbank has no target for the exchange rate. If the inflation rate is in line with the target and there is confidence that the situation will remain this way, there is no reason to try to steer the exchange rate to a particular level by means of currency interventions. Nor is there usually any reason to intervene to stabilise the exchange rate.

There is usually no reason to intervene to stabilise the exchange rate.

An exchange rate that is substantially out of line with that perceived as the equilibrium rate could affect resource utilisation in the economy or economic growth in an undesirable way, as could rapid changes in exchange rates that are not motivated by real economy fundamental factors. In these situations, there may be a motivation for interventions, if it is considered possible to affect the foreign exchange market in the desired direction. Interventions would then contribute in the long run to supporting the objectives of the general economic policy, in line with the secondary objective for monetary policy.

In a situation where the exchange rate is substantially out of line with the equilibrium rate, interventions could be motivated, if it is deemed possible to influence the foreign exchange market in the desired direction.

However, interventions in this type of context involve considerable problems. It is difficult to determine what is an equilibrium rate. Additionally, an ambition to maintain a particular exchange rate or to stabilise the development of the exchange rate could come into conflict with the inflation target or create greater uncertainty regarding monetary policy.

One situation where a central bank might want to intervene on the foreign exchange market, even when exchange rate developments do not comprise a threat to the inflation target, could be if there was reason to try to change the

In a situation where a very strong or weak exchange rate has a negative effect on the allocation of resources between the domestic economy and the sectors subject to competition from abroad, there may be a motive for interventions.

composition of the monetary conditions. In a situation where a very strong or weak exchange has a negative effect on the allocation of resources between the domestic economy and the sectors subject to competition from abroad, there may – at least in principle – be a motive for interventions in the foreign exchange market. Even if the total monetary conditions are well balanced, there could be reason to try to change the balance between the interest rate and the exchange rate. It could be claimed that the UK is in this type of situation. Some similar arguments were put forward at the time of the Riksbank's interventions in 1998.[22] However, one complication here is that the interventions and interest rate adjustments move in opposite directions.

The method of functioning of the foreign exchange market as a motive

The Riksbank may, in certain situations, wish to act to promote a satisfactory method of functioning in the foreign exchange market.

The Riksbank may also, in certain situations, wish to act to promote a satisfactory method of functioning in the foreign exchange market.[23] This is connected with, for instance, the fact that the foreign exchange market comprises an important link between the payment systems in Sweden and other countries. However, it is not evident that the foreign exchange market should function less efficiently than other markets, e.g. the stock market or treasury bond market.[24] The methods and measures normally used to influence the method of functioning of financial markets, such as oversight, supervision and regulation, are therefore usually to be preferred when it comes to the foreign exchange market too, rather than direct intervention.

There is a difficulty in this context in that severe disturbances to the functioning of the market in recent years have been connected with shocks of a macroeconomic or financial nature. The fact that pricing here is under unsettled

[22] Bäckström (1998).

[23] It is important to distinguish between interventions made for other purposes, where the method of functioning of the market is used to achieve a particular effect, and interventions where the purpose is to influence the method of functioning. The Riksbank's measures 1996-97 can be viewed partly in the light of this. One of their aims was to reduce volatility in the market (Aguilar & Nydahl [2000]).

[24] Schwartz (2000), amongst others, has demonstrated that intraday volatility on the foreign exchange market is tangibly lower than, for instance, on the bond or stock markets. The same conditions apply in Sweden for both the most recent five-year period and the most recent ten-year period.

conditions cannot usually be regarded as an indication that the functioning of the market is less efficient than normal. One particular difficulty is that conflicts of objectives can also arise. For instance, in the event of a crisis in the financial system, it is probable that demand and price developments in the economy would be subdued. In this type of situation it is natural for the central bank to lower the interest rate, which can also be assumed to lead to a depreciation in the exchange rate.

There is no evidence that interventions contribute to lower volatility on the foreign exchange market. No support has been found in the study made by the Riksbank, or other central banks' studies or in other research, for the theory that interventions systematically contribute to lower volatility.[25] This may be connected with the fact that interventions in themselves supply the market with new information, which can be assumed to increase volatility in the short term.[26] It may also be due to the increase in uncertainty regarding the direction of future monetary policy.[27]

No support has been found in the study made by the Riksbank, or other central banks' studies or in any other research, for the theory that interventions systematically contribute to lower volatility.

Conclusion

Under the current regime the Riksbank does not have any target for the exchange rate in terms of targeting a particular exchange rate level or having an ambition to stabilise exchange rate developments. Interventions in the foreign exchange market are primarily a means of signalling and emphasising changes in monetary policy that are used to maintain price stability. Without neglecting the inflation target, and in exceptional cases, the Riksbank can, if it considers it to be possible and appropriate, act in the foreign exchange market to influence exchange rate developments with the aim of supporting the general objectives of economic policy. The Riksbank can also, in exceptional cases, resort to interventions to promote market functionality.

Interventions on the foreign exchange market are primarily a means of signalling and emphasising changes in monetary policy in order to maintain price stability.

[25] See, for instance, Aguilar & Nydahl (2000), Ballie & Osterberg (1996), Dominguez (1999) and Naranjo & Nimalendran (2000).
[26] Dominguez (1999).
[27] Broaddus & Goodfriend (1996).

Some bases for the system regarding interventions

The procedure for interventions that has been agreed states that it is obvious that preparation and decision-making in this field should be characterised by a high degree of openness and clarity. At the same time, it should of course be possible to take any measures rapidly and efficiently.

Arguments in favour of openness and clarity

Normally, the policy pursued will be more effective if it is communicated in an open and clear manner.

The essential motives for openness and clarity in monetary policy also apply to currency interventions. The Riksdag (Swedish parliament) has delegated decision-making on monetary policy to the Riksbank. This also includes currency interventions. When decision-making on important issues has been delegated to an independent authority, it is desirable that the grounds on which the decision is made are reported in an open and clear manner.[28] This makes it easier for the Riksdag to assess the work of the Executive Board, for instance. Openness also makes it easier for external analysts to assess the quality of the information on which the decision is based. Normally, the policy pursued will also be more effective if it is communicated in an open and clear manner.

The fact that intervention decisions in Sweden, unlike in many other countries, are made by the central bank without consultation with the government, contributes to making the policy clear; there can be no uncertainty with regard to the central bank's operational control over monetary policy.[29]

A clear system for preparation and decision-making regarding interventions could help increase confidence in both the underlying assessment made and the decision taken. This can be of particular importance given that interventions on the foreign exchange market have often been associated with a lower degree of openness than that characterising other monetary policy in Sweden in recent years. The facts that interventions are an instrument used relatively rarely in a

[28] For a general discussion on delegation, transparency and evaluation, see for instance Blinder (1998), Heikensten & Vredin (1998) or Svensson (1999).

[29] If one assumes that interventions primarily have effects via signalling the direction of future monetary policy, it is surprising that they have been associated with a lower degree of clarity and transparency than, for instance, interest rate decisions. This has been referred to as "the secrecy puzzle" in academic literature (Sarno & Taylor [2001]). For a discussion of principles, see Broaddus & Goodfriend (1996). Fabian Reeves has launched a model framework to show how the relationship between interventions, openness and credibility can be discussed(1998). There are no empirical studies that examine the relationship between openness and the efficiency of the interventions.

regime with a fixed exchange rate and that Sweden may join the EMU at some point in the future, could also contribute to uncertainty arising as to whether a particular importance is attributed to the exchange rate on top of what is motivated by a total assessment of future inflation. There may also be a particular value in ensuring that the preparation and decisions regarding interventions are handled in a way as similar as possible to that for monetary policy decisions. This could provide stability in the internal processes and reduce the risks of mistakes in internal management and external communication. Openness and clarity could thus support the interventions' function as instrument for signalling.

A clear system for preparation and decision-making regarding interventions could help increase confidence in both the underlying assessment made and the decision taken.

The balance between openness and efficiency

In addition to openness and clarity, efficiency is also an important basis when designing a system for interventions in the foreign exchange market. In those cases where openness and clarity increase efficiency, there is no problem.[30] However, situations could arise where this is not the case, and a balance has to be found between efficiency and openness.

The difficulties in implementing interventions in an efficient manner are essentially connected to the fact that the Riksbank's direct influence on the foreign exchange market via interventions is limited. Interventions are more complicated to implement with the intended effects than are repo rate decisions, as the Riksbank can normally determine the short market rate through its position on the daily lending market, while in currency interventions the bank is merely one operator among many in the market. Interventions can thereby have a greater effect if the Riksbank does not show complete openness with regard to its readiness to intervene, the length of its operations, the time the deci-

The difficulties of implementing the interventions efficiently is essentially connected with the fact that the Riksbank's direct influence on the foreign exchange market via interventions is limited.

[30] The fact that central banks have chosen a lower degree of openness could, according to Dominguez & Frankel (1993), be connected with the fact that responsibility for foreign exchange policy is often shared between governments and central banks. In certain situations, central banks may have intended to limit the effect of the interventions on the exchange rate because the decisions have not been consistent with the direction for interest rate policy and have been taken outside of the bank. Dominguez & Frankel write: "Central bankers that care about their reputation for sending truthful signals regarding future policy will prefer to keep false signals quiet" (p. 61).

sion was made, and the scope, currencies or counterparties involved in the intervention.

It is possible, for instance, that knowledge of the Executive Board's considerations and decisions could have a detrimental effect on the outcome of the measures taken.[31] There is also a possibility that information regarding the scope of the interventions could contribute to action by market operators that limited the effect of the interventions. If the Riksbank provides more information on its actions than the other operators in the foreign exchange market, these may gain an information advantage that can be utilised in a way that counteracts the desired effect.

There is no self-evident balance between openness and clarity on the one side and efficiency on the other side.

There is no self-evident balance between openness and clarity on the one side and efficiency on the other side. Taking into account that the motive for openness is primarily to enable an assessment of the Executive Board's activities, it appears natural that openness should be greatest with regard to the fundamental discussion of motive, etc. The risks involved in publishing information that shows the decision-making situation within the Executive Board will also decline over time. Taking into account that the motive for openness is primarily to enable an assessment of the Executive Board's activities, it appears natural that openness should be greatest with regard to the fundamental discussion of motive, etc. The risks involved in publishing information that shows the decision-making situation within the Executive Board will also decline over time.[32]

The Riksbank has chosen, particularly with regard to the most recent interventions in July 2001, to show considerable openness in its operational actions. In its contacts with counterparties the Riksbank has stated that the price query is for the purpose of making an intervention. When questioned by the general public,

[31] Some studies provide support for the hypothesis that an information advantage for the central bank increases the effectiveness of the interventions, partly through strategic actions by counterparties in the gambling-like situations that can arise on the market (Battachaarya & Weller [1996], Naranjo & Nimalendran [2000], Cukierman & Meltzer [1986} and Vitale [1999]).

[32] The intervention in June was notified in a speech by Riksbank Governor Urban Bäckström the day before the measure was taken (2001) and on the same day by First Deputy Governor Lars Heikensten (2001). At the same time as the interventions were implemented, a press release was published (2001a), presenting the motives for the measure. The day after the interventions, Mr Bäckström was interviewed in Swedish radio. The Riksbank's press release had been prepared in the same way as for other monetary policy decisions. In July a decision was taken to raise the interest rate (Sveriges Riksbank [2001f]). The Executive Board's discussions at the meetings in June and July were published in November (Sveriges Riksbank [2001c] and [2001b]), together with the minutes from the Executive Board's assessment of the interventions, which was made in November (Sveriges Riksbank [2000d]). These minutes showed the line taken in the discussion and how the members of the board had voted. The minutes of the assessment also published the amounts, times and currencies of the interventions.

the Riksbank has immediately communicated whether currency interventions are implemented. The interventions have also been made with a large number of counterparties on each occasion. This appears to have functioned well on the whole. However, there may be reason for exceptions from this method of working in future, which is one reason why operational considerations are handled in a different system from the considerations regarding the motives for the interventions in the rules of procedure described here.

The Riksbank has chosen to show considerable openness in its operational actions with regard to the most recent interventions.

The agreed system for preparing, deciding and communicating interventions

Routines for decisions on interventions

Decisions on interventions in the foreign exchange market are normally taken by the Executive Board. Taking a decision requires a quorum of at least three members. However, pursuant to § 4 of the Riksbank's Instructions, the Governor of the Riksbank can decide on measures motivated by foreign exchange policy, if the Governor assesses the situation to be so urgent that it cannot wait for a decision by the entire Board. In this type of situation, the decision should be reported to the Executive Board and this report should be minuted in accordance with the principles established. If necessary, the Executive Board can also delegate the decision-making right for individual matters.

Decisions on interventions on the foreign exchange market are normally taken by the Executive Board. Taking a decision requires a quorum of at least three members.

A situation that has not been completely unusual in the past is that the Riksbank receives an enquiry from private or public counterparties interested in exchanging large amounts of currency or Swedish kronor. This may be so urgent, that it motivates implementing interventions, without waiting for a decision by the Executive Board. The rules of procedure for making decisions now make it clear that these transactions should not normally be made with private operators. Transactions with public counterparties should also be made with great restriction.

It is also established that interventions should normally be prepared like other monetary policy decisions. This secures a clear connection to other monetary policy work within the Riksbank at the same time as the risk of mistakes in exter-

Interventions should normally be prepared like other monetary policy decisions.

nal communications declines. Before interventions are taken up on the Executive Board's agenda, they should normally have been prepared by the drafting committee for monetary and foreign exchange policy.[33]

The Executive Board intends to take two separate decisions with regard to foreign exchange interventions:

- a nominal intervention mandate and
- a motivation text for the interventions.

The same division will be followed in the minutes of the meeting (see next section).

The idea is that the Executive Board will take a stand on the motives for the interventions and decide on a motivation text. The main elements in this should normally be published in the form of a press release. A public motivation contributes to a thorough preparation work, where possible motives are examined against the Riksbank's objectives. Clear and jointly-decided motives also facilitate communication with the surrounding world in connection with interventions.

The mandate should normally state the time period for implementing the intervention and give a framework for the scope of the interventions.

The mandate should normally state the time period for implementing the intervention and give a framework for the scope of the interventions. This can be more or less detailed, depending on the circumstances. The mandate should normally apply no longer than until the next monetary policy meeting of the Executive Board (naturally, a shorter delegation period is also possible). The responsibility for implementing and communicating the interventions would normally be delegated to the Governor of the Riksbank in consultation with one or more of the members of the Executive Board.

Minutes of meetings when taking decisions on interventions

Deliberations with regard to the motives for the interventions will be reported in separate minutes of the meetings published some time after the mandate has run out. This enables the desired openness and clarity to be achieved. The minutes of

[33] The drafting committee for monetary and foreign exchange policy consists of officials within the Riksbank and is headed by one of the deputy governors. The main features of the discussion within the committee will be reported to the Executive Board meeting.

the meeting can have the same form as with other monetary policy decisions with regard to the discussion of the factors affecting the decision, how members of the Executive Board have voted, and so on.[34] The minutes will normally be published with a time lag of a minimum of one month and a maximum of one year after the intervention mandate has expired. An assessment will be made from case to case as to whether information in the minutes can be assumed to counteract the purpose of the decided or anticipated measures and when the confidentiality requirement can be lifted.[35]

Deliberations with regard to the motives for the interventions will be reported in separate minutes.

The decision on the mandate for the interventions will normally be entered into separate minutes for the meeting. However, publishing these minutes can be assumed to counteract the purpose of the decided or anticipated measures. It will therefore not be possible to revoke the confidentiality until a later date.

Co-ordinated interventions

It is possible that interventions may be implemented at the initiative of other central banks. In such cases there may be reason to deviate from parts of the system that has been proposed.

In the event of co-ordinated interventions, there may be reason to deviate from the system proposed here.

[34] The effects of the interventions are uncertain, particularly as they are due to specific market conditions, which contributes to interventions being much more complicated from a decision-making point of view than other monetary policy measures. It is therefore natural that there should be differing opinions within the Executive Board with regard to such decisions. As the members take decisions on their own behalf and are assessed on the basis of these decisions, it is reasonable that the considerations that form the base for the decision be openly reported when it can be assumed that this will no longer counteract the purpose of the measures.

[35] See Chapter 3 § 1 of the Secrecy Act.

References

Apel, M., Nessén, M., Söderström, U. & Vredin, A., (1999), "Different ways of conducting inflation targeting – theory and practice", *Sveriges Riksbank Quarterly Review*, no. 4, Sveriges Riksbank, pp. 13–42.

Aguilar, J. & Nydahl, S., (2000), "Central Bank Intervention and the Exchange Rates: the Case of Sweden", *Journal of International Financial Markets*, Institutions and Money, vol. 10, pp. 303–322.

Ballie, R.T. & Osterberg, W., (1997), "Central Bank Intervention and Risk in the Forward Market", *Journal of International Economics*, vol. 43, pp. 483–497.

Ballie, R.T., Humpage, O.F. & Osterberg, W., (1999), "Intervention as Information: A Survey", Federal Reserve Bank of Cleveland Working Paper, 9918.

Bank of England Act, (1998).

Bernanke, B.S., (1999), "Japanese Monetary Policy: A Case of Self-induced Paralysis, Working Paper.

Bhatacharya, U. & Weller, P., (1997), "The Advantage of Hiding One's Hand: Speculation and Central Bank Intervention in the Foreign Exchange Market", *Journal of Monetary Economics*, vol. 39, pp. 251–277.

Blinder, A.S., (1998), *Central Banking in Theory and Practice*, The MIT Press.

Bonser-Real, C., Roley, V. & Sellon, G., (1998), "Monetary Policy Action, Intervention and Exchange Rates: A Re-examination of the Empirical Relationship Using Federal Funds Rate Target Data", *Journal of Business*, vol. 71, pp. 147–177.

Broaddus, A.J. & Goodfriend, M., (1996), "Foreign Exchange Operations and the Federal Reserve", *Federal Reserve Bank of Richmond Economic Review*, vol. 82, pp 1–19.

Bäckström, U., (1998), "The Swedish economy", speech by Riksbank Governor Urban Bäckström at Handelsbanken's seminar in New York.

Bäckström, U., (2001), "Currency interventions cannot be ruled out", Sveriges Riksbank, Press Release no. 38.

Cheung, Y-W. & Chinn, M.D., (1999), "Traders, market microstructure and exchange rate dynamics", NBER Working Paper no. 7416.

Cheung, Y-W. & Wong, C.Y-P., (2000), "A Survey of Market Practitioners' Views on Exchange Rate Dynamics, *Journal of International Economics*, vol. 51, pp. 401–419.

Cukierman, A. & Melzer A., (1986) "A Theory of Ambiguity, Credibility and Inflation under Discretion and Asymmetric Information", *Econometrica* vol. 54, pp. 1099–1128.

Dominguez, K.M., (1999), "The Market Microstructure of Central Bank Intervention", NBER Working Paper 7337.

Dominguez, K.M. & Frankel, J.A., (1993), *Does Foreign Exchange Intervention Work?*, Institute for International Economics.

Dornbusch, R., (1976), "Expectations and Exchange Rate Dynamics", *Journal of Political Economy*, vol. 84, pp. 1161–76.

Edison, H., (1993), "The Effectiveness of Central Bank Intervention: A Survey of the Literature after 1982", Special papers on International Economics 18, Princeton University.

Evans, M. & Lyons, R., (1999), "Order Flow and Exchange Rate Dynamics" NBER Working Paper 7317, August 1999.

Evans, M. & Lyons, R., (2000), The Price Impact of Currency Trades: Implications for Intervention. Haas School of Business Working Paper, UC Berkley.

Fatum, R., (2000), "On the Effectiveness of Sterilized Foreign Exchange Intervention", ECB Working Paper Series, 10.

Feldstein, M., (1986), New Evidence on the Effects of Exchange Rate Intervention", NBER Working Paper 2052.

Flood, R. & Taylor, M., (1996), "Exchange Rate Economic: What's Wrong with the Conventional Macro Approach" in Frankel, J., Galli, G. & Giovanni, A., (1996), *The microstructure of foreign exchange markets*, University of Chicago Press for NBER.

Ghosh, A., (1992), "Is it signalling? Exchange Interventions and the Dollar-Deutschemark Rate", *Journal of International Economics* 32, pp. 201–220.

Heikensten, L. & Vredin, A., (1998), " Inflationsmålet och den svenska penningpolitiken: Erfarenheter och problem", *Ekonomisk Debatt*, vol. 26, pp. 573–593. (The inflation target and Swedish monetary policy: Experiences and problems).

Heikensten, L., (1999), "The Riksbank's inflation target – clarification and evaluation", *Sveriges Riksbank Quarterly Review*, no. 1, pp. 5–17.

Heikensten, L., (2001), "The krona has shifted the risk spectrum", Sveriges Riksbank, press release no. 39.

Humpage, O.F., (1996), "Institutional Aspects of US Intervention", *Federal Reserve Board of Cleveland Economic Review*, pp. 2–19.

Humpage, O.F. & Osterberg, W.P., (2000), "Why Intervention Rarely Works". Federal Reserve Bank of Cleveland Economic Commentary, February, pp. 1–4.

Jurgensen, P., (1983), "Report of the Working Group on Exchange Market Intervention", Washington DC, US Treasury Department.

Kaminsky, G.L. & Lewis, K.K., (1996), "Does Foreign Exchange Intervention Signal Future Monetary Policy", *Journal of Monetary Economics*, vol. 37, pp. 285–312.

Lewis, K., (1988), "Testing the Portfolio Balance Model: a Multilateral Approach", *Journal of International Economics*, vol. 24, pp. 109–127.

Lindberg, H., (1994), "The Effects of Sterilised Interventions through the Signalling Channel, Sweden 1986-1990", Sveriges Riksbank Working Paper 19, Sveriges Riksbank.

Melzer, A., (1999), "A Policy for Japanese Recovery", Working Paper.

Mussa, M., (1981), The Role of Official Interventions, NY, Group of Thirty.

Neely, C.J., (2001), "The Practice of Central Bank Intervention: Looking under the Hood", *Federal Reserve Bank of St Louis Economic Review*, May/June, pp. 1–10.

Naranjo, A. & Nimalendran, M., (2000), "Government Intervention and Adverse Selection in Foreign Exchange Markets", *The Review of Financial Studies*, vol. 13, pp. 453–477.

Ragnartz, J., (2001), "Sterilised foreign exchange interventions: theory and empirical experience", appendix to separate minutes from Executive Board meeting on 8 November, 2001.

Reserve Bank of New Zealand, (2000), "Independent Review of the Operation of Monetary Policy. Submission by the Reserve Bank of New Zealand: Alternative Monetary Policy Instruments".

Reeves, S.F., (1998), "Partial Credibility, Information Selection and the Signalling Channel of Sterilized Interventions", *Journal of Economic Integration*, vol. 13, pp. 108–130.

Rogoff, K., (1984), "On the Effects of Sterilized Intervention: an Analysis of Weekly Data". *Journal of Monetary Economics*, vol. 14, pp. 133–150.

Sarno, L. & Taylor, M.P., (2001), "Official intervention in the foreign exchange market: Is it effective and, if so, how does it work?", *Journal of Economic Literature*, vol. 34, pp. 839–868.

Schwartz. A.J., (2000), "The Rise and Fall of Foreign Exchange Market Intervention", NBER Working paper 7751.

Svensson, L.E.O., (1999), "Inflation Targeting as a Monetary Policy Rule," *Journal of Monetary Economics*, vol. 43, pp. 607–654.

Svensson, L.E.O., (2001), "The Zero Bound in an Open-Economy: A Foolproof Way of Escaping from a Liquidity Trap", *Monetary and Economic Studies*, vol. 19, pp. 277–312,

Sveriges Riksbank, (1999), "The Riksbank's inflation target – clarification and evaluation, Memorandum.

Sveriges Riksbank, (2001a), "The Riksbank has intervened in the currency market", Press Release no. 41 in connection with the Executive Board meeting on 14 June 2001.

Sveriges Riksbank, (2001b), Separate minutes of the Executive Board meeting on 5 July 2001.

Sveriges Riksbank, (2001c), Separate minutes of the Executive Board meeting on 14 June 2001.

Sveriges Riksbank, (2001d), Separate minutes of the Executive Board meeting on 8 November 2001.

Sveriges Riksbank, (2001e), Preparations, decision-making and communication regarding foreign exchange interventions.

Sveriges Riksbank (2001f), "Repo rate raised 0.25 percentage points to 4.25 per cent", Press Release no. 47.

Vitale, P., (1999), "Sterilized Central Bank in the Foreign Exchange Market", *Journal of International Economics*, vol. 49, pp. 245–267.

The real interest rate and monetary policy

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In recent years, Knut Wicksell's theory on the interest rate gap and its effect on inflation have come into focus. By interest rate gap is meant the difference between the actual real interest rate and the real interest rate that would apply if prices were flexible, often called the "natural" real interest rate. The purpose of this article is to discuss the determinants of the natural real interest rate in a dynamic general equilibrium model. In the long run, households' time preference, economic growth and capital income tax determine the natural real interest rate. The short-run adjustment after a productivity shock and various fiscal policy shocks is also illustrated.

What determines the "natural interest rate"?

The conventional view is that a large part of the changes in the real interest rate are explained by monetary policy.

A key issue in the understanding of monetary policy is how a change in a nominal interest rate, the so-called repo rate, affects the real interest rate. The conventional view is that monetary policy, due to price rigidities, explains a large part of the short-term changes in the real interest rate. This view is confirmed by the fact that productivity shocks and fiscal policy shocks in simple dynamic general equilibrium models give rise to relatively small changes in the real interest rate.

A related issue is how changes in the real interest rate affect the general price level and the rate of inflation in the economy. Knut Wicksell was one of the first economists to shed light on this issue. In Wicksell's view, the price level is deter-

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mined by a so-called interest rate gap. The interest rate gap is defined as the difference between the actual real interest rate and the "natural" real interest rate. The actual real interest rate can deviate from the natural rate because of price rigidities and is thus affected by monetary policy. The natural interest rate, on the other hand, is not affected by monetary policy since it is defined as the interest rate that would apply if prices were flexible.

In Wicksell's view, the price level is determined by a so-called interest rate gap; the difference between the actual and the "natural" real interest rate.

Wicksell's framework can briefly be described in the following way: An increase in the natural interest rate (given the actual interest rate) implies that the firms' profits increase due to an increase in the return on their capital.[1] This leads to an increased demand for labour and thus, eventually, increased wages. The increased wages increase households' demand for consumer goods, which pushes up prices. That is, if the natural interest rate exceeds the actual interest rate, the price level will increase. Correspondingly, the price level will fall if the natural rate is lower than the actual rate. To maintain a stable price level, a central bank must prevent the occurrence of an interest rate gap.[2]

To maintain a stable price level, a central bank must prevent the occurrence of an interest rate gap.

In recent years, the so-called Wicksellian approach has come into focus due to a couple of essays by Woodford[3] and Neiss and Nelson.[4] Woodford shows how Wicksell's approach can be incorporated in a dynamic general equilibrium model with price rigidities. Neiss and Nelson's paper has attracted interest since it does not only show that the interest rate gap is a good inflation indicator but also that it is relatively easy to measure. In particular, it is easier to measure than the output gap.[5] This is due to the fluctuations in natural GDP being relatively large while they are small in the natural interest rate. This means that simple filtration methods, such as the HP filter, can be used to calculate the natural interest rate and

The interest rate gap is a good inflation indicator and is relatively easy to measure.

[1] Unless otherwise stated the interest rate refers to the real interest rate.

[2] See Siven (1998) and the references included in that work for an accessible and more detailed description of Wicksell's framework.

[3] Woodford (2000).

[4] Neiss & Nelson (2001).

[5] The output gap is defined as the difference between actual GDP and "natural" GDP. The definition of natural GDP usually varies although it is defined as the output that would apply if prices were fully flexible in this article.

thus the interest rate gap. However, they are not so useful for calculating the output gap.

The interest rate gap and the level of the natural interest rate are of key importance for the conduct of monetary policy.

According to Wicksell among others, the interest rate gap and thus the determination of the natural interest rate is of key importance for the conduct of monetary policy. The purpose of this article is therefore to discuss what determines the natural interest rate. The discussion is based on a real dynamic general equilibrium model where the interest rate can be interpreted as the natural interest rate. The effects on the interest rate of a productivity shock and a number of fiscal policy shocks are illustrated. The fact that productivity shocks and other real shocks seem to have small effects on the interest rate is also highlighted.

In the long run, the interest rate is determined by households' time preference, economic growth and the capital income tax.

In order to understand what determines the interest rate, it is convenient to first study the long-run determinants and then the short-run adjustment of the interest rate to different types of shocks. In the long run, households' time preference, the growth rate and capital income tax determine the interest rate. In the short run, the interest rate is determined in an interaction with all of the other variables of the model. Important factors are, however, productivity, capital intensity and the growth of consumption.[6]

The next section contains an account of the dynamic general equilibrium model. Thereafter follows a discussion of what determines the interest rate in the long run and an illustration of the short-run adjustment of the interest rate to various types of shocks. We study the adjustment of a productivity shock, a public consumption shock, a labour income tax shock and a capital income tax shock. Finally, some concluding comments are made.

The dynamic general equilibrium model

The purpose of the model is to illustrate the basic mechanisms that determine the interest rate in a simple and consistent way.

In order to conduct a meaningful discussion on the determinants of the interest rate, a conceptual framework or model is required. The purpose of the model is to illustrate the basic mechanisms that determine the interest

[6] Unless otherwise stated, productivity refers to total factor productivity.

rate in a simple and consistent way. We perform the analysis in a dynamic general equilibrium model based on the neo-classical growth model. The equilibrium model is in principle the simplest possible. There is no heterogeneity among households or firms. Neither is there any "asymmetric" information, i.e. all households and firms have access to the same information. These assumptions simplify the discussion considerably without losing the basic mechanisms. Since the interest rate is a "price" that affects the allocation of consumption and leisure over time, it is necessary to have a dynamic model.[7] The modelling approach is based on the following principles:

- Economic outcomes do not occur arbitrarily but are the result of rational households and firms that maximise utility and profit, respectively.
- Households and firms are assumed to be "price takers" on every market, i.e. their individual behaviour does not affect prices. The economy is in equilibrium when prices are such that supply and demand in every market are equally large.
- Households' and firms' decisions are consistent with one another; i.e. it is a general equilibrium model.
- The long-run determinants of the economy and the short-run dynamic adjustment to different types of shocks are explained in one and the same model.

The main reason for using Jonsson and Klein's model is that it has proven to be empirically relevant.

The model is similar to the one presented by Jonsson and Klein.[8] The main reason for using that model is that it has proven to be empirically relevant. It is not only consistent with a number of stylised facts on long-run growth, it can also explain a large part of the short-run fluctuations in Swedish data.

Households choose consumption and leisure in order to maximise their "utility" given that their budget and time constraints are fulfilled.

A non-technical description of the model is presented here while the appendix provides a more detailed and formal description. Households choose consumption and leisure in order to maximise their "utility" given that their budget and time constraints are fulfilled. When they choose a level of con-

[7] In a dynamic model the analysis is more complicated since the income effect of a shock depends on the length of the shock. A short-lived shock has a relatively small income effect while a persistent shock has a relatively large income effect.

[8] Jonsson & Klein (1995). The difference lies in the specification of the tax system, Jonsson and Klein also include a consumption tax.

sumption, a balance is struck between the utility of consuming more today and the utility of saving and thus obtaining a higher future level of consumption.

Utility is assumed to increase with the level of consumption and leisure. However, the *marginal utility* is declining, which means that the marginal value of any good decreases as more of that good is consumed. The economic significance of this is that households wish to smooth consumption over time. The model accordingly incorporates a form of the permanent income hypothesis.[9]

Households must comply with their budget and time constraints in each period. The revenues in the budget constraint consist of labour and capital incomes, which are both subject to tax. A certain part of the tax is returned to the households in the form of transfers. Their expenditure consists of consumption and saving (i.e. investments in the economy's capital stock). Time is allocated between work and leisure.

Households have a subjective discount rate or a so-called time preference.

Finally, households have a subjective discount rate or a so-called time preference, β, which indicates how they value future consumption and leisure relative to consumption and leisure today. Their discounting of future consumption and leisure can be described in the following way,

$$U(c_t,l_t) + \beta U(c_{t+1},l_{t+1}) + \beta^2 U(c_{t+2},l_{t+2}) + \ldots$$

where $U(c_t,l_t)$ denotes the households' so-called utility function, which consists of consumption, c_t, and leisure, l_t, at a particular time t. If β is less than 1 households are "impatient", which means that they value consumption and leisure today higher than in the future. If β is larger than 1 households are "patient" and they value future consumption and leisure higher. In most studies β is usually less than 1 even if there are arguments for it being close to 1.[10]

Firms choose their capital stock and labour force in order to maximise profits in each period.

The firms in the economy produce a product that can be used for private consumption, investments and public consumption. They choose their capital stock and labour force in order to maximise profits in each period. Since there are a large number of firms, the individual firm does not affect the interest rate or the wage rate, i.e. these are taken as given.

[9] Friedman (1957).

[10] Frank Ramsey assumed in an article in 1928 that β should be equal to 1 with the motivation that it would be "ethically indefensible" to set a lower value on the utility of future generations than the present.

The public sector is assumed to "purchase" a certain part of the output and finance this by taxing households' capital and labour incomes. A part of these incomes are returned to households in the form of transfers while the rest are used for public consumption.

At the aggregate level, the collective saving and investment decisions by households and firms determine the interest rate.

What determines the interest rate in this economy? Since there are a large number of households and firms, their individual decisions do not affect the interest rate. At the aggregate level, it is the collective saving and investment decisions by households and firms that determine the interest rate. That is, it is the total supply and demand for capital that determines the interest rate. Somewhat simplified, it can be described as follows:

- Firms choose capital so that the marginal product of capital will be equal to the interest rate. The marginal product depends partly on productivity and partly on capital intensity (capital in relation to labour). A high productivity increases the marginal product of capital and therefore the interest rate. The interest rate also increases when capital is a scarce resource in relation to labour. In other words, high productivity and low capital intensity tend to increase the interest rate.
- Households' choice of consumption and saving, and also their supply of labour, depends on the interest rate. An increase in the interest rate implies that households would like to reduce consumption now (i.e. increase saving) and consume more in the future. A high interest rate is therefore associated with a high *consumption growth*. The supply of labour depends on the development of wages but also on the interest rate. A high interest rate makes it profitable to increase the supply of labour and save the extra income.

What determines the interest rate in the long run?

The long-run determinants of the interest rate are relatively simple to derive. It is namely possible to derive a simple equation in terms of the model's parameters and exogenous variables. The long run is defined as the hypothetical state when the effects of any shocks have vanished and the variables in the model are independent of time. This is usually called "steady state" in the literature. These long-run determinants are shown in the following equation,

$$r = \left(\frac{1}{\beta}\gamma^{1-\alpha(1-\sigma)}-1\right)\frac{1}{1-\tau^k},$$

where r denotes the interest rate, γ denotes the growth rate of the economy, α denotes the weight given by households to consumption in relation torelative leisure in the utility function, $1/\sigma$ is a measure of households' intertemporal substitution willingness. A high σ means that households' willingness to substitute consumption over time is low and they would like to have a smooth consumption path, finally, τ^k denotes the capital income tax.[11]

According to the above equation, the interest rate is determined in the long run by three factors. Firstly, there is a pure *time preference factor*.

According to the above equation, the interest rate is determined by three factors in the long run. Firstly, there is a pure *time preference factor*, β. Assume that households are "impatient" and value present consumption more than future consumption. If households are then to be willing to save and postpone their consumption, they will want to be compensated for doing so. This compensation consists of receiving interest on their savings. The more impatient households are, the higher the interest rate will be.

Secondly, the interest rate depends on *economic growth*.

Secondly, the interest rate depends on *economic growth*, γ. In an expanding economy, future consumption opportunities are greater than at present. Since the marginal utility of consumption is declining, households value an increase in consumption today higher than one in the future. They will therefore be willing to pay a premium or interest to be able to increase their consumption today. How high an interest rate they are willing to pay depends on their substitution willingness, $1/\sigma$, and the weight of consumption in the utility function, α. A low substitution willingness implies that they are prepared to pay a high interest rate to be able to increase consumption today.

Thirdly, the interest rate depends on the *capital income tax*.

Thirdly, the interest rate depends on the *capital income tax*, τ^k. Households' consumption decisions depend on the return of capital after tax. If the tax rate on capital incomes increases, households will require a higher return to compensate for the tax loss. An increase in the tax rate on capital income will therefore give a higher interest rate. It is worth noting that the labour income tax does not affect the interest rate in the long run.

[11] See also appendix for a discussion on the parameters' economic significance.

Some simulation examples

This section shows the adjustment of the interest rate to a number of shocks over time. First the effects of a productivity shock are shown and then the effects of different fiscal policy shocks.[12] The purpose of the simulations is to qualitatively illustrate the determinants of the interest rate.

The purpose of the simulations is to qualitatively illustrate the determinants of the interest rate.

In a dynamic model, the adjustment of the economy depends on the duration of the shock, and we therefore present simulations with both short-lived and persistent shocks. The short-lived shock is 1 per cent in the first period and thereafter zero. The persistent shock is also 1 per cent initially but is auto-correlated with a factor of 0.95. This means that productivity, in for instance a productivity shock, declines in a smooth path towards zero during a number of periods.

The adjustment paths in the diagrams are shown as percentage deviations from their long-run values. The parameter values that are used in the simulations are given in the appendix together with the formal description of the model.

A productivity shock

Diagram 1 shows the dynamic paths of the interest rate, the wage rate, consumption, investment and the supply of labour to a short-lived productivity shock. In period one, the increase in productivity leads to an increase in the marginal product of labour and thus wages. The higher wages affect the supply of labour by income and substitution effects. The income effect, which tends to reduce the supply of labour, will be small, since the productivity shock is short-lived. The supply of labour therefore increases and together with the increased productivity, this entails a strong increase in production.

Households choose how much of the increased production they wish to consume and save. Since the marginal utility of consumption is decreasing, households wish to smooth consumption over time. A large part of the increase in production is therefore saved.[13]

In period two, productivity returns to its long-run level. The only difference to the time before the productivity shock is that households have accumulated a

[12] It is not uncommon for economists to categorise shocks as so-called "supply shocks" and "demand shocks". In a dynamic general equilibrium model, a distinction of this kind is rather meaningless or even misleading. A productivity shock affects for instance the supply of goods, since the production opportunities are changed, but it also affects demand since incomes are changed.

[13] The relatively high fluctuations in investment that can be observed in the data, which Keynes related to "animal spirits", thus arise naturally in an economy where households wish to smooth consumption over time.

larger capital stock. This is used to enjoy more consumption and leisure over a number of periods.

What happens to the interest rate? The interest rate is below its long-run level throughout the entire period of adjustment. This is due to the higher capital stock giving rise to a higher capital intensity, which pushes down the interest rate. The interest rate determines households' allocation of consumption over time.

Diagram 1a. A short-lived increase in productivity

Per cent

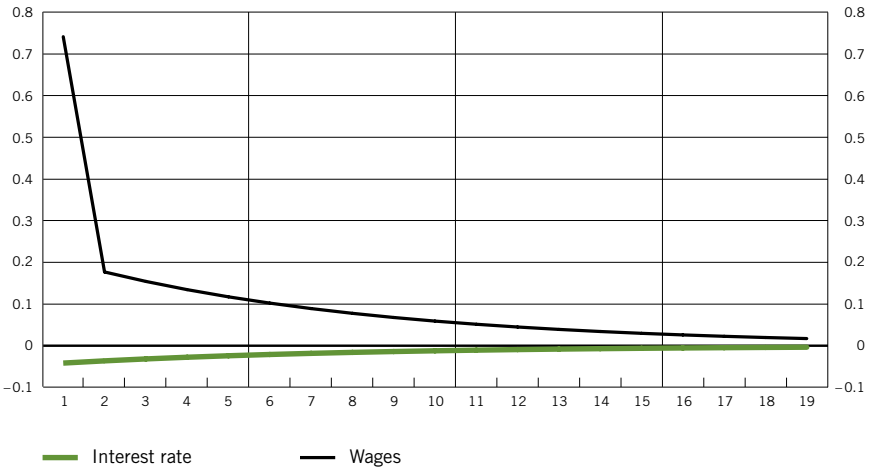
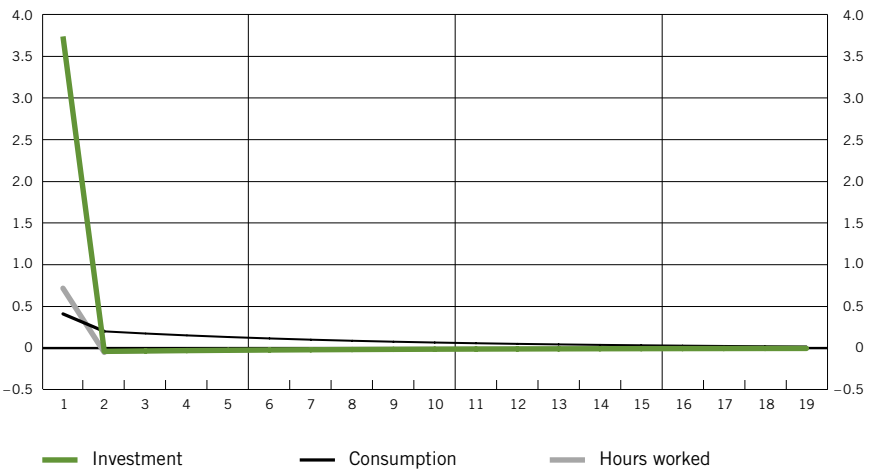


Diagram 1b. A short-lived increase in productivity

Per cent



The low interest rate implies that households prefer to have a falling consumption profile throughout the adjustment.

The results of a persistent productivity shock are shown in Diagram 2. It is basically the same mechanisms that affect economic development as in the case of a short-lived shock. The marginal product of labour and thus wages increases initially, which implies that households increase the supply of labour. The increase will not be as great in this case since the income effect is greater.

Diagram 2a. A persistent increase in productivity

Per cent

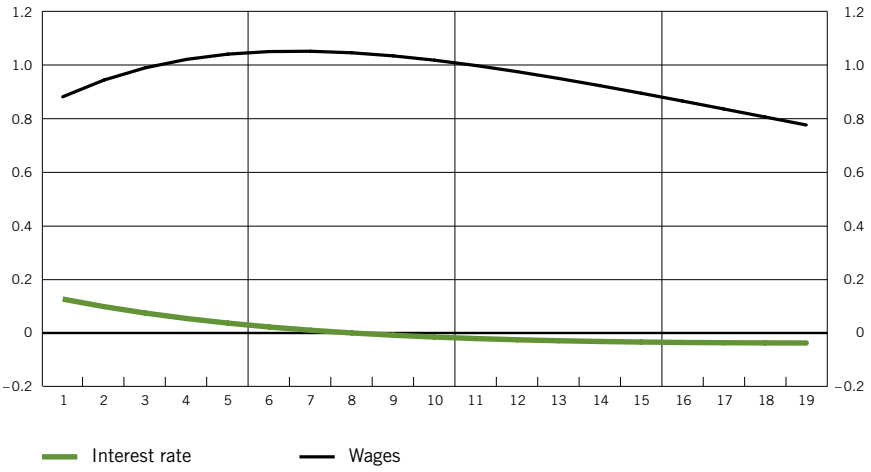
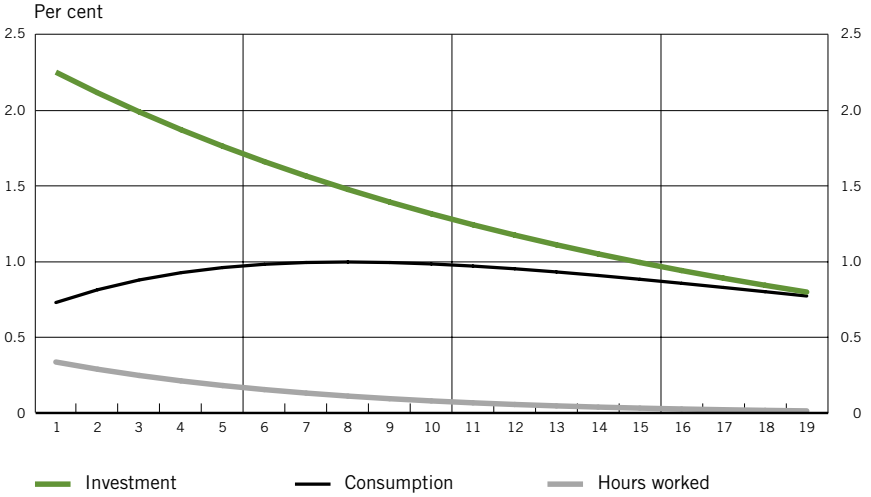


Diagram 2b. A persistent increase in productivity

Per cent



The interest rate follows a qualitatively different path compared to the short-lived productivity shock. Initially, the interest rate is higher than its long-run level, which is due to the high productivity. The large investments lead to a gradual increase of the capital stock. This, together with the slowly decreasing productivity, gradually pushes the interest rate down.

Productivity shocks have relatively small effects on the interest rate in this model.

These simulations illustrate that productivity shocks have relatively small effects on the interest rate in this model. In the case of a short-lived productivity shock, the interest rate only falls by 0.05 per cent and in the case of a persistent productivity shock, it increases by about 0.15 per cent. This is to be compared with the effects on consumption and in particular investments. In the case of a short-lived productivity shock, investments increase by over 3.5 per cent. It is basically these mechanisms that give rise to Neiss and Nelson's conclusion that the interest rate gap is easier to measure than the output gap.

Fiscal policy shocks

This section illustrates the effect on the interest rate of shocks to public consumption, labour income tax and capital income tax.

An increase in public consumption leads to a negative income effect due to the reduction of transfers. This means that the supply of labour increases and investments are reduced. These effects reduce capital intensity, which pushes the interest rate upwards. This applies both to short-lived and persistent increases in public consumption. Quantitatively, the interest rate increase is stronger if the shock is persistent since the income effect is greater. Diagram 3 illustrates the dynamic path of a short-lived increase in public consumption.

The effect on the interest rate of an increase in labour income tax is ambiguous. As in the case of a productivity shock, the adjustment depends on the duration of the shock.

An increased tax rate on labour income affects the supply of labour and thus output negatively. Households reduce both consumption and investment. Whether this leads to an increase or reduction in the interest rate depends on the strength of the reduction in the supply of labour relative to investment.

In the event of a short-lived tax increase, the effect on investment will be relatively strong, which will reduce capital intensity and increase the interest rate. If the increase is persistent, on the other hand, the effect will be less strong initially. This makes capital intensity increase to start with and the interest rate falls. The

Diagram 3a. A short-lived increase in public consumption

Per cent

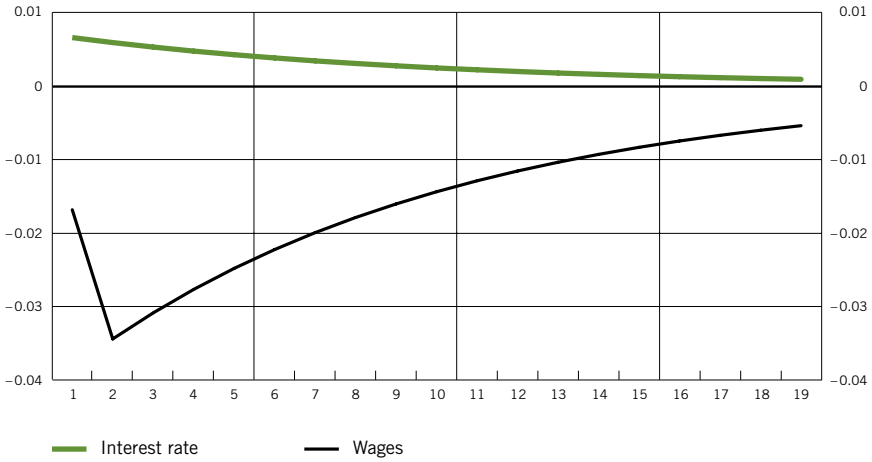
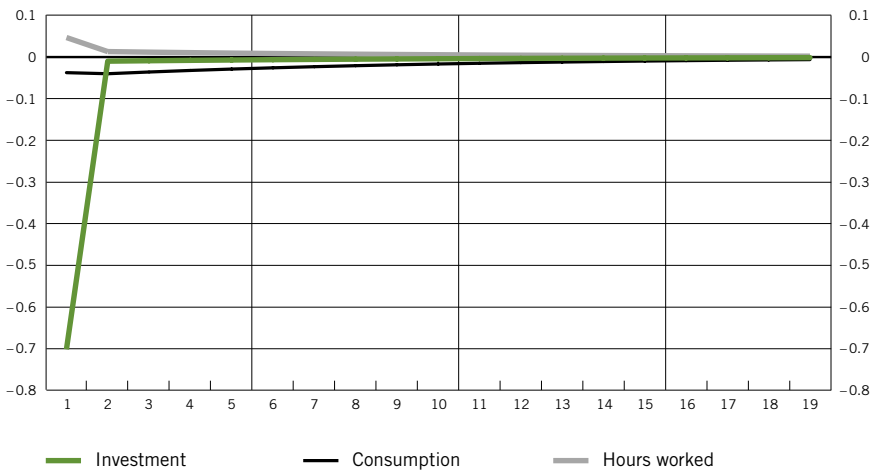


Diagram 3b. A short-lived increase in public consumption

Per cent



effects of a short-lived and a persistent increase of the labour income tax are illustrated in Diagrams 4 and 5, respectively.

The capital stock has to be determined one period in advance and cannot be changed in the current period. This means that a short-lived increase in capital income tax has no effect on the capital stock. However, a persistent increase of the tax rate will affect the capital stock and the interest rate. The direct effect of a persistent increase of the tax rate is a reduction of the interest rate after tax. This makes it more advantageous to increase consumption and reduce investment.

Diagram 4a. A short-lived increase in labour income tax

Per cent

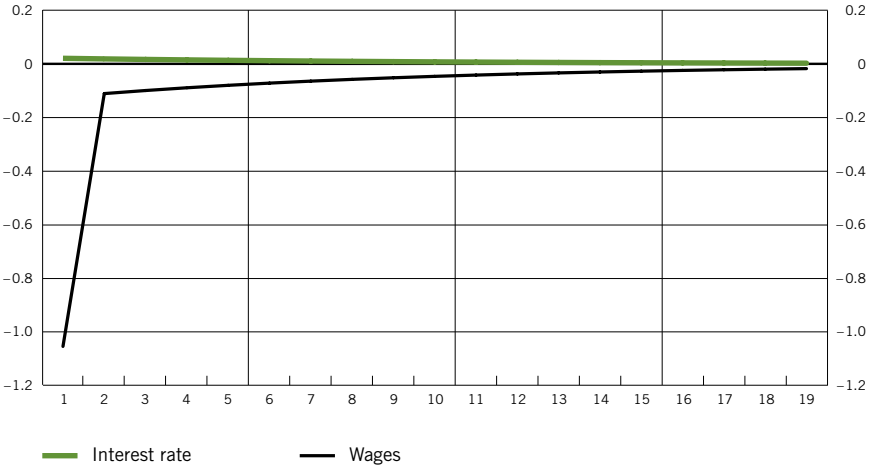
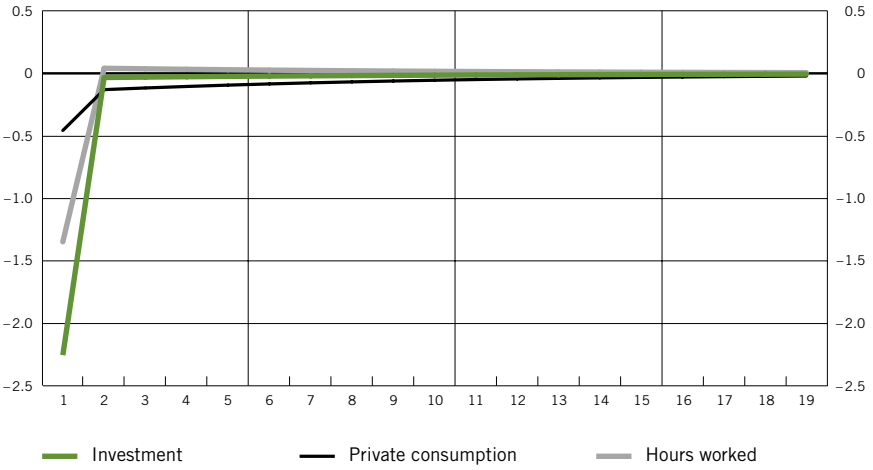


Diagram 4b. A short-lived increase in labour income tax

Per cent



The lower interest rate also tends to reduce the supply of labour. The reduced investment entails a lower capital intensity, which pushes up the interest rate. This is illustrated in Diagram 6.

These simulations illustrate that fiscal policy shocks also tend to have small effects on the interest rate.

These simulations illustrate for fiscal policy shocks what we found earlier for the productivity shock, i.e. they tend to have small effects on the interest rate. In quantitative

Diagram 5a. A persistent increase in labour income tax

Per cent

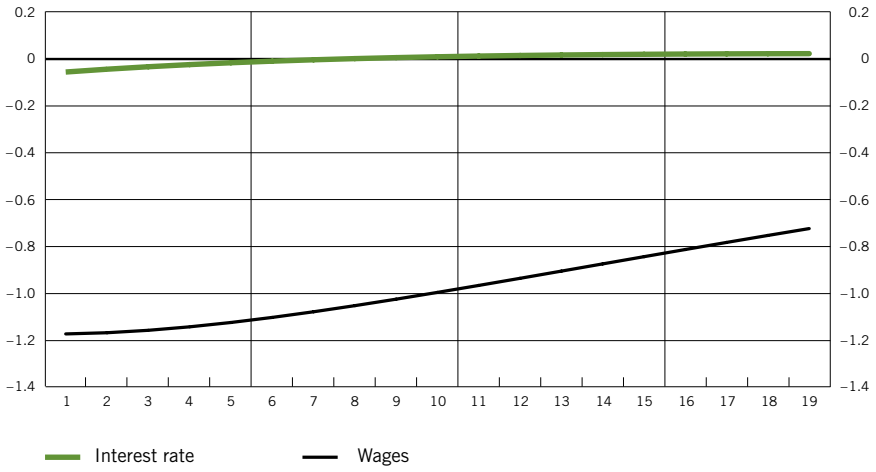
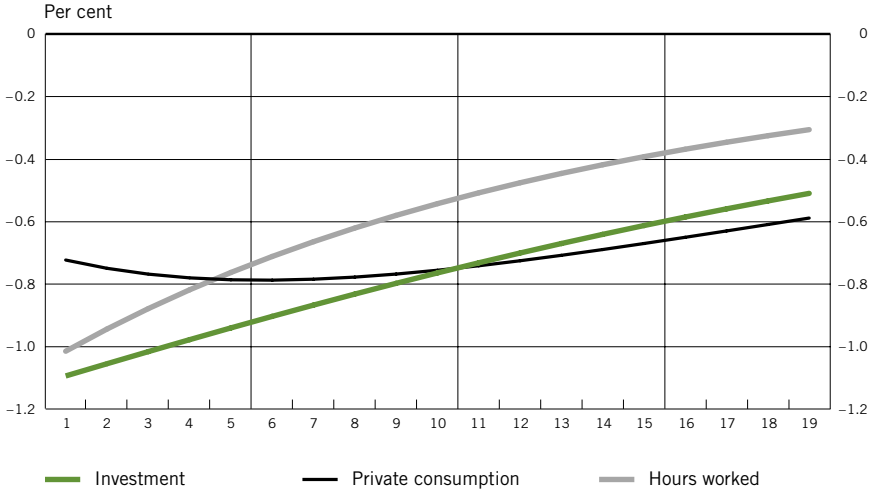


Diagram 5b. A persistent increase in labour income tax

Per cent



terms, the effect on the interest rate of the fiscal policy shocks is even somewhat less than that of the productivity shock.

Concluding comments

According to Wicksell among others, the interest rate gap is of key importance in the conduct of monetary policy. To maintain a stable price level, the central bank

Diagram 6a. A persistent increase in capital income tax

Per cent

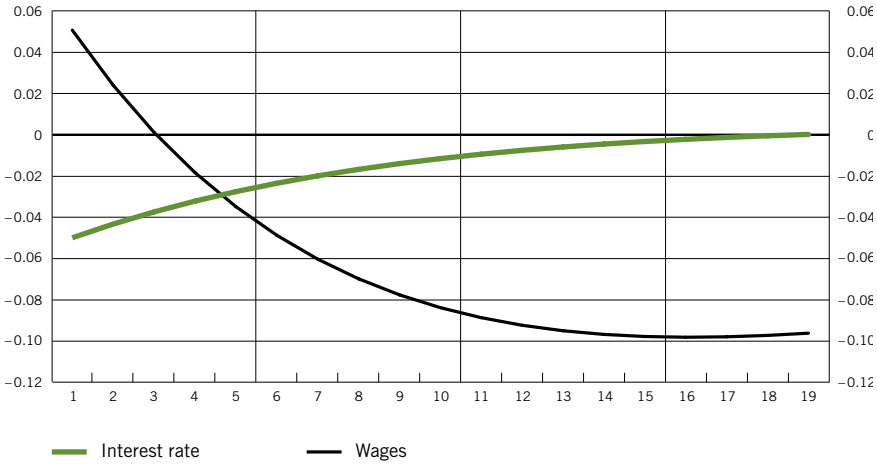
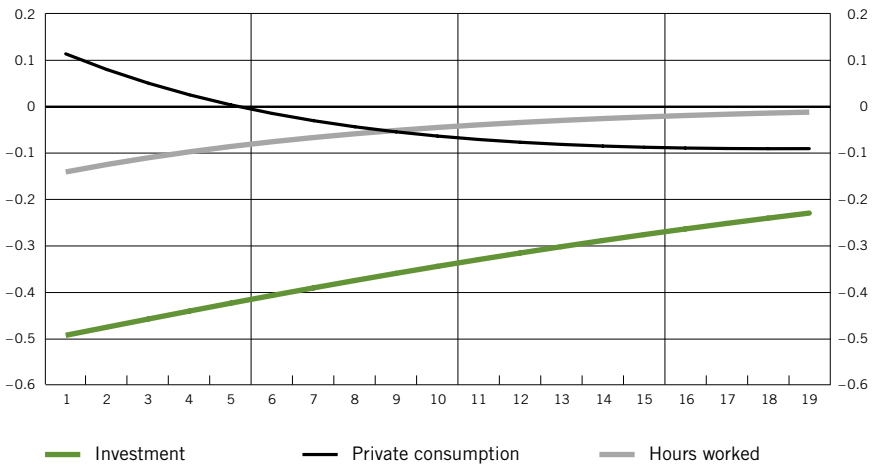


Diagram 6b. A persistent increase in capital income tax

Per cent



To maintain a stable price level, the central bank must prevent an interest rate gap from arising.

must prevent an interest rate gap from arising. This means that the actual interest rate must be controlled so that it is at the level of the natural interest rate all the time.

In practice, it is difficult to measure the interest rate gap since the natural interest rate cannot be observed. It may therefore be valuable to understand the determinants of the natural interest rate in simple theoretical models. This can be exemplified by the so-called new economy. The new economy has been charac-

terised by a long and high increase in productivity. According to the model, the effect of this should be an initially higher interest rate, which subsequently declines. After a time, it even falls below its long-run level. How should monetary policy react to this? In order not to create an interest rate gap, which can affect inflation, the central bank must initially increase the interest rate and then reduce it apace with changes in the natural interest rate.

Despite it probably being difficult to measure the interest rate gap, it may still be easier to measure this gap than the output gap.

Despite it probably being difficult to measure the interest rate gap, it may still be easier to measure this gap than the output gap. This is shown by Neiss and Nelson.[14] The reason for this is that the natural interest rate, in contrast to natural GDP, is relatively insensitive to productivity and fiscal policy shocks in simple dynamic general equilibrium models. However, this is not a general result but depends on, among other things, the utility function and capital formation. With another type of utility function and installation costs for capital, Boldrin, Christiano and Fisher[15] and Smets and Wouters[16] show that productivity shocks can very well have strong effects on the natural interest rate.

Smets and Wouter's result moreover indicates that there may be a number of practical problems in using the interest rate gap as an indicator for monetary policy. The interest rate gap is very sensitive to the identification of shocks and different model assumptions.

The significance of the interest rate gap for inflation development and the conduct of monetary policy is not entirely without objections.

It can be noted in conclusion that the significance of the interest rate gap for the development of inflation and the conduct of monetary policy is not without objections. However, this also applies to other established concepts such as the output gap and NAIRU, which are both used as monetary policy indicators by central banks and external analysts.[17] There are in other words good reasons to use different models and approaches as a basis for monetary policy decisions.

[14] Neiss & Nelson (2001).
[15] Boldrin, Christiano & Fisher (2001).
[16] Smets & Wouters (2001).
[17] See Annual Report (1999), for a critical discussion on NAIRU and potential GDP and their significance for monetary policy. An excellent discussion on NAIRU is also contained in Rogerson (1997).

Appendix

Households maximise the sum of their discounted utility over an "infinite" time horizon such that time and budget constraints are fulfilled. Households preferences, Ω, can formally be described in the following way,

$$\Omega = E\left[\sum_{t=0}^{\infty} \beta^t U(c_t, 1-h_t)\right],$$

where E denotes the unconditioned expectation operator, $U(\cdot)$ denotes the utility function, c_t denotes consumption and h_t denotes hours worked in period t. For the sake of simplicity, the time endowment is normalised to 1, $1-h_t$ denotes accordingly leisure. The parameter β denotes households' subjective discount factor or so-called time preference. Households having an infinite planning horizon simplifies the solution of the model but can also be motivated on the basis of altruistic links between different generations. The period utility function has the standard iso-elastic form,

$$U(c_t, 1-h_t) = \frac{\left(c_t^{\alpha}(1-h_t)^{1-\alpha}\right)^{1-\sigma}}{1-\sigma},$$

where the parameter σ is greater than zero and is a measure of households' risk aversion. The inverse of σ is at the same time a measure of households' intertemporal substitution elasticity. A high σ means that households' willingness to substitute consumption over time is low and that they want to have a smooth consumption path. The parameter α is between zero and 1 and states the relative weight given by households to consumption and leisure respectively.

The specific function form has the following characteristics. Households prefer a consumption basket with more consumption, more leisure or both. This is a reasonable assumption at the aggregate level since it is likely that the average household in Sweden would like to consume more if this were possible. Households want to have diversity in the consumption basket, i.e. they want to have both consumption and leisure in the consumption basket. They also prefer a smooth level of the consumption basket over time. Finally, consumption and leisure are normal goods in the following sense: If income increases, they both want to increase consumption and have more leisure. At the aggregated level, this is probably a reasonable assumption even if there may be examples of specific goods that are not normal in this sense.

Public consumption does not formally generate any utility for households.

However, we would have exactly the same allocation of resources if public consumption were incorporated in an additive way in the utility function. The only thing that would be affected is the level of households' utility.

Households' budget constraint is given by,

$$c_t + i_t = \left((1-\tau_t^k)r_t + \tau_t^k\delta\right)k_t + (1-\tau_t^h)w_t h_t + tr_t.$$

The left side consists of households' expenditure and the right side of their income after taxes and transfers. The notation is as follows, i_t denotes investment, k_t denotes capital stock, r_t denotes the rental rate of capital, w_t denotes the wage rate, τ_t^k denotes capital income tax, τ_t^h denotes the labour income tax, tr_t denotes transfers and δ is a parameter that denotes the rate of depreciation of capital. The formulation of the budget constraint implies that depreciation is modelled as tax deductible.

The capital stock evolves according to,

$$k_{t+1} = i_t + (1-\delta)k_t,$$

That is, in the next period the capital stock is equal to current investment plus the current capital stock minus the depreciation of the current period's capital stock.

Firms solve the following maximisation problem,

$$\max_{\{k_t,h_t\}}[y_t - r_t k_t - w_t h_t],$$

where y_t denotes firms' income. The expenditure consists of costs for capital and labour. The firms' production function that combines labour and capital is of the standard Cobb-Douglas type,

$$y_t = z_t k_t^{\theta}(\gamma^t h_t)^{1-\theta},$$

where θ $(0<\theta<1)$ denotes capital's share of income, z_t denotes total factor productivity (exogenously given) and γ^t $(\gamma>1)$ denotes the long-run growth of the economy.

The restriction on θ implies "constant returns to scale", that is, if capital and labour increase by a certain factor λ, total output will also increase by the same factor λ. The economic significance of this is that small and large firms are equal-

ly efficient. It is hardly likely that this is the case for each particular firm and industry. However, it can still be a reasonable assumption at an aggregate level.

The public sector simply fulfils its budget constraint each period. It consists of exogenous objectives for public consumption and taxes on households' capital and labour incomes. Transfers are determined residually (and hence endogenously), formally,

$$TR_t + G_t = \tau_t^h H_t + \tau_t^k (r_t - \delta) K_t,$$

where G_t denotes public consumption and large letters indicate that they are aggregated variables.

Finally, the aggregate resource constraint must be fulfilled, that is,

$$Y_t = C_t + I_t + G_t.$$

In order to carry out the simulations, values must be set for the parameters in the model. This can be done in a number of different ways. Usually, the parameters are estimated by econometric methods. Since the simulations are only used for illustrative purposes, the parameters are set at what can be judged to be standard values in the literature. Table 1 shows the parameter values used in the simulations.

Table 1. Parameter values in the simulation examples

σ	δ	θ	α	β	γ
2.00	0.10	0.36	0.33	0.99	1.02

References

Annual Report, (1999), "Theory Ahead of Rhetoric: Economic Policy for a New Economy", Federal Reserve Bank of Cleveland, pp. 7–18.

Boldrin, M., Christano, L. & Fisher, J., (2001), "Habit Persistence, Asset Returns and the Business Cycle", *American Economic Review* 91.

Friedman, M., (1957), *A Theory of the Consumption Function*, Princeton University Press.

Jonsson, G. & Klein, P., (1995), "Stochastic Fiscal Policy and the Swedish Business Cycle", *Journal of Monetary Economics* 38.

Neiss, K. & Nelson, E., (2001), "The Real Interest Rate Gap as an Inflation Indicator", Working Paper 130, Bank of England.

Rogerson, R., (1997), "Theory Ahead of Language in the Economics of Unemployment", *Journal of Economic Perspectives* 11.

Smets, F. & Wouters, R., (2001), "Monetary Policy in an Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area", manuscript, ECB.

Siven, C.-H., (1998), "Penningteori utan pengar – hundra år med Knut Wicksell", *Ekonomisk Debatt* 26. (Monetary theory without money – a hundred years of Knut Wicksell).

Woodford, M., (2000), "A neo-Wicksellian Framework for the Analysis of Monetary Policy", chapter 4 of *Interest and Prices*, manuscript, Princeton.

The role of the gold reserves and the rate of return on gold

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Most central banks in industrialised countries have gold reserves which are part of the total foreign reserves. The reason for this is that gold has played a historic role in the monetary system. During the past decade, the price of gold has steadily fallen so that the role of gold in foreign currency reserves has been called into question in a portfolio-theoretical perspective. Central banks which have gold in their foreign reserves are able to obtain a return by lending the gold, however.

The historic role of gold

Gold was already used as a means of payment and as a store of value in ancient Egypt and in Mesopotamia. Gold has retained its role over the millennia. Gold continued to play an important role in a number of monetary systems at the end of the nineteenth century and for the greater part of the twentieth century.

The first international gold standard was introduced by Great Britain in the 1870s.

The first international gold standard was introduced by Great Britain during the 1870s. Great Britain was then the world's leading industrial power with very extensive trade. A lot of the world's major trading nations joined the gold standard system. The value of each currency was linked to a fixed quantity of gold which also meant that the exchange rates between the participating countries were fixed. The Riksbank exchanged gold for a particular quantity of kronor[1] and everyone had the right to exchange their banknotes for gold at this exchange rate. During the First World War, the gold standard collapsed although an attempt to re-establish it was made in 1925. However, the war had brought weaknesses in the gold

[1] The Riksbank's official exchange rate was SEK 2.48 per gram of fine gold.

standard system and this led to major problems during the economic depression in the early 1930s. On 21 September 1931, Great Britain announced that it would no longer be bound by the obligation to redeem pound notes for gold. Only six days later, Sweden also abandoned the gold standard.

A new international organisation, the International Monetary Fund, was established in 1944.

Towards the end of the Second World War, there was great interest in the re-establishment of global economic forms of collaboration in the field of foreign exchange. A new international monetary organisation, the International Monetary Fund, was accordingly established in July 1944 at an international conference at Bretton Woods in the United States. The main objective of the Fund was to facilitate the movement of goods and services from one country to another without major problems with trade restrictions. The Bretton Woods system was established as a result of this meeting and Sweden joined in 1950. In this system, it was now only the United States that undertook to maintain a fixed exchange rate to gold.[2] Unlike the situation during the gold standard, only central banks were now allowed to exchange U.S. dollars for gold at the Federal Reserve. During the 1960s, however, confidence in the U.S. dollar fell as a result of the large deficits in the American balance of payments, while Western Europe had increasing surpluses in its balance of payments. The surplus of dollars abroad eventually exceeded the value of the United States' gold holdings. Those with large dollar holdings had a tacit agreement not to destroy the system by demanding gold for their dollars. However, despite this, the situation became untenable in the long run. In August 1971, Richard Nixon announced that the United States was withdrawing its commitment to convert gold at a fixed exchange rate with the dollar. However, another two years were to pass before the Bretton Woods system collapsed altogether. Since 1971, gold therefore no longer plays a role with regard to exchange rate parities between countries.

Price trends after 1971

Since 1971, when the fixed price of gold in relation to the dollar was abolished, the gold price in dollars has been very volatile.

Ever since 1971, when the fixed price of gold in relation to the dollar was abolished, the price of gold in dollars has been very volatile. At the end of the 1970s and in the early 1980s, most countries in the western world

[2] The fixed exchange rate was 35 dollars per ounce. An ounce is equivalent to 31.103 grams.

suffered from high inflation which had been set off by a number of oil price shocks, among other things. This resulted in investors fleeing to gold which was considered to serve as a so-called "inflation hedge". The price of gold rose dramatically in real terms (see Diagram 1).

Diagram 1. The real gold price in dollars, January 1971–September 2001 (monthly data)

Index: 1 January 1971=100

Source: EcoWin.

Since the mid-1990s, the trend for the gold price in dollars has been negative.

At its peak, the gold price was 850 dollars per ounce, which was recorded on 21 January 1980. Since then, the trend for the gold price in dollars has been negative (see Diagram 2). The gold price was at its lowest in mid-1999 at 255–257 dollars per ounce. There are a number of reasons for the negative trend. The factors which are often mentioned are reduced inflation in the world, the loss of the role of gold as a "safe haven" and the sales of gold by the central banks.

The rumours on future sales of gold by central banks were considered as having a negative effect on the price of gold. For this reason, fifteen European central banks[3] published a joint statement on gold holdings on 26 September 1999. Their agreement was to apply for five years, accordingly until 26 September 2004, and the statement published had the following wording:

[3] The fifteen central banks were the national central banks that then took part in the Eurosystem (Greece was not a member at this time and therefore did not participate), the European Central Bank and the central banks of Switzerland, the United Kingdom and Sweden.

1. Gold will remain an important element of global monetary reserves.
2. The undersigned institutions will not enter the market as sellers, with the exception of already decided sales.
3. The gold sales already decided will be achieved through a concerted programme of sales over the next five years. Annual sales will not exceed approximately 400 tons and total sales over this period will not exceed 2,000 tons.
4. The signatories to this agreement have agreed not to expand their gold lending and their use of gold futures and options over this period.
5. This agreement will be reviewed after five years.

Diagram 2. The price of gold in SEK and USD respectively January 1971–October 2001 (monthly data)

SEK and USD respectively

Note. As only monthly data is used, the highest daily listings that occurred during January 1980 are not visible.

Source: EcoWin.

When this agreement was published, the price of gold in dollars initially rose by approximately 25 per cent, although it then fell back to approximately the same level as before the agreement was reached. Diagram 2 shows gold price movements from January 1971 until October 2001 inclusive in Swedish kronor and U.S. dollars.

The Riksbank's gold reserves

The Riksbank's gold reserves total 185.4 tonnes, which is equivalent to approximately 10 per cent of the total reserves.

The Riksbank's gold reserves total 185.4 tonnes, and the value of these corresponded to slightly more than 10 per cent of the total reserves on 30 June 2001. Table 1 shows a selection of central bank holdings of gold in relation to the total reserves also on 30 June.[4] The table shows that a number of countries in Europe, as well as the United States, have very large gold reserves in relation to other reserves. Among the Nordic countries, Sweden has the largest gold reserves.[5]

Table 1. The gold reserves versus other foreign reserves of the industrialised countries

	Gold holdings Tonne	Gold holdings Million USD	Total foreign reserves Million USD	Share of gold of total foreign reserves Per cent
Euro countries				
Germany	3 469	29.42	81.49	36.1
France	3 025	25.65	60.96	42.1
Italy	2 452	20.80	46.85	44.4
The Netherlands	912	7.73	16.96	45.6
Portugal	607	5.15	13.91	37.0
Spain	523	4.44	35.86	12.4
Austria	347	2.95	15.01	19.6
Belgium	258	2.19	12.25	17.9
Finland	49	0.42	8.12	5.1
Ireland	6	0.05	5.39	0.9
Luxembourg	2	0.02	0.11	18.8
Other industrialised countries (excl. Nordic)				
Switzerland	2 354	19.96	50.98	39.1
USA	8 137	69.01	122.70	56.2
United Kingdom	436	3.70	43.57	8.5
Japan	764	6.48	362.63	1.8
Australia	80	0.68	18.90	3.6
Canada	36	0.31	33.21	0.9
Other Nordic countries				
Sweden	185	1.57	15.71	10.0
Denmark	67	0.56	13.71	4.1
Norway	37	0.31	20.84	1.5

Source: International Financial Statistics, IMF.

[4] The gold holding is market value at the actual gold price as per 30 June 2001. This value can therefore differ from the book value that certain banks use in their accounts.

[5] The total quantity of gold that was owned by the public sector as per 31 December 2001 was 32 973 tonnes. Public sector here means all central banks and the supranational bodies such as the Bank for International Settlements, BIS, and the International Monetary Fund, IMF.

The Riksbank's gold reserves, measured by weight, have not changed in recent decades. The size of the gold reserves depends on the part played by the gold reserves earlier in the monetary system. The question of whether gold still plays a role in the monetary system will be taken up later in this section. First, an evaluation will be carried out of the gold reserves in a purely portfolio-theoretical perspective, independent of the agreement that the Riksbank is subject to on future gold management.

The Riksbank's gold reserves, measured by weight, have not changed in recent decades.

The gold reserves in a portfolio theoretical perspective

In this section, the characteristics of the gold reserves relative to the foreign reserves are analysed from a risk and result-oriented perspective. The question is whether the Riksbank would have chosen to have gold in the total reserves had the bank not owned gold for historical reasons.

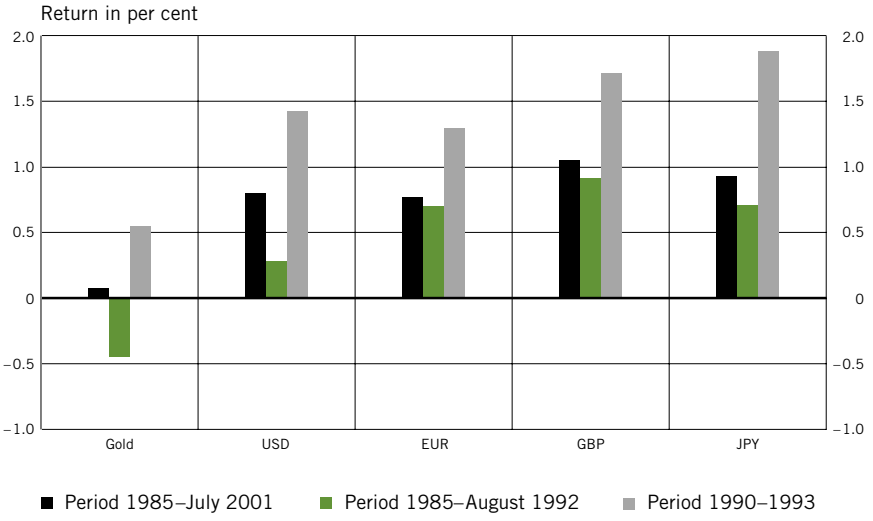
The return in the gold and foreign reserves is measured in Swedish kronor, which means that both the interest rate effect and the exchange rate effect are included. The period studied is from January 1985 up to July 2001 inclusive. During this period, the Swedish krona has depreciated in relation to all currencies that are now represented in the foreign reserves. The interest rate level (both as regards long and short loans) is generally lower at the end of the period than at the beginning. Two part-periods have also been selected in the study: January 1985 to August 1992 inclusive and January 1990 to December 1993 inclusive. The first part period was dominated by a depreciation of the dollar. The Swedish krona was then linked to the European currencies firstly through a basket of currencies and then through an ecu-basket. The second part period was dominated by a global reduction in interest rates at the same time as the krona, which towards the end of the period was no longer linked to the European currencies and started to float, depreciated in relation to all currencies in the present foreign reserves.

The return on the gold and foreign reserves is measured in Swedish kronor, which means that both the interest rate effect and the exchange rate effect are included.

Diagram 3 shows the return measured in Swedish kronor and Diagram 4 the risk measured in standard deviation, in both diagrams for gold[6] and the curren-

[6] The return on gold consists both of the change in value of the gold and the return on gold received by lending the gold. In the calculation, three-months' deposit interest for gold has been used. The gold price, the gold borrowing fee and the exchange rate development have been taken from EcoWin.

Diagram 3. The average monthly return on gold and for currencies in the foreign reserve for the respective period



cies[7] included in the foreign reserves. The rate of return on gold has been relatively low throughout the period. The reason for this is primarily the negative development of the gold price in dollars. Since the return on gold is measured in Swedish kronor, the average monthly return is maintained over zero, however, since the Swedish krona has depreciated slightly in relation to the U.S. dollar during the period. The fact that the return on gold was negative during the period January 1985 to August 1992 inclusive is mainly due to the appreciation of the krona in relation to the dollar. During the period January 1990 to December 1993 inclusive, the depreciation of the krona contributed to the return being relatively high.

If one studies the risk measured in standard deviation, the risk for gold at the same time has been high relative to the currencies included in the foreign reserves. It is only the interest rate investment in Japanese yen that has had as high a risk as gold in the different periods.

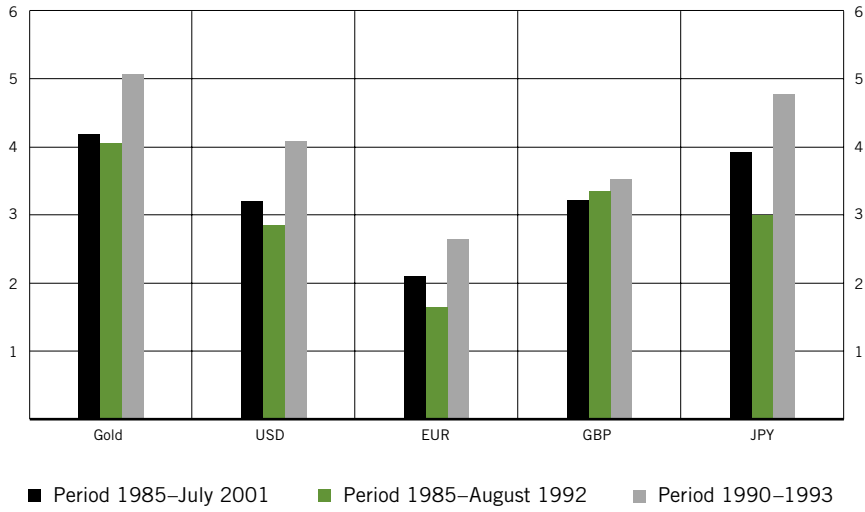
In an assessment of the risk for a portfolio, it is, however, not only the risk of each individual asset that plays a role, but also the correlation between the returns on the assets. A low or negative correlation between two assets indicates that the risk can be reduced by investing in both assets.

There are not many studies that analyse gold as part of a portfolio. The few

[7] The interest index for the different currencies has been obtained from SalomonSmithBarney.

Diagram 4. Risk measured as standard deviation for gold and for currencies in the foreign reserve for the respective period

Standard deviation



studies that exist claim that gold can improve the return on a portfolio by its price having a negative or low correlation to the price of other assets.[8] The studies only relate to a portfolio that is exclusively invested in American assets such as short U.S. government paper, U.S. shares and the like. In an assessment of the correlation between the gold reserves and the American interest portfolio in local currency (USD) for the three periods, the correlation is negative, between 0.00 and –0.20. When the correlation calculations are made between the gold reserves and the U.S. interest portfolio expressed in Swedish kronor, a somewhat different result is obtained. The correlation between these two assets is very high. This is due to there being an equal effect on the interest portfolio in dollars and the gold reserves in the event of an appreciation or depreciation of the Swedish krona in relation to the dollar. Diagram 5 also shows the correlation coefficients[9] between the gold reserves and the three other interest portfolios in the exchange reserves.

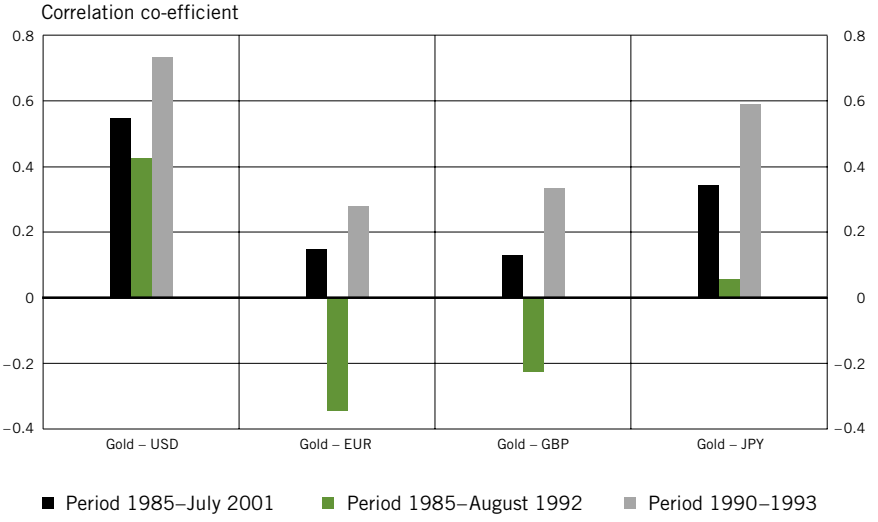
The few studies that analyse gold as a part of a portfolio claim that gold can improve the return on a portfolio by its price having a negative or low correlation with the price of other assets.

The fact that the correlation is negative to certain currencies during the peri-

[8] World Gold Council (1999) and World Gold Council (2000).

[9] If the correlation coefficient of the two assets is 1, this means that they are perfectly correlated, if it is 0, this means that they are uncorrelated and if it is –1, this means that they are perfectly negatively correlated.

Diagram 5. Correlation co-efficients between gold and the four currencies in the foreign reserve expressed in Swedish kronor for the respective period



od January 1985 to August 1992 inclusive, is probably due to the Swedish krona being first linked to a basket of currencies and then to an ecu basket before the krona was allowed to float in November 1992.

Based on these data, effective fronts[10] between reserves with a gold holding of 10 per cent and reserves without a gold holding have been calculated for the three periods (see Diagram 6, 7 and 8). In the calculation, it is assumed that the weights for the currencies included in the foreign reserves are the same as in the present foreign exchange norm distribution[11], since they are set on the basis of other criteria than risk and return.

Since the calculation has only been carried out on two assets, the gold reserves and the foreign reserves, all combinations of the two assets end up on the front. The combination with lowest risk indicates that the proportion of gold should only be half as large as today, i.e. 5 per cent. In the effective front for the period January 1985 to August 1992 inclusive, it can be seen that despite gold producing a negative return, the negative or low correlation of gold to the currencies included in the foreign reserves made a positive contribution to the portfolio

[10] An effective front is obtained by optimising the distribution between the two assets in a portfolio, given a specific level of return. A portfolio is accordingly a front portfolio if it has the lowest variance of all portfolios with the same expected return.

[11] The foreign exchange norm distribution for the foreign reserves is 35 per cent USD, 35 per cent EUR, 15 per cent GBP and 15 per cent JPY.

Diagram 6. Effective front January 1985–July 2001

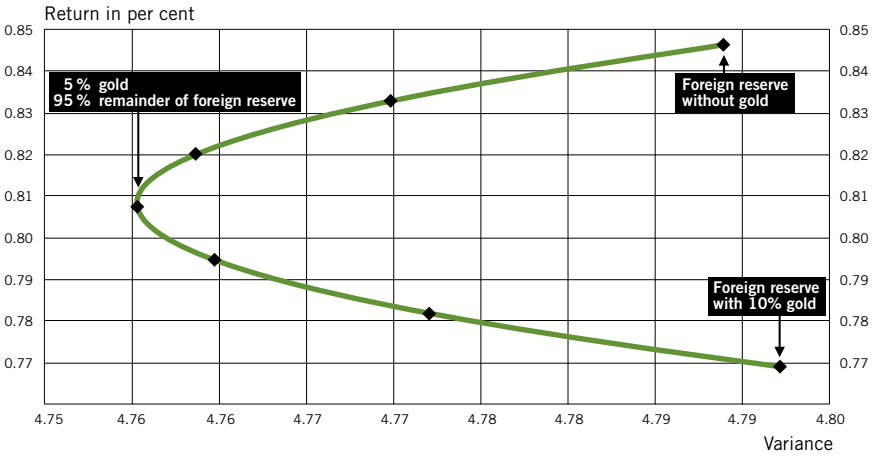
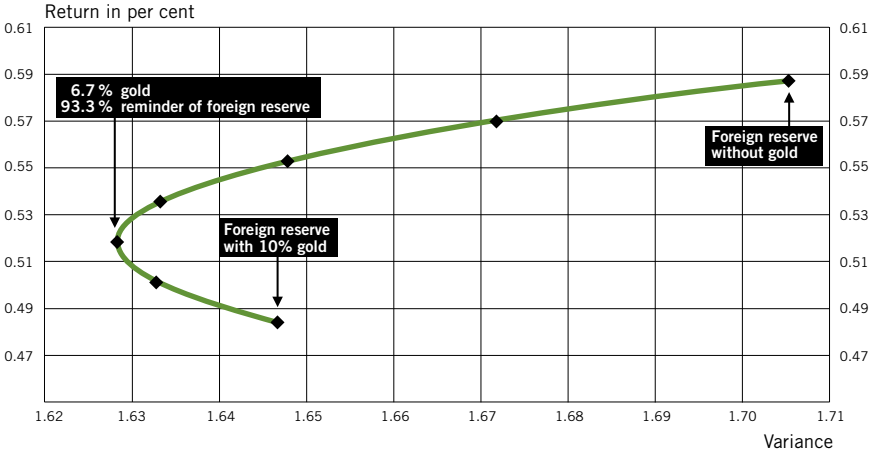


Diagram 7. Effective front January 1985-August 1992

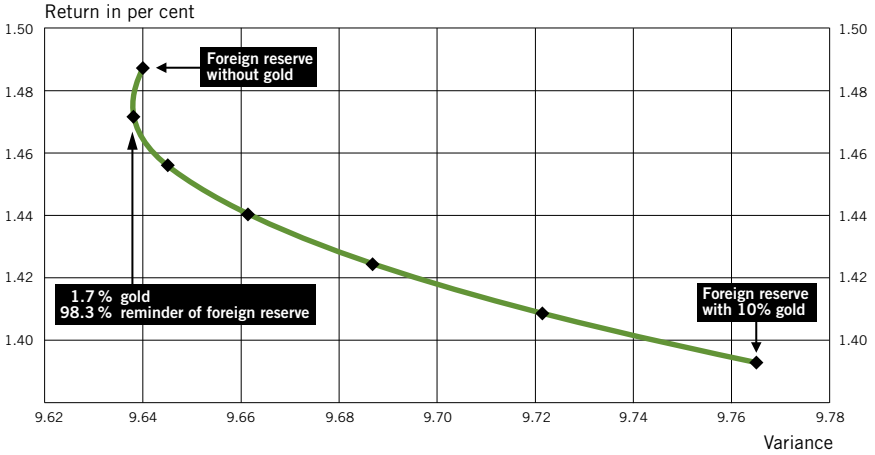


in terms of risk and the proportion of gold in the combination with the lowest risk is proposed as being 6.7 per cent. During the second part period from January 1990 to December 1993 inclusive, the result is the opposite.

The interpretation of the result of the analysis is thus that gold serves to some extent to diversify risk in the total reserves although gold reserves of 10 per cent can be considered as being too large from a portfolio theoretical perspective. However, one should be careful in interpreting this result since the analysis is based on ex post-calcula-

Gold serves to some extent to diversify risk in the total reserves, although a proportion of 10 per cent can be considered too large from a portfolio theoretical perspective.

Diagram 8. Effective front January 1990–December 1993



tions over a period that cannot be considered as being representative for the future. It is not probable that the pattern from the period with a fixed exchange rate regime will be repeated.

Does gold still play its traditional part in the monetary system?

Gold is considered to be a safer asset in global crisis periods than other assets. The central banks therefore keep the gold reserves for reasons of preparedness for emergencies.

Gold has not served as an anchor in a fixed exchange-rate system since the Bretton-Woods system ceased in 1973. Since then, gold has served more as a store of value during turbulent periods both for central banks and investors. In the recent period, investors have tended, however, to replace gold as a so-called safe haven with currencies such as U.S. dollars and Swiss francs. In the above-mentioned agreement between the 15 European central banks, the participants consider, however, that gold is still an important component of the global reserves. The reason for this is that gold is considered a safer asset in global crisis periods, a reserve asset. The central banks therefore keep the gold reserves for reasons of preparedness for emergencies. The probability of gold playing a part in a fixed exchange rate system, as under the gold standard and the Bretton Wood, must be considered as very small, however.

The lending market for gold

Central banks, who opt to retain gold in their reserves, have an opportunity to obtain a return on the gold beside the change in value. This takes place either through the central banks lending gold through making a so-called gold deposit. Or the central banks can obtain a return on their gold through a so-called gold/currency swap in the spot market, invest the payment received in a risk-free interest-bearing asset and purchase back the same quantity of gold on the forward market. The counterparty in both cases is a bullion bank. As a rule, the maturities are short, three to twelve months, due to restrictions in the risk mandates of the central banks. The fact that a demand to borrow gold has arisen is due to the derivative markets for gold that have developed over the last decade. Before these existed there was largely only a spot market for trade with gold.

The derivative market for gold has offered new opportunities for gold producers to hedge against future price risks.

The derivative markets that exist for gold are used both in speculative and price-hedging purposes. Above all, the derivative market for gold offers new opportunities for gold producers to hedge against future price risks, since it takes a long time to extract gold from the mines. The next section describes how a central bank obtains a return on its gold.

Gold deposits

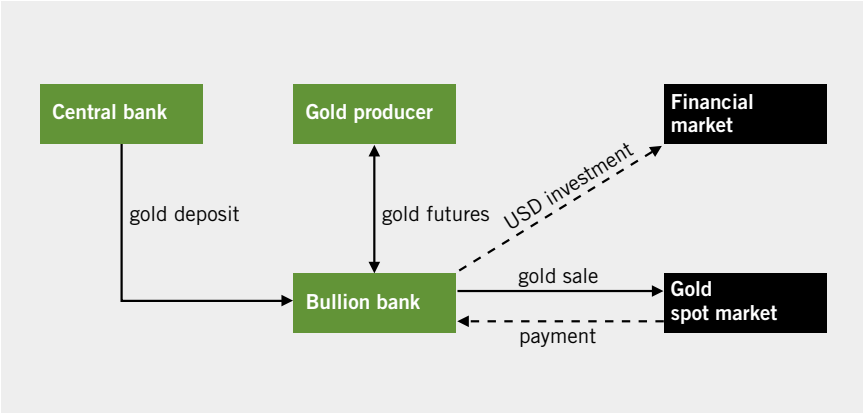
Gold deposits are the commonest way for central banks to lend gold.

Gold deposit is the commonest way for central banks to lend gold. A typical example of how a gold deposit can take place is described here. The starting point is that a gold producer wishes to hedge his future gold production.

At the time t the gold producer hedges against a price risk by selling gold production as a future to a bullion bank. The bullion bank wishes to cover its open position and therefore borrows on deposit the equivalent quantity of gold from a central bank for a gold lending rate. We assume for the sake of simplicity that the maturity for the forward and the gold deposit are equally long. The gold is then sold by the bullion bank in the spot market and the payment received for the gold invested at a dollar interest rate.

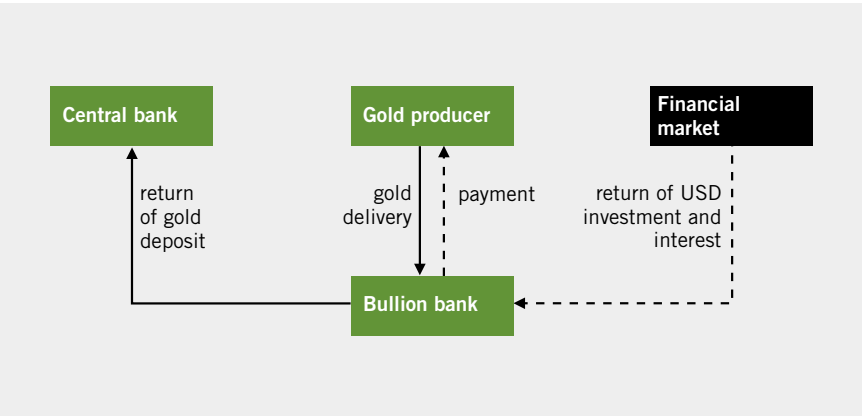
At time T, the bullion bank receives back the dollar investment and the interest in dollars. The gold producers supply the gold to the bullion bank for payment at the forward price. The bullion bank returns the gold to the central bank and pays the gold lending rate.

Figure 1. Business transactions and flows at the time *t*



The return for the central bank in the case of a gold deposit is accordingly a gold lending rate received from the bullion bank. If the bullion bank is declared bankrupt, the central bank can lose the gold lent. The gold lending rate must therefore compensate for this risk.

Figure 2. Business transactions and flows at time *T*



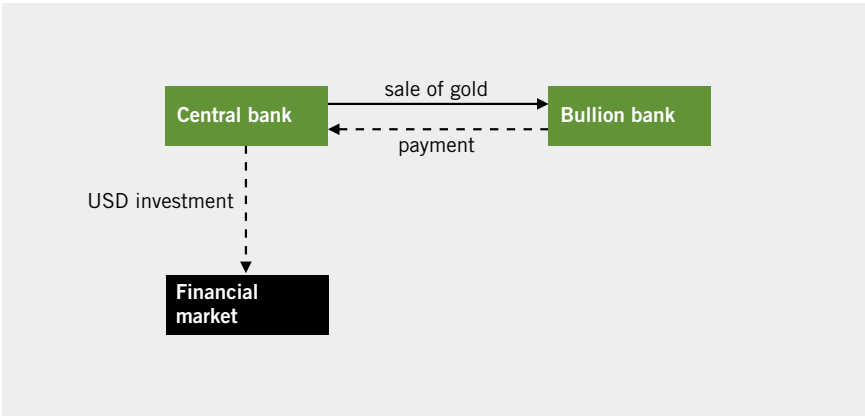
Gold/foreign exchange swap

A gold/currency swap is less risky for the central bank since the bank in theory sells the gold to buy it back at a fixed price at the end of the maturity. The central bank receives dollars for its gold which are invested at a risk-free interest rate. This investment can be regarded as collateral in the event of the failure of the

counterparty. The same transactions take place between the gold producer and the bullion bank as in the case of the gold deposit so that only the transactions and flows between the central bank and the bullion bank are shown here.

A gold/foreign exchange swap is less risky for the central bank since the bank in theory sells the gold to buy it back at a fixed price at the end of the maturity.

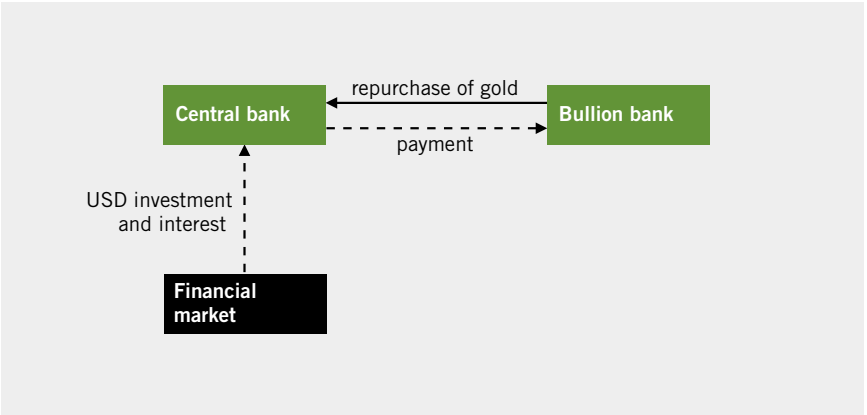
Figure 3. Business transactions and flows at time *t*



At time *t* the central bank makes a gold/currency swap with a bullion bank, i.e. the central bank sells gold in return for an agreement to re-purchase the gold at a fixed price, a "forward price", when the swap falls due. The dollars received by the central bank are invested at a risk-free market interest rate for dollars.

At time *T*, the central bank receives the dollars back that were invested and interest on the investment. The gold is repurchased from the bullion bank at the forward price set at time point t. As long as the amount the central bank receives for its dollar investment is larger than the amount the bank is to pay to re-purchase the gold according to the forward contract, the central bank makes a profit. The gold/currency swap is associated with some risk, however. If the bullion bank cannot supply the gold that has been agreed upon according to the forward contract, the gold must be re-purchased at market price. If the market price is higher than the future price, the central bank can make a loss. The risk in a swap transaction is, however, lower than in lending gold without collateral. The return the central bank receives is therefore normally lower in a gold/currency swap than in a gold deposit.

Figure 4. Business transactions and flows at time *T*



Historical trend for the gold lending rate

Risks when lending gold

By lending gold, the central banks assume a credit risk and a liquidity risk.

A central bank's holding of gold is wholly risk-free viewed from a credit perspective. Gold as an asset generates no return, however, except by a change in its market value. By lending gold or by making a gold/currency swap, central banks assume in this way as described earlier a risk that the return must compensate for. The risks are:

- **Credit risk on gold deposit**. By lending gold without collateral, the central bank assumes a counterparty risk since there may then be a risk that the bank will not get the gold back if the counterparty fails.
- **Credit risk in a so-called gold/currency swap**. If the counterparty cannot comply with his undertaking in the future contract, the central bank may need to repurchase the gold at a higher price than the forward price in order to retain the gold reserve.
- **Liquidity risk**. During the maturity that the gold is lent or sold, there is small possibility of changing the gold into liquid assets.

If the central bank can accept an increased risk taking, there is an incentive to lend gold[12] as long as the return is higher than the risk.

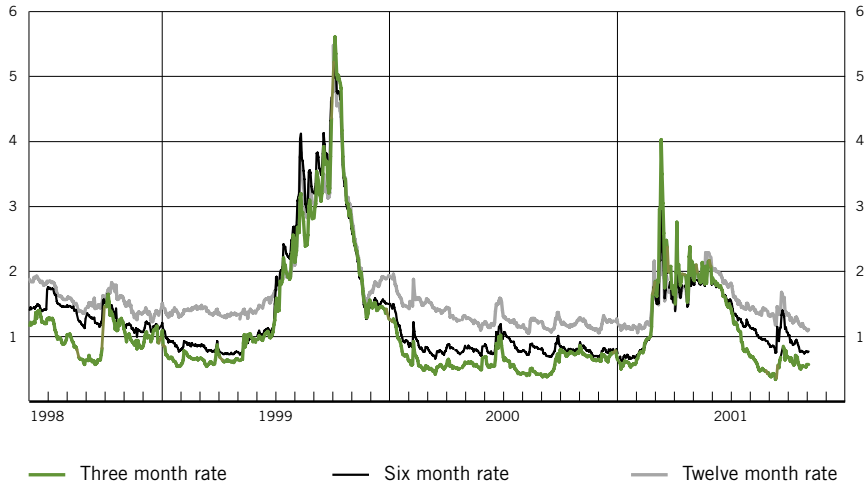
[12] By assuming a credit risk on lending gold, the central bank places a burden on the set credit risk which could possibly be used for a more effective management of assets with higher returns.

Many central banks are willing to lend their gold to obtain a return on the gold in addition to the change in value. The supply of gold for loan has increased in recent years. As per 31 December 2000 the estimated quantity of gold for lending by central banks was 4 830 tonnes.[13] At the same time, gold producers have reduced their forward books somewhat which means that the demand for gold for lending has fallen. This means that the return for lending gold is relatively low for central banks (see Diagram 9).

The return for lending gold is relatively low for central banks.

Diagram 9. Gold lending rate 1 June 1998–30 October 2001 for gold deposits of three, six and twelve months

Per cent



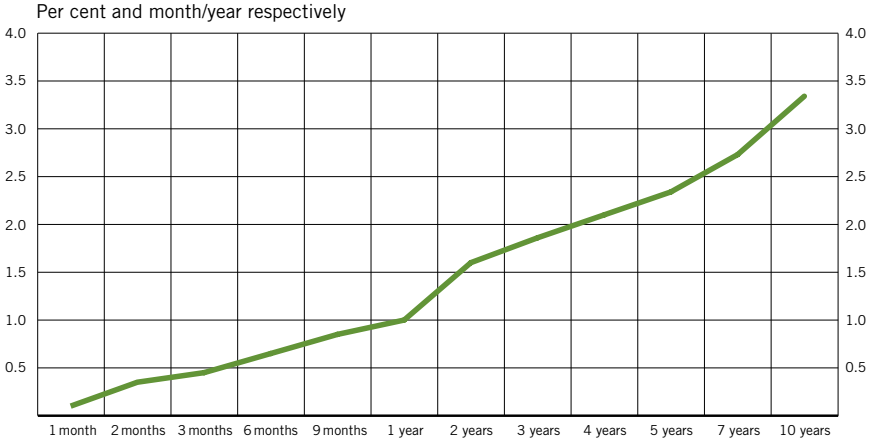
Source: EcoWin.

In the above example as regards gold deposit, it is assumed that the maturity for gold deposit and the gold forward were equally long. Gold lending by central banks previously took place as mentioned above most often on short maturities because of the credit risk. Gold producers on the other hand want to have a long maturity on their forwards since it can take a number of years to extract gold from gold mines. In this way, a mis-match arises between the preferred maturities for supply and demand for gold lending. This mis-match is reflected in the yield curve for gold which has a steep positive slope (see Diagram 10).

[13] According to Gold Fields Mineral Services Ltd.

Diagram 10. The yield curve for gold as of 2 November 2001

Per cent and month/year respectively



Source: Societé General.

Summary

From a portfolio theoretical perspective, there is no major reason for the gold reserves to be as large as 10 per cent of the total reserves.

The reason that there is still gold in central banks' reserves is not due to gold being considered to be an effective asset versus currencies in the foreign reserves. The return on gold has been low in recent years at the same time as the risk has been high. When the correlation between gold and interest rate portfolios in the foreign reserves is measured in Swedish kronor, the correlation is so high that gold can no longer be considered as being a risk-diversifying asset in a portfolio. In this way, there is from a portfolio-theoretical perspective no major reason for the gold reserves being as high as 10 per cent of the total reserves. The reason for gold remaining in the reserves is rather that gold is still considered to play a special role in the monetary system.

Gold as an asset does not generate a return apart from a change in value. Central banks can obtain some return on the gold reserves by lending their gold, however. The fact that there is any demand to borrow gold whatsoever is due to the development of a derivative market for gold which makes it possible for gold producers to hedge future gold production. When lending gold, the central banks assume both a credit and a liquidity risk, however.

References

Kenwood, A.G. & Lougheed, A.L., (1996), *Den internationella ekonomins tillväxt 1820–1990*, Studentlitteratur, Lund.

International Monetary Fund, (2001), *International Financial Statistics*, September 2001.

World Gold Council, (1999), "*How Gold Can Enhance a Portfolio's Return*", Gold Portfolio Letter no. 8, March 1999.

World Gold Council, (2000), "*Comparing Gold to Treasury Bills*", Gold Portfolio Letter no. 10, July 2000.

Gold Fields Mineral Services Ltd., (2001), *Gold Survey* 2001.

Notices

Statistics Sweden takes over the production of financial market statistics

The Riksbank and Statistics Sweden, SCB, signed an agreement in November 2001, which entails Statistics Sweden taking over the production and development of the Riksbank's financial market statistics with effect from 1 April 2002. The financial market statistics include bank deposits, bank lending and the money supply. Their content is largely governed by the requirements of the European Central Bank.

Swedish corporate assets abroad increased considerably in 2000

Swedish corporate assets in the form of direct investment abroad increased substantially during 2000. At the end of 2000, Swedish direct investment abroad amounted to SEK 1,145 billion, which is an increase over just over 30 per cent on the previous year. The value of the corresponding foreign direct investment in Sweden also increased, although to a lesser degree. This information was revealed in the Riksbank's annual survey of direct investment.

The increase in Swedish direct investment assets abroad is mainly accounted for by a few large mergers and acquisitions in the banking and telecom sectors. The main contribution to the growth in foreign direct investment in Sweden, on the other hand, comes from investments in the engineering and pharmaceuticals industries.

The survey also measures the income generated by direct investment assets, i.e. corporate profits. Swedish direct investment assets abroad provided an in-

come of SEK 111 billion for 2000, while the income for foreign countries with direct investment assets in Sweden amounted to SEK 70 billion.

The Swedish Financial Market

The Riksbank published the report The Swedish Financial Market in December 2001. This publication, which is issued annually, describes the structure and functioning of the Swedish financial sector. The aim is to provide a general description of the most important markets and operators based in Sweden.

The introduction of euro banknotes and coins in the euro zone

On 1 January 2002 euro banknotes and coins were introduced in twelve countries in Europe: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

Sweden is not taking part in stage three of the monetary union and has not replaced its currency. The euro will be treated as a new foreign currency in Sweden. The only one of the Nordic countries to change its currency to euro banknotes and coins was Finland.

More information on the euro can be found on the Riksbank's website (www.riksbank.se) under the heading EMU.

Swedish National Debt Office currency exchanges

The Swedish National Debt Office has been commissioned to repay government debt denominated in foreign currency to a value of SEK 15 billion during 2002. There is an interval of SEK ±15 billion for deviations from this figure, which the Debt Office can utilise without a special decision by the government. The Swedish National Debt Office has now decided to utilise the scope allowed in this deviation interval to reduce its amortisation and will therefore not make any repayments for the time being on the government debt in foreign currency during 2002, see www.rgk.se for further details

However, it will still be necessary to pay interest of approximately SEK 20 billion on the government debt denominated in foreign currency. The Riksbank, in its role as agent for the Swedish National Debt Office in currency exchanges,

will therefore purchase foreign currency for approximately SEK 10 billion in the market during the first half of next year. According to a government decision, the Debt Office will have the right to exchange currency with counterparties other than the Riksbank with effect from 1 July 2002.

The Riksbank's currency exchanges on behalf of the Swedish National Debt Office will be implemented each trading day between 8.30 and 8.45 a.m. The transactions will be spread evenly over time and handled with complete transparency. The currency exchanges will be arranged with the institutions that have a primary dealer agreement with the Riksbank for the Swedish foreign exchange market.

Sale of the Swedish Mint

The Riksbank has signed a final agreement with the Finnish state-owned Mint Rahapaja Oy, on the sale of the Swedish Mint in Eskilstuna. The purchase price is SEK 200 million. At the same time, the Riksbank concluded a long term agreement with Rahapaja Oy regarding delivery of coins and commemorative coins.

Rahapaja has taken over the Swedish Mint with effect from 1 January 2002. Rahapaja intends to co-ordinate activities in Finland and Sweden and continue operations in Eskilstuna. All of the fifteen employees based in Eskilstuna will be offered continued employment at the Mint.

Sale of Tumba Bruk

The Riksbank has signed a final agreement with the American company Crane & Co on the sale of AB Tumba Bruk. The purchase price is USD 15 million. The sale covers the paper mill for banknote paper and the banknote printing works. Crane & Co took over Tumba Bruk with effect from 1 January 2002, and at the same time changed the name of the Swedish company to Crane AB. The Riksbank has signed a delivery agreement with Tumba Bruk on the continued production of Swedish banknotes.

Exchange of EU payment

Sweden's EU membership means that the National Debt Office periodically makes payments towards the EU budget. One of these payments was made in the first week of 2002, amounting to SEK 6.5 billion. In connection with this, the Riksbank exchanged the payment for euro from the foreign currency reserve, in

the same manner as last year. This measure was taken with the aim of preserving market functionality.

The Riksbank intends to repurchase the equivalent amount on the foreign exchange market at regular intervals over the next three months. This will be done by extending the daily morning purchases of foreign currency made on behalf of the Swedish National Debt Office.

The Riksbank has neutralised the effect of the foreign exchange transaction on liquidity in Swedish krona through an FX swap, which involves selling Swedish currency for foreign currency in the spot market while at the same time repurchasing the corresponding amount of krona in forward transactions. This swap position will be phased out as the size of the foreign currency reserve is restored.

Preparations, decision making and communication in the event of foreign exchange interventions

The Executive Board of the Riksbank decided on 31 January 2002 to clarify its procedures with regard to the preparations, decision and communication concerning interventions in the foreign exchange market. A corresponding system for processing decisions regarding the repo rate was established in January 1999. The decision made now should be regarded in the light of the experiences from the interventions in the foreign exchange market during 2001. The clarification emphasises the importance of transparency and clarity when deciding on interventions. With this document, the Riksbank is showing much greater transparency than is normally the case among central banks.

Monetary policy calendar

1999-01-04 The *reference* (official discount) *rate* is confirmed by the Riksbank at 1.5 per cent as of 5 January 1999.

1999-02-12 The *fixed repo rate* is lowered by the Riksbank to 3.15 per cent as of 17 February 1999. The Riksbank also lowers its *deposit* and *lending rates*, in each case by 0.5 percentage points. The deposit rate is set at 2.75 per cent and the lending rate at 4.25 per cent. The decision takes effect on 17 February 1999.

1999-03-25 The *fixed repo rate* is lowered by the Riksbank from 3.15 per cent to 2.90 per cent as of 31 March 1999.

1999-04-01 The *reference* (official discount) *rate* is confirmed by the Riksbank at 1.0 per cent as of 6 April 1999.

1999-07-01 The *reference* (official discount) *rate* is confirmed by the Riksbank at 1.0 per cent (unchanged).

1999-10-01 The *reference* (official discount) *rate* is confirmed by the Riksbank at 1.5 per cent as of 4 October 1999.

1999-11-11 The *repo rate* is increased by the Riksbank from 2.90 per cent to 3.25 as of 17 November 1999.

2000-01-03 The *reference* (official discount) *rate* is confirmed by the Riksbank at 2.0 per cent as of 4 January 2000.

2000-02-03 The *repo rate* is increased by the Riksbank from 3.25 per cent to 3.75 as of 9 February 2000.

2000-04-03 The *reference* (official discount) *rate* is confirmed by the Riksbank at 2.5 per cent as of 4 April 2000.

2000-12-07 The *repo rate* is increased by the Riksbank from 3.75 per cent to 4.0 per cent as of 13 December 2000. The Riksbank also increases its *deposit* and *lending rates* in each case by 0,5 percentage points. The deposit rate is set at 3.25 per cent and the lending rate at 4.75 per cent. The decision takes effect on 13 December 2000.

2001-07-05 The *repo rate* is increased by the Riksbank from 4.0 per cent to 4.25 per cent as of 11 July 2001. The Riksbank also increases its *deposit* and *lending rates* in each case by 0.25 percentage points. The deposit rate is set at 3.5 per cent and the lending rate at 5.0 per cent. The decision takes effect on 11 July 2001.

2001-09-17 The *repo rate* is lowered by the Riksbank from 4.25 per cent to 3.75 per cent as of 19 September 2001. The Riksbank also lowers its *deposit* and *lending rates* in each case by 0.50 percentage points. The deposit rate is set at 3.0 per cent and the lending rate at 4.5 per cent. The decision takes effect on 19 September 2001.

Statistical appendix

Statistics from Sveriges Riksbank are to be found on the Internet (http://www.riksbank.se). Dates of publication of statistics regarding the Riksbank's assets and liabilities including foreign exchange reserves plus financial market and the balance of payments statistics are available on the homepage of the International Monetary Fund, IMF (http://dsbb.imf.org). Dates of publication can also be obtained from the Information Centre at Sveriges Riksbank.

1 Riksbank's assets and liabilities

Assets. Period-end stock figures. SEK million

		Gold	Government securities	Lending to banks	Fixed assets	Other	**Total**
2000	July	14 774	22 935	40 460	126 133	1 397	205 699
	Aug	14 774	22 691	38 197	132 165	1 933	209 760
	Sept	14 774	21 610	40 730	134 464	1 089	212 667
	Oct	14 774	21 610	36 054	140 628	3 422	216 488
	Nov	14 774	21 610	31 257	142 397	3 350	213 388
	Dec	15 428	20 728	43 204	152 619	1 276	233 255
2001	Jan	15 428	19 218	46 861	144 875	3 734	230 116
	Feb	15 428	19 218	47 199	146 900	3 057	231 802
	March	15 428	19 218	45 686	151 422	5 122	236 876
	April	15 428	19 218	47 648	153 379	1 799	237 472
	May	15 428	19 218	46 018	145 454	1 888	228 006
	June	15 428	–	56 904	137 037	6 830	216 199
	July	15 428	–	60 215	131 003	3 004	209 650
	Aug	15 428	–	67 658	125 724	3 331	212 141
	Sept	15 428	–	69 951	126 611	2 177	214 167
	Oct	15 428	–	65 779	133 427	1 897	216 531
	Nov	15 428	–	58 678	140 723	3 160	217 989
	Dec	15 428	–	69 107	141 880	1 745	228 160
2002	Jan	15 428	–	59 248	141 967	3 008	219 651

Liabilities

		Notes and coins in circulation	Capital liabilities	Debts to monetary policy counterparts	Debts in foreign currency	Other	**Total**
2000	July	88 355	63 466	73	6 295	47 510	205 699
	Aug	88 947	63 466	237	7 731	49 379	209 760
	Sept	89 732	63 466	19	10 751	48 699	212 667
	Oct	88 981	63 466	1 999	11 116	50 926	216 488
	Nov	90 530	63 466	231	8 905	50 256	213 388
	Dec	97 663	62 988	108	8 603	63 893	233 255
2001	Jan	91 489	62 988	290	9 761	65 588	230 116
	Feb	91 145	62 988	404	11 119	66 146	231 802
	March	92 281	62 988	61	6 843	74 703	236 876
	April	93 210	62 988	77	14 455	66 742	237 472
	May	94 123	70 890	107	11 179	51 707	228 006
	June	94 956	70 890	83	16 207	34 063	216 199
	July	94 018	70 890	408	8 439	35 895	209 650
	Aug	95 540	70 890	71	8 629	37 011	212 141
	Sept	95 520	70 890	127	11 171	36 459	214 167
	Oct	96 599	70 890	132	12 943	35 967	216 531
	Nov	98 295	70 890	75	10 488	38 241	217 989
	Dec	107 105	70 890	48	8 584	41 533	228 160
2002	Jan	98 571	70 890	402	9 517	40 271	219 651

2 Money supply

End-of-month stock

		SEK million			Percentage 12-month change	
		M0	M3		M0	M3
1999	Jan	74 940	855 180	Jan	5.9	4.1
	Feb	74 621	853 298	Feb	5.9	5.8
	March	75 302	853 557	March	8.3	6.3
	April	75 533	861 790	April	7.6	6.7
	May	76 532	868 965	May	8.1	6.6
	June	76 413	879 740	June	7.4	6.0
	July	77 050	872 884	July	8.0	4.5
	Aug	78 080	889 817	Aug	6.9	6.5
	Sep	78 479	900 077	Sept	9.1	7.3
	Oct	79 413	930 834	Oct	8.7	10.0
	Nov	80 681	915 960	Nov	9.1	7.4
	Dec	87 510	926 983	Dec	12.0	9.9
2000	Jan	82 625	929 003	Jan	10.3	8.6
	Feb	81 421	930 617	Feb	9.1	9.1
	March	81 352	924 490	March	8.0	8.3
	April	81 853	946 288	April	8.4	9.8
	May	82 113	964 551	May	7.3	11.0
	June	81 666	933 106	June	6.9	6.1
	July	81 637	924 248	July	6.0	5.9
	Aug	82 499	929 259	Aug	5.7	4.4
	Sept	83 182	945 672	Sept	6.0	5.0
	Oct	82 993	942 114	Oct	4.5	1.2
	Nov	84 239	946 657	Nov	4.4	3.4
	Dec	89 162	946 118	Dec	1.9	2.1
2001	Jan	84 608	932 534	Jan	2.4	0.4
	Feb	84 562	919 230	Feb	3.9	–1.2
	March	85 407	937 105	March	5.0	1.4
	April	86 591	943 156	April	5.8	–0.3
	May	86 923	951 496	May	5.9	–1.4
	June	87 534	979 330	June	7.2	5.0
	July	86 951	944 985	July	6.5	2.2
	Aug	87 940	952 921	Aug	6.6	2.5
	Sept	88 130	974 525	Sept	5.9	3.1
	Oct	89 047	988 666	Oct	7.3	4.9
	Nov	90 185	1 005 618	Nov	7.1	6.2

3 Interest rates set by the Riksbank

Per cent

	Date	Repo rate	Deposit rate	Lending rate		Date	Discount rate
1997	12-17	4.35			1996	07-02	4.50
1998	06-10	4.10				10-02	3.50
	11-04	3.85			1997	01-03	2.50
	11-18		3.25	4.75	1998	07-02	2.00
	11-25	3.60			1999	01-05	1.50
	12-16	3.40				04-06	1.00
1999	02-17	3.15	2.75	4.25		10-04	1.50
	03-31	2.90			2000	01-04	2.00
	11-17	3.25				04-04	2.50
2000	02-09	3.75				07-01*	2.00
	12-13	4.00	3.25	4.75			
2001	07-11	4.25	3.50	5.00			
	09-19	3.75	3.00	4.50			

* 1 July 2000 the National Debt Office took over the Riksbank's task of setting and publishing the discount rate.

4 Capital market interest rates

Effective annualized rate for asked price. Monthly average, per cent

		Bond issued by:					
		Central government				Housing	(Caisse)
		3 years	5 years	7 years	9–10 years	2 years	5 years
2000	Jan	5.20	5.68	5.87	5.95	5.61	6.22
	Feb	5.36	5.76	5.86	5.90	5.81	6.35
	March	5.17	5.44	5.49	5.51	5.66	6.11
	April	5.04	5.36	5.41	5.42	5.50	6.04
	May	5.02	5.34	5.37	5.34	5.48	6.13
	June	4.94	5.16	5.17	5.13	5.39	5.94
	July	5.05	5.32	5.34	5.31	5.48	6.06
	Aug	4.91	5.25	5.32	5.31	5.31	5.97
	Sept	4.69	5.08	5.21	5.26	5.05	5.74
	Oct	4.56	5.01	5.18	5.23	4.90	5.66
	Nov	4.51	4.90	5.04	5.13	4.81	5.46
	Dec	4.39	4.60	4.74	4.92	4.69	5.19
2001	Jan	4.22	4.56	4.72	4.89	4.51	5.08
	Feb	4.15	4.51	4.71	4.86	4.41	5.04
	March	4.01	4.33	4.59	4.75	4.28	4.87
	April	4.12	4.51	4.78	4.93	4.36	5.03
	May	4.43	4.82	5.12	5.27	4.63	5.33
	June	4.75	5.03	5.26	5.38	4.98	5.59
	July	4.78	5.08	5.30	5.42	5.20	5.76
	Aug	4.49	4.77	5.01	5.16	4.88	5.39
	Sept	4.23	4.74	5.04	5.26	4.65	5.39
	Oct	3.98	4.60	4.92	5.17	4.41	5.25
	Nov	3.92	4.49	4.76	4.96	4.34	5.13
	Dec	4.21	4.90	5.09	5.24	4.67	5.49
2002	Jan	4.53	5.01	5.17	5.27	4.71	5.40

5 Overnight and money market interest rates

Monthly average, per cent

		Repo rate	Inter bank rate	SSVX			Company certificates	
				3 months	6 months	12 months	3 months	6 months
1999	Jan	3.40	3.50	3.27	3.25		3.45	3.46
	Feb	3.30	3.40	3.14	3.16		3.31	3.35
	March	3.14	3.24	3.13	3.18	3.17	3.30	3.33
	April	2.90	3.00	2.87	2.90		3.04	3.07
	May	2.90	3.00	2.92	2.96	3.24	3.11	3.15
	June	2.90	3.00	2.97	3.03	3.37	3.18	3.22
	July	2.90	3.00	3.01	3.16		3.30	3.57
	Aug	2.90	3.00	3.00	3.20		3.32	3.77
	Sept	2.90	3.00	3.05	3.28	3.91	3.27	3.75
	Oct	2.90	3.00	3.23	3.55		3.87	4.00
	Nov	3.06	3.16	3.38	3.63	4.28	3.83	3.91
	Dec	3.25	3.35	3.41	3.73	4.24	3.71	3.95
2000	Jan	3.25	3.35	3.57	3.86		3.77	4.05
	Feb	3.61	3.71	3.90	4.22		4.11	4.43
	March	3.75	3.85	4.06	4.29	4.74	4.27	4.53
	April	3.75	3.85	3.99	4.16		4.21	4.45
	May	3.75	3.85	3.96	4.09	4.57	4.21	4.43
	June	3.75	3.85	3.94	4.04	4.56	4.15	4.44
	July	3.75	3.85	4.03	4.21		4.31	4.66
	Aug	3.75	3.85	4.00	4.21	4.59	4.23	4.50
	Sept	3.75	3.85	3.94	4.04	4.51	4.14	4.36
	Oct	3.75	3.85	3.99	4.09		4.15	4.31
	Nov	3.75	3.85	4.00	4.09	4.50	4.14	4.26
	Dec	3.89	3.99	4.07	4.22	4.37	4.19	4.38
2001	Jan	4.00	4.10	4.07	4.12		4.17	4.26
	Feb	4.00	4.10	4.01	4.07		4.14	4.23
	March	4.00	4.10	4.06	4.02	4.11	4.24	4.23
	April	4.00	4.10	3.94	3.98	4.01	4.12	4.11
	May	4.00	4.10	4.01	4.06	4.28	4.16	4.20
	June	4.00	4.10	4.17	4.27	4.48	4.39	4.46
	July	4.17	4.27	4.31	4.42		4.50	4.58
	Aug	4.25	4.35	4.28	4.31	4.37	4.45	4.48
	Sept	4.05	4.15	4.01	4.06	4.15	4.18	4.22
	Oct	3.75	3.85	3.70	3.72		3.90	3.91
	Nov	3.75	3.85	3.71	3.74	3.91	3.89	3.87
	Dec	3.75	3.85	3.71	3.76	3.97	3.96	3.96
2002	Jan	3.75	3.85	3.74	3.81		3.94	3.97

6 Treasury bills and selected international rates

Monthly average, per cent

		3-month deposits				6-month deposits			
		USD	EUR	GBP	SSVX	USD	EUR	GBP	SSVX
1999	Jan	4.88	3.04	5.74	3.27	4.89	2.99	5.52	3.25
	Feb	4.87	3.02	5.38	3.14	4.93	2.97	5.25	3.16
	March	4.89	2.98	5.26	3.13	4.97	2.93	5.17	3.18
	April	4.87	2.63	5.17	2.87	4.94	2.62	5.12	2.90
	May	4.90	2.51	5.20	2.92	5.01	2.51	5.18	2.96
	June	5.09	2.57	5.08	2.97	5.28	2.63	5.09	3.03
	July	5.22	2.61	5.03	3.01	5.53	2.81	5.21	3.16
	Aug	5.37	2.64	5.13	3.00	5.78	2.97	5.43	3.20
	Sept	5.48	2.66	5.29	3.05	5.87	3.03	5.68	3.28
	Oct	6.11	3.29	5.85	3.23	6.02	3.33	5.95	3.55
	Nov	6.01	3.38	5.72	3.38	5.96	3.40	5.88	3.63
	Dec	6.07	3.38	5.91	3.41	5.09	3.46	6.10	3.73
2000	Jan	5.93	3.28	6.00	3.57	6.14	3.50	6.25	3.86
	Feb	5.99	3.47	6.09	3.90	6.24	3.67	6.27	4.22
	March	6.12	3.70	6.10	4.06	6.34	3.89	6.29	4.29
	April	6.24	3.88	6.16	3.99	6.48	4.02	6.32	4.16
	May	6.66	4.29	6.16	3.96	6.93	4.48	6.31	4.09
	June	6.70	4.43	6.09	3.94	6.87	4.61	6.20	4.04
	July	6.63	4.52	6.05	4.03	6.83	4.76	6.16	4.21
	Aug	6.59	4.72	6.08	4.00	6.74	4.95	6.20	4.21
	Sept	6.58	4.78	6.05	3.94	6.67	4.96	6.15	4.04
	Oct	6.65	4.98	6.01	3.99	6.63	5.04	6.12	4.09
	Nov	6.64	5.03	5.95	4.00	6.61	5.06	5.97	4.09
	Dec	6.41	4.85	5.83	4.07	6.26	4.85	5.80	4.22
2001	Jan	5.62	4.71	5.69	4.07	5.47	4.62	5.59	4.12
	Feb	5.25	4.70	5.61	4.01	5.11	4.61	5.53	4.07
	March	4.87	4.64	5.41	4.06	4.72	4.51	5.31	4.02
	April	4.53	4.64	5.25	3.94	4.40	4.53	5.14	3.99
	May	3.99	4.58	5.09	4.01	3.99	4.50	5.07	4.06
	June	3.74	4.40	5.10	4.17	3.74	4.28	5.18	4.27
	July	3.66	4.41	5.11	4.31	3.69	4.33	5.18	4.41
	Aug	3.48	4.30	4.87	4.28	3.49	4.17	4.88	4.35
	Sept	2.92	3.91	4.56	4.01	2.89	3.78	4.49	4.06
	Oct	2.31	3.54	4.27	3.70	2.25	3.39	4.25	3.72
	Nov	2.01	3.32	3.88	3.71	2.02	3.20	3.86	3.74
	Dec	1.84	3.27	3.94	3.71	1.90	3.19	3.96	3.76
2002	Jan	1.74	3.28	3.94	3.74	1.85	3.28	4.04	3.81

7 Krona exchange rate: TCW-weighted index and selected exchanges rates

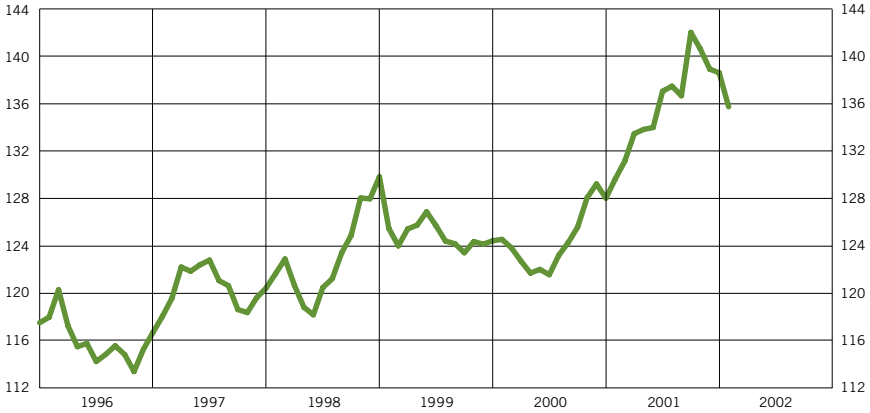
Monthly averages

			SEK per			USD per	
		TCW-index	USD	EUR	100 JPY	EUR	JPY
1999	Jan	125.46	7.82	9.0838	6.92	0.8615	113.16
	Feb	124.00	7.95	8.9096	6.82	0.8924	116.72
	March	125.43	8.22	8.9447	6.87	0.9189	119.64
	April	125.75	8.32	8.9162	6.97	0.9343	119.72
	May	126.87	8.44	8.9766	6.93	0.9410	122.05
	June	125.69	8.51	8.8338	7.05	0.9636	120.76
	July	124.40	8.46	8.7485	7.07	0.9663	119.54
	Aug	124.17	8.26	8.7584	7.29	0.9432	113.25
	Sept	123.42	8.22	8.6330	7.67	0.9524	107.01
	Oct	124.35	8.15	8.7289	7.69	0.9341	106.03
	Nov	124.14	8.34	8.6305	7.96	0.9674	104.70
	Dec	124.42	8.48	8.5892	8.27	0.9891	102.59
2000	Jan	124.54	8.47	8.5956	8.07	0.9867	105.10
	Feb	123.81	8.65	8.5112	7.91	1.0170	109.45
	March	122.71	8.69	8.3950	8.16	1.0370	106.38
	April	121.70	8.72	8.2700	8.28	1.0564	105.53
	May	122.00	9.09	8.2388	8.41	1.1040	108.28
	June	121.56	8.74	8.3118	8.24	1.0536	106.11
	July	123.20	8.93	8.4080	8.28	1.0643	107.90
	Aug	124.26	9.27	8.3962	8.58	1.1062	108.13
	Sept	125.57	9.66	8.4121	9.05	1.1469	106.76
	Oct	128.05	9.96	8.5266	9.19	1.1698	108.45
	Nov	129.22	10.08	8.6271	9.25	1.1678	108.91
	Dec	128.03	9.66	8.6629	8.62	1.1149	112.11
2001	Jan	129.66	9.47	8.8963	8.11	1.0659	116.78
	Feb	131.16	9.74	8.9736	8.38	1.0851	116.18
	March	133.47	10.03	9.1254	8.28	1.0999	121.35
	April	133.83	10.20	9.1103	8.24	1.1212	123.72
	May	133.99	10.33	9.0536	8.48	1.1442	121.81
	June	137.05	10.78	9.2010	8.82	1.1722	122.24
	July	137.48	10.77	9.2557	8.64	1.1622	124.57
	Aug	136.67	10.33	9.3036	8.51	1.1108	121.45
	Sept	142.04	10.61	9.6670	8.94	1.0978	118.78
	Oct	140.62	10.56	9.5798	8.71	1.1040	121.28
	Nov	138.92	10.60	9.4131	8.66	1.1258	122.35
	Dec	138.61	10.56	9.4436	8.32	1.1207	127.06
2002	Jan	135.74	10.44	9.2292	7.88	1.1324	132.60

Note. The base for TCW-index is 18 November 1992.

8 Nominal effective TCW exchange rate

Index: 18 November 1992=100



9 Forward foreign exchange market

Forward net position with authorized currency dealers. SEK million, period ends

		Non-bank public		Bank abroad	Riksbank	Total
		Resident (1)	Non-resident (2)	Net (3)	Net (4)	(1+2+3+4)
2000	Jan	–316 818	14 641	186 082	0	–116 095
	Feb	–311 986	12 019	198 174	0	–101 793
	March	–305 951	7 131	201 270	0	– 97 550
	April	–308 822	10 696	190 084	0	–108 042
	May	–344 256	8 940	214 764	0	–120 552
	June	–333 512	8 125	198 414	0	–126 973
	July	–337 305	10 218	206 364	0	–120 723
	Aug	–366 627	5 903	175 860	0	–184 864
	Sept	–396 430	3 818	177 540	0	–215 072
	Oct	–420 862	1 528	221 120	0	–198 214
	Nov	–446 831	– 6 231	282 909	0	–170 153
	Dec	–405 651	–14 207	281 242	0	–138 616
2001	Jan	–465 225	–16 547	317 823	0	–163 949
	Feb	–503 678	–12 293	278 249	0	–237 722
	March	–493 323	–17 304	350 014	0	–160 613
	April	–495 192	–15 971	293 878	0	–217 285
	May	–483 697	–14 993	238 561	0	–260 129
	June	–473 712	–28 931	326 895	0	–175 748
	July	–341 744	–30 030	190 190	0	–181 584
	Aug	–451 257	–25 654	221 546	0	–255 365
	Sept	–455 862	–18 079	244 130	0	–229 811
	Oct	–308 376	–18 025	170 595	0	–155 806

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