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How much equity does a central bank need?

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Over the past few decades many central banks have been given a significantly greater degree of autonomy as it is believed that this will aid their conduct of monetary policy. One question that has only been broached to a limited extent is to what extent this independence also relies on the central banks holding equity. The discussions on this subject have often lacked analytical foundation and have either been based on superficial analogies with the risk capital requirements of private companies or on strict principles of accounting methodology. There is therefore a need for an analysis of the principles determining why a central bank might need equity. This article is an attempt to provide such an analysis.

A decision by the Swedish Riksdag (parliament) in 1998 gave Sveriges Riksbank a statutory position of independence in monetary policy. The significance of this decision, which came into force the following year, was further emphasised by the fact that the Riksbank was also given responsibility for implementing foreign exchange policy, as this is an important part of monetary policy. On the other hand, the independent position determined by parliament did not include the Riksbank's financial position. The recent discussions within the Riksdag's Finance Committee regarding the Riksbank's need for equity have indicated that there is political support for the opinion that an independent central bank should be well capitalised. However, there appear to be differences of opinion with regard to the size of this capital.

> To what extent does a central bank require equity in order to carry out its tasks independently?

This article therefore contains a discussion of the two questions of why a central bank needs equity and the size of this equity. The assessment of the size of the equity uses Sveriges Riksbank as an example. We arrive at the conclusion that it is

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impossible to provide a precise answer. The amount of equity that is needed is, in the final analysis, a question of what safety margins the principal, in Sweden's case the Riksdag, decides to allot to the central bank as a means of guaranteeing its autonomy. This in turn depends on what it would cost the state to build up the central bank's equity.

Why does a central bank need equity?

A central bank needs equity to give it so much financial independence that there is no risk of its autonomy being restricted.

Before we look at the question of why a central bank needs equity, a number of matters of principle need clarifying. Unlike a private sector bank or company, a central bank can always, in some sense, pay upon demand. This makes bankruptcy in the accepted sense a meaningless concept in the context of a central bank. A central bank can always pay its day-to-day expenses or repay its debts by issuing banknotes, since these have the status of legal tender. As long as the total demand among the public for banknotes has not changed, however, these newly printed banknotes will be quickly exchanged at the central bank. This means that the bank has to finance itself by issuing accelerating[1] interest-bearing debt. If this is perceived as an institutional weakness, the general public's confidence might be undermined. To avoid borrowing, the central bank could instead increase the general public's demand for banknotes by lowering the interest rate. In the long run, this will result in rising inflation, which in turn will increase the demand for banknotes. Lowering the prime rate as a means of stimulating the interest in holding banknotes is, of course, not compatible with the role of a modern central bank in the field of monetary policy. Without these opportunities the state would, in a situation where the central bank had financial problem, need to inject more capital, which could undermine the ability of the central bank to conduct its monetary policy. That is because one cannot rule out the possibility that the capital injection would come with special conditions attached constraining the central bank's activities. Nor is it possible to exclude the possibility that the bank's financial weakness, even if it is a direct consequence of its central bank mandate, could be exploited by the principal with the object of replacing an awkward bank management by not discharging it from liability.[2] The con-

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[1] By accelerating is meant that the issue of debt certificates leads to higher interest costs, which, other things being equal, increases the borrowing requirement and thus pushes up interest costs even further, and so on.

[2] In the event of the central bank's financial difficulties being a consequence solely of mismanagement, the principal would naturally have to consider replacing the management.

clusion therefore is that a central bank needs enough equity to give it such a large degree of financial independence so that there is no risk of its autonomy being restricted on account of problems in financing its activities.

Why, then, does a central bank need to have equity? In broad outline, a central bank could need equity firstly to secure the long-term financing of its operating costs, which normally consist of wages and salaries, the cost of premises and the cost of printing ban-

Firstly, the bank's day-to-day operating costs have to be covered. Secondly, a buffer in the form of equity is needed to cover any losses that might be incurred.

knotes and minting coins; secondly, it has to be able to cover losses that may be incurred as a consequence of its mandate as a central bank. The risk of any individual central bank incurring a loss is thus associated with the specific mandate that bank has been given. However, the mandate of most central banks is in one way or another to conduct monetary and foreign exchange policy and to maintain a secure and stable payment system. This means that losses can be incurred on the day-to-day management of the currency reserves and as a consequence of the bank granting emergency credits.

Losses can be incurred on the day-to-day management of the foreign reserves if market interest rates rise or the country's currency has strengthened by the time the securities that make up the foreign reserves are

Losses incurred by a central bank on its day-to-day activities can be due to interest risk, currency risk or credit risk.

realised. If the securities are held until maturity the interest rate risk will disappear, whilst the currency risk will remain. But in the event of the securities being realised before maturity, which could, for example, be the case in connection with interventions on the foreign exchange market or if the portfolio has to maintain a given duration, both of these risks could materialise, as a result of which the central bank will incur losses. Over and above these risks, there may also be a credit risk. However, it is probably quite limited as a central bank's financial assets normally consist of securities with very low credit risk. This is also true for the collateral taken for the lending connected to monetary policy.

However, to prevent a financial crisis from leading to the collapse of a country's financial system central banks normally have the right to grant credits, in domestic or foreign currencies, to banks against poorer collateral than would normally be required. This is known as emergency liquidity

If there are particularly pressing reasons a central bank is entitled to grant emergency credits, on which it could incur losses.

assistance.[3] In Sweden, such credits may only be provided with the object of improving liquidity. This has been interpreted to mean that emergency credits can only be granted to solvent institutions, whereas responsibility for dealing with insolvent institutions rests on the government. In a financial crisis, however, it may be difficult to decide which institutions are solvent and which are not. Since, in such circumstances, loans have to be granted at very short notice one cannot exclude the possibility that in exceptional circumstances credits will have to be provided without adequate collateral. The risk that such commitments could involve the central bank in losses depends primarily on the possibility that the bank or company that has received an emergency credit will go bankrupt and that the value of the collateral that has been accepted falls short of the amount of the credit.

Assessment of the amount of equity

On the basis of the principles outlined above regarding why a central bank needs to have some equity, it would naturally be interesting to make an assessment of how much equity it might need. In this section we have endeavoured to make such a calculation, basing it specifically on the Riksbank's needs. However, we would like to emphasise that this exercise should primarily be seen as an illustrative example, firstly since there is so much uncertainty associated with the individual estimates and secondly since opinions differ regarding exactly what safety margins should apply to cover operating costs as well as potential losses. In order to properly understand the following discussion we need first of all to provide a brief description of the Riksbank's balance sheet.

Riksbank's balance sheet

Total equity – balancing account, capital and result for the year – amounted to 117 billion kronor at December 31, 2001.

The active side of the Riksbank's balance sheet consists of the gold and foreign reserves, monetary policy repos, lending facilities, fine-tuning operations, and other assets. The equity is on the passive side, which shows how the Riksbank's assets have been financed. The aggregate equity, which consists of the balancing account, capital and result for the year, amounted to 117 billion kronor

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[3] In Sweden's case this applies only to banking institutions and companies subject to supervision by Finansinspektionen (The Swedish Financial Supervisory Authority), (Chapter 6, §8 of the Act concerning Sveriges Riksbank (1988:1385)).

at 31 December, 2001. Otherwise the passive side consists of notes and coins in circulation, borrowing facilities and other liabilities.

Table 1. Sveriges Riksbank: balance sheet at 31 December, 2001
Million kronor

Assets		Liabilities	
Gold and foreign reserve	165,134	Banknotes and coins	107,111
Monetary policy repos	65,118	Deposit facility	48
Lending facility	29	Other liabilities	11,805
Fine-tuning operations	3,988	Balancing account	26,401
Other assets	1,263	Capital	70,890
		Result for the year	19,277
	235,532		235,532

In a discussion of a central bank's equity only the gold and foreign reserves and the volume of outstanding notes and coins are relevant. All the other items can in fact be described either as residuals (monetary policy repos[4], borrowing and lending facilities and fine-tuning operations), where the Riksbank's mandate does not require any given volume, or items that have no direct significance for its core activities (other assets[5] and liabilities). Since our discussion is concerned in principle with what approach should be adopted to the question of equity we will take the level of the foreign reserves as given.

> **In a discussion of a central bank's equity only the gold and foreign reserves and the volume of outstanding notes and coins are relevant.**

The Riksbank's capital requirement

As can be seen from the Riksbank's balance sheet, the bank has a large volume of notes and coins in circulation, which represent, in a formal sense, a liability. However, it is a very special kind of liability as it carries no interest and does not have any predetermined duration. On the other hand it generates a great deal of ope-

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[4] Monetary policy repos are a residual in the sense that if the asset side is less than the liability side the Riksbank needs to satisfy the commercial banks' borrowing requirement at the Riksbank by issuing monetary policy repos. This means that the stock of repos will fall automatically if the volume of notes in circulation declines, given that the currency reserves remain unchanged. In a situation where the banks need to place funds on deposit at the Riksbank this is handled by issuing certificates. The steering of interest rates (and signals regarding the stance of monetary policy) can be arranged equally well regardless of whether the Riksbank uses monetary policy repos or issues certificates. See Mitland & Vesterlund (2001).

[5] Other assets include tangible fixed assets (real estate, machinery and equipment), financial fixed assets (equities and shares in AB Tumba Bruk, Pengar i Sverige AB, Swift, BIS and the European Central Bank), derivative instruments (market values stated net of the Riksbank's forward positions) prepaid costs and accrued income and staff loans to employees of the Riksbank and Pengar i Sverige AB.

We have assumed that the Riksbank is capitalised with the security margins that are required to cover a decline in or the total disappearance of seigniorage.

rating income for the Riksbank in the form of seigniorage.[6] As long as the public is willing to hold the same amount of cash as it is today, the Riksbank has a source of finance that can play the same role as equity. The problem, however, is that there is no complete guarantee that this seigniorage income will continue. New means of payment are being developed very quickly and even though banknotes have so far maintained their position to a surprising extent, an abrupt reduction on the part of the public cannot be excluded in the future. In our example, therefore, we have assumed that the Riksbank has been capitalised with the security margins that are required to handle a radical reduction in, or even the total disappearance of seigniorage.

With a nominal interest rate of 5 per cent a base capital of 10 billion kronor would meet this need.

Based on this security margin we can calculate the Riksbank's equity capital requirement in the following way. The Riksbank's operating costs in 2001 amounted to approximately 0.8 billion kronor. At present this amount is more than covered by the seigniorage that is generated by the outstanding banknotes and coins. Were seigniorage to disappear, a large proportion of the cost of producing and handling banknotes and coins would also be eliminated. Based on the level of operating costs for 2001 current operating income of just over 0.5 billion kronor would be required to cover the operating costs. With a nominal interest rate of 5 per cent, which is a reasonable assumption based on historical experience, capital of 10 billion kronor would be adequate to ensure that the Riksbank could carry on its business in a situation where the public had ceased to use banknotes and coins. One could alternatively suppose that the capital might instead be built up gradually as the seigniorage declines. However, there is a risk that the principal would impose special conditions if capital were to be built up successively in this way, which is one argument for seeing that the capital needed to cover operating costs is already in the balance sheet.

It is difficult to estimate how much buffer capital is needed to cover losses on day-to-day operations.

It is difficult to make a very precise estimate of how much buffer capital would be needed to cover any losses that could arise in the performance of the Riksbank's mandate. To cov-

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[6] The Riksbank's seigniorage (monetary income) is generated by the interest income the Riksbank earns by holding financial assets that are financed by interest-free banknotes and coins.

er potential losses on its day-to-day operations we need to know firstly what changes in the value of the krona and market interest rates can be expected, we need to have a view about how often interventions on the foreign exchange markets are likely to be made in the future and how often it will be necessary to sell securities to maintain the duration of the Riksbank's foreign reserves. Under the present floating exchange rate regime, the risk of losses on day-to-day operations would normally be modest, but with a fixed exchange rate regime there is a higher probability of currency intervention and thus a greater risk of loss. This could happen if the Riksdag were to decide that Sweden should join the third phase of the EMU. Losses would then be incurred if the Riksbank's intervened to strengthen the krona, as the securities in the foreign reserves might then have to be realised at a time when market rates had risen. On the other hand, the risk of loss as a consequence of changes in exchange rates is probably very small, as intervention to strengthen the krona would in normal circumstances probably mean that the Riksbank would sell foreign reserve assets in a situation where the krona was weaker than it was when these assets were acquired.

When it comes to what losses might arise as a result of granting emergency credits, the level of uncertainty is, if possible, even greater. Such an assessment has to be based on estimates of several unpredictable sets of

Estimating the losses that could be incurred as a result of granting emergency credits is an even more uncertain process.

circumstances, among them the sequence of events and scope of financial disturbances or crises in the future. For example, will one or more institutions be hit by problems? In addition to this, the final loss will depend on whether the collateral that has been accepted to cover these credits is adequate or not. Moreover, we need to know how any losses will be shared between the Riksbank and the government.

If, despite all of this uncertainty, one had to indicate what amount of buffer capital might be needed to handle future losses as a result of granting emergency credits, we could base our estimate on our experiences

An amount in the region of 25 to 45 billion kronor would in our view be adequate to cover losses resulting from emergency liquidity assistance.

from the Swedish banking crisis at the beginning of the 1990s. The support paid to the banking sector at the time amounted to some 65 billion kronor. However, it has been estimated that the final cost of the banking crisis amounted to 35 billion kronor.[7] It should not be assumed, however, that the course of events in the future

[7] See Jennergren & Näslund (1997).

will be the same as it was during the early years of the 1990s. For example, growing internationalisation has strengthened the links between different countries' financial systems, and thus created additional risks. In this context, the banking sector's short-term currency borrowing could play an important role, and, in the event of a crisis, could involve the Riksbank in losses. At the same time the banks are now more capable of assessing and protecting themselves against the various risks that might arise. This makes it impossible to say that the losses that could be caused by a banking crisis in the future would be more or, for that matter, less than those that arose in connection with the Swedish banking crisis at the beginning of the 1990s. On account of this uncertainty, and the uncertainty regarding losses on other day-to-day operations, we would suggest that the capital buffer that could be needed would be in an interval centred on the 35 billion kronor that the last banking crisis cost the state. If this argument can be accepted, capital in the region of 25 to 45 billion kronor would be adequate.

According to these principles, the Riksbank's financial autonomy would be secured with capital of 35 to 55 billion kronor.

In order to ensure the financial autonomy of the Riksbank in the long term, therefore, the bank would in present circumstances, and according to our example, need equity between 35 and 55 billion kronor.

Factors relating to accounting methodology

A discussion of how much equity a central bank needs must also take into account the question of how unrealised profits and losses are to be handled and whether these should be allowed to influence the bank's stated equity. Should unrealised profits on the Riksbank's asset management activities be added to the equity and thus become available for dividend, if the equity is already regarded as high enough? Or should it be possible for unrealised losses to be netted off against equity?[8] The answer to both these questions is in the negative, and we will explain why this is so in the following section.

According to generally accepted accounting practice unrealised profits should not be paid out as dividend.

The Riksbank regularly values its assets in the form of gold and foreign reserves at market values and states these values in kronor. The value of assets that are not realised is also affected. According to generally accept-

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[8] According to the Sveriges Riksbank Act (Chapter 10, §1) the bank shall have an equity capital of at least 1.5 billion kronor divided into capital and a balancing account. Over and above this the Riksbank should also have a contingency reserve. The law stipulates no specific amount for this reserve.

ed accounting practice, unrealised profits should not be paid out as dividend. The reason for this is that it is not possible to determine in advance whether such profits will continue until the assets need to be realised. In order to avoid misunderstanding about what lies behind changes in various balance sheet items it would be desirable if unrealised profits could be reserved on special entries in the balance sheet. For the sake of clarity these reservations could be distinguished from each other on the basis of what caused the unrealised profits, which could be changes in exchange rates, market interest rates or the price of gold. The variations in the level of these liability items that will occur with time, would be reflected by corresponding variations on the asset side, that is to say, in the value of the gold and foreign reserves. This would make it clear that it is only a matter of reservations made in order to handle changes in value due solely to accounting practice.

The most visible of these transfers is the reserve for changes in the value of the foreign reserves that take place when the krona depreciates or appreciates. It is, for the sake of comprehensibility, important to emphasise that it is the number of units in foreign assets, and not the value of these assets in kronor at

It is the number of units of foreign assets not the corresponding value in kronor at any given time that is critical if the foreign reserves are to serve the purpose for which they were created.

any given time, that is the key to whether the foreign reserves are capable of serving the purposes for which they were created, which is to say that the Riksbank should, when necessary, be able to give emergency liquidity assistance in foreign currency and intervene on the foreign exchange market. As at 31 December, 2001, approximately 38 billion kronor had been reserved in the Riksbank's accounts as a consequence of the depreciation of the krona since the fixed exchange rate was abandoned in 1992.

It is fairly obvious that these funds cannot be regarded as an addition to the Riksbank's equity. The fact that the value of the foreign reserves is stated in kronor is due to the fact that other items in the Riksbank's balance sheet are also stated in kronor. If the value of the krona depreciates, this would mean that the value of the foreign reserves, expressed in kronor, will increase, and vice versa.

When the foreign reserves and the Riksbank's kronor-denominated assets are valued at market values unrealised profits also arise owing to the effect on the result of falling market interest. As with currency effects,

As with currency effects, unrealised bookkeeping profits caused by falling market rates of interest should not be available for distribution.

such bookkeeping profits should not be paid out as dividend. One reason for this

is that profits and losses will by definition match each other if fixed-income securities are retained until maturity. The reservations made in the Riksbank's balance sheet up until 31 December, 2001 for unrealised profits on changes in long-term interest rates amounted to 0.5 billion kronor.

The Riksbank also has a gold reserve. Changes in the price of this should be treated in the same way as changes in the value of the foreign reserves, which is to say that profits should only be distributed in so far as they have been realised. The reservations made as a consequence of an increase in the price of gold amounted as at 31 December, 2001 to just over 16 billion kronor.

To the extent that unrealised losses are incurred these should naturally be netted off against any unrealised profits that have arisen earlier. Should these profit reservations not be sufficient it would be reasonable for the bookkeeping losses to be netted off against a special item on the balance sheet, which could from time to time be negative, on the passive side of the balance sheet. The same principle should also apply to realised losses except that losses over and above any unrealised profits should not be netted off against the above mentioned item. When there are no accumulated profits remaining to net such losses off against, the Riksbank would in fact be in the very situation in which the buffer capital of 25 to 45 billion kronor, which should be set up to handle real losses, should be used.

This would mean that total provisions of 90 to 110 billion kronor would be needed.

As outlined in our argument above as to why the central bank needs equity, 10 billion kronor would be needed to finance the Riksbank's operating costs, and 25 to 45 billion kronor would be needed to cover potential losses on the Riksbank's activities. Since, at 31 December, 2001, the Riksbank had unrealised profits of some 55 billion kronor, total reserves of 90 to 110 billion kronor would be needed.

What drawbacks are associated with having too much equity?

If there were no drawbacks, there would be no problem in letting the Riksbank have an equity that covers the needs discussed above by a wide margin.

The point of the above discussion was to show that the equity should not be allowed to become too small. If the Riksbank were undercapitalised its ability to carry out its mandate independently could be challenged. As the exact level of equity, excluding provisions for unrealised profits, is, in the final analysis, a matter of judgement it is, however,

reasonable to ask what drawbacks would be associated with too high a level of equity. If one reaches the conclusion that there are no drawbacks, in that case there would be no problem in allowing the Riksbank to have an equity that meets the needs discussed above by a wide margin.

One drawback associated with having too much equity arises if the return earned on this capital is not higher than the interest the state pays on the corresponding amount in the form of loans, naturally assuming that the country has a national debt. In such a situation it could be worthwhile for the state sector as a whole if the extra capital could be used to reduce the national debt. If, on the other hand, the central bank can invest its assets in such a way that the return they earn at least matches the cost to the state of its borrowing this would not be a problem.

What is the situation in this regard at the Riksbank? As far as the return on its assets is concerned, it should be emphasised that by far the greater part of the Riksbank's assets is invested in the foreign reserves, in other words, in foreign securities with long durations. Even though the size and types of asset in the foreign reserves must primarily be determined by their role in the execution of foreign exchange policy, the question of cost should cause few problems as the assets in the foreign reserves have a longer duration than the central government debt. As the yield curve against time normally has a positive slope, the assets invested in the foreign reserves should therefore not represent a cost when it comes to public finances. The answer is not equally obvious in the case of the outstanding stock of monetary policy repos whose durations are short in comparison with the corresponding government borrowing. As was mentioned above, the yield curve normally slopes upward, retaining the repo stock could involve the state in unnecessary costs. By investing in securities with longer durations, however, this cost could probably be reduced. As there are no monetary or foreign exchange policy grounds for maintaining the repo stock at any given level[9], this would be possible.

> **A change in the structure of the assets portfolio must not be allowed to impair the Riksbank's ability to carry out its mandate.**

There are several different means of lengthening the duration of the assets that are at present held in the form of monetary policy repos. However, the

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[9] The purpose of monetary policy repos is to satisfy the banking systems need to borrow from the Riksbank. If instead the banking system has a placement requirement vis-à-vis the Riksbank this is satisfied by issuing certificates. The Riksbank's ability to control interest rates is, however, the same, regardless of whether liquidity is injected into or withdrawn from the banking system. There is, however, a risk that administration could become more difficult if the Riksbank were to issue certificates one week and inject liquidity in the form of repos the next, but this cannot be seen as a particularly telling argument for retaining the repo stock at its present level.

options are limited by the condition that any change in the structure of the assets must not have an adverse effect on the Riksbank's ability to execute its monetary and foreign exchange policy and to ensure the country has a reliable and efficient payment system.

A reduction in the monetary policy repo stock can have consequences for the execution of monetary and foreign exchange policy.

It is not likely that responsibility for the payment system would be influenced by a reduction in the volume of the repo stock. On the other hand, such a reduction could have consequences for the execution of monetary and foreign exchange policy. A direct transfer from monetary policy repos with durations of one week to domestic securities with longer durations would in fact mean a portfolio change vis-à-vis market players and could, therefore, be regarded in practice as identical to an intervention by the Riksbank on the fixed-income securities market.[10] Similar problems arise if durations are lengthened by direct purchases of foreign securities. In this case the change could be perceived as an intervention on the foreign exchange market, and thus as a signal regarding the future direction of monetary policy.[11] However, such effects can be avoided either by reducing the repo stocks successively in accordance with a given timetable or by neutralising the effects on markets using the means provided by the markets in derivative instruments.

Conclusion

In our discussion we have examined whether having equity is of importance for a central bank's ability to carry out its mandate as an autonomous player. We have drawn attention to certain risks that the under-capitalisation of a central bank could involve. These risks consist partly of the conditions that could be imposed on the central bank in the event of an injection of capital by the state turning out to be necessary and partly of the risk that public confidence could be undermined if the central bank were not perceived to be adequately consolidated for the performance of its mandate.

In order to avoid ending up in a situation that could require an injection of new capital, a central bank, according to the principles discussed in this article, needs to have adequate financial resources to enable it to cover both current

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[10] Since in present circumstances the Riksbank only accepts securities as collateral for its loans in the form of repos, such a change in the portfolio would, however, have a relatively limited effect on the yield curve.

[11] Corresponding restrictions also apply to the future management of the assets that are the result of the reduction in the repo stock.

operating costs as well as potential losses arising from the carrying out of its mandate. Losses could be incurred partly as a result of its administration of the foreign reserves and partly in connection with emergency liquidity assistance in order to help financial institutions weather a crisis that threatened the payment system. Based on these principles, we have presented a numerical example using the Riksbank as a model. This shows that the Riksbank could probably manage with equity of between 35 and 55 billion kronor, provided that the unrealised profits that arise from time to time as a result of the accounting practice adhered to by the bank are not paid out as dividend.

It should be emphasised that the estimate of how much capital the Riksbank might need involves considerable uncertainty, and this is also reflected in the relatively broad interval in our estimate. Depending on what assumptions are made regarding the risk of loss and the future pattern of banknote usage, it is a relatively easy matter to arrive at a higher or lower figure.

If one regards the autonomy of a central bank as important for the economy at large and wishes to safeguard its credibility, one should endeavour to give the bank a generous amount of equity. Adhering to this principle is made easier by the fact that the capital held in the central bank need not involve any additional cost to public finances in the sense that the return on assets held in the central bank are lower than the cost to the government of its borrowing to finance these assets.

This means that there is no reason on grounds of cost to encroach on the central bank's ability to perform its mandate by allotting it an inadequate equity.

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Inter-bank exposures and systemic risk

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Systemic risk is the primary reason for public interest in the financial sector. Although an essential part of the public interest, little has been done to assess the risk of contagion in banking systems. Since June 1999 the Riksbank have the four major Swedish banks report their largest counterparty exposures quarterly. The purpose of this article is to present to which extent the Swedish banks are exposed to direct contagion from potential failures of their counterparties and how the authorities should consider this problem.

Background

Sweden underwent a severe banking crisis in the early 1990's. One of the experiences of the crisis was that the authorities were ill-prepared to deal with this type of situation, both with regard to crisis management and crisis prevention. After the crisis, in the mid 1990's, the Riksbank started to develop a new framework for what its role as a non-supervisory central bank should be regarding financial stability.

The starting point for this framework was that the central bank role, as well as other public interest in the financial sector, was built upon the existence of systemic risk. Without dwelling too much on the concept of systemic risk, it can be said that it exists because of the combination of two important factors. Firstly, the financial sector in general and the payment system in particular is very important for the functioning of the economy. A breakdown of the financial system will most likely cause substantial socio-economic costs. Secondly, the financial system, especially the banking system, is vulnerable to exter-

> **High probable social costs of failure and high fragility in the banking system are the main motives for regulating banks.**

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nal shocks. Basically, depositors relate this to the fact that banks fund illiquid loans with liquid deposits, which make them vulnerable to loss of depositor trust, which may lead to withdrawal of funds. Moreover, financial problems in one bank may spread to other banks and lead to losses and consequential failures of other banks (contagion). This combination of high probable social costs of failure and high fragility in the banking system is the main motive for regulating banks, according to the Banking Law Commission, which was set up with the purpose of reforming bank regulation in Sweden after the crisis.[1]

Risk of contagion between banks is an important element of systemic risk.

Risk of contagion between banks is thus an important element of systemic risk. Contagion in the banking system can typically be divided into *direct* and *indirect* contagion. Direct contagion arises because banks are financially exposed to one another, both through the payment system and through other types of positions such as outright loans, derivatives, repurchase agreements et cetera. Indirect contagion can arise mainly through two channels. Firstly, markets may expect that direct contagion effects exist, even where this is not the case. Secondly, if one bank is struck by financial problems, markets may expect that other banks in the same system will be hit by the same problem.

It is striking how little risk of contagion is reflected in regulatory systems.

Although risk of contagion is crucial as a motive for a public interest in banking systems, it is striking how little this is reflected in regulatory systems. Regulation and supervision are to a very large extent directed at avoiding the failure of individual banks rather than the failure of the system as a whole.[2] Even if indirect contagion may be hard to influence by regulation or supervision, that should not be the case when it comes to direct contagion. In the area of payment systems, the main focus of the authorities is on the possible contagion effects that may arise due to the construction of the system. A large majority of developed countries have during the 1990's been focused on using Real Time Gross Settlement (RTGS) and delivery versus payment (DvP) mechanisms for making payment and settlement systems robust to individual bank failures and diminishing direct contagion effects through the system. However, little attention has been paid to the contagion effects arising outside of the payment system. Many of the relevant inter-bank mar-

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[1] The Commission's proposal is presently under consideration by the Government. For a brief description of the proposal, see Lind & Molin (1999).

[2] See Acharya (2001) for a discussion on the scope for directing bank regulation to systemic risk rather than individual banks.

kets have grown substantially during the 1990's, making other types of inter-bank exposures potentially larger.

The most obvious way for authorities to limit direct contagion effects would be to set regulatory limits for the size of the exposures banks were allowed to have towards one another. Most countries have rules regarding large exposures, but these are mainly set up in order to limit concentrations in banks' lending portfolios. In the EU regulatory framework, banks are not allowed to have individual counterparty exposures that are larger than 25 per cent of their capital base. However, exposures between financial institutions that are shorter term than one year are exempted from these rules.[3] It is common to regard the need for banks to take on large exposures between each other as an unavoidable part of their business. The direct contagion effects are often considered as natural.

> **The most obvious way for authorities to limit direct contagion effects would be to set regulatory limits for the size of the exposures.**

In the field of research, the lack of data has been a general obstacle. Some work has been done on empirical measurement of contagion risks[4], but to our knowledge there is nothing covering all inter-bank exposures, simply because data is not available. The lack of data is naturally connected to the low interest of this issue in the regulatory system. If supervisors do not demand reporting of these exposures, no reporting data that can be used for research will be available. The banks' incentives to do research themselves or provide data to outsiders are weak. Data on counterparties is normally not given freely, as this would disclose important information on the business of the bank. The incentives for banks to show the exposure to direct contagion effects may be weak, since this exposure may be one reason why the authorities may protect them in a crisis. Another reason for the lack of data in this area is simply that banks may not have felt any call to show this type of data, either from investors or supervisory authorities.

> **In the field of research there is nothing covering all inter-bank exposures simply because no data is available.**

When developing the new financial stability framework at the Riksbank and trying to focus on systemic risk, the gap between the emphasis on contagion in theory on the one hand and the lack of regulatory initiatives or empirical research

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[3] Individual countries may have stricter rules than this, but according to a brief survey of some EU countries made by the Swedish Financial Supervisory Authority, no country did so. One country followed inter-bank credit limits regularly.

[4] See for instance Furfine (1999).

on the other hand were identified as a major area of concern. The Riksbank therefore wanted to develop an empirical base for estimating the effects of direct contagion. Even though the Riksbank is a non-supervisory central bank, it has a quite unique opportunity to collect information directly from financial institutions, since the Riksbank has a legal right to demand any information from Swedish financial institutions. This article describes the kind of data that has been collected with the objective of analysing direct contagion effects, as well as presenting some quantitative results and drawing some conclusions as to how public authorities could deal with direct contagion.

Measurement of direct contagion

This section describes some of the issues that were important when the reporting of inter-bank exposures was developed at the Riksbank. In terms of procedure, the design of reporting was set up after a quite thorough investigation into what kinds of exposures Swedish banks had, what risks different types of exposures lead to, how variable these exposures were over time et cetera. This investigation was carried out in autumn 1998 and the reporting began in summer 1999.

The problem of direct contagion is normally seen as the risk that a failure of one bank will lead to credit losses for other banks that are so great that their solvency is also threatened – if one bank falls, other will follow like dominoes. To answer the question "How large could the losses be for other banks if one bank fails?" was the objective for the Riksbank when measuring direct contagion. This reflects only the solvency effect of a bank failure on other banks. A failure of a bank may also have liquidity impacts on other banks. The focus of the Riksbank's analysis and measurement of direct contagion has been on the solvency effect, which is reflected in the kinds of exposure that have been measured. However, the available data is also used for approximating effects on liquidity (see section "Liquidity impact" pages 35–36).

The willingness of banks to take on large exposures is quite dependent on the maturity. Banks may consider that it is quite likely that they would get at least some information in advance if an important counterparty was about to fail. If the time to maturity is only one day or a couple of days, it would be possible to

withdraw credit exposures if a warning signal of potential failure were observed. An important issue here, therefore, is at what time horizon a bank is expected to fail, as an instantaneous failure would normally be expected to induce much greater losses than a prolonged failure. In the payment system area, the focus is normally on the instantaneous failure of a bank. Inter-bank exposures are often of very short maturity. Inter-bank deposits, for instance, are pre-dominantly overnight, at least in Sweden. As it may be difficult to measure intra-day exposures globally[5] in large banks, the Riksbank chose to measure all overnight exposures, to investigate what would happen if one bank were to fail from one day to another. Although a failure of a large bank from one day to another is an unlikely event, it does happen, the failure of Barings probably being the most prominent example.

The Riksbank chose to measure all overnight exposures, to investigate what would happen if one bank were to fail from one day to another.

Sweden has a concentrated banking system – four large banks cover at least 80 per cent of the system. Because of its focus on systemic risk, the Riksbank concentrates its analysis on these four banks. Contagion could in general be expected to be a bigger problem in a concentrated system, since the large banks have fewer alternatives to deal with in the inter-bank markets. As it is pre-dominantly the failure of one of these four banks that could pose a systemic threat to the Swedish banking system, the measurement of direct contagion was conducted through the largest exposures of these four major banks. As reporting is costly for the banks, it was considered to be unnecessary to require all banks to do this special reporting.

Four large banks cover 80 per cent of the banking system, thus the Riksbank concentrates its analysis on these four banks.

The reporting requirements cover the fifteen largest individual exposures. The reasoning behind this is that there should be few counterparties to whom banks are willing to take exposures large enough to threaten their solvency. This hypothesis has been confirmed by data (see figure 1). The size of exposures drops rapidly from the largest to the fifteenth largest counterparty. The fifteenth largest counterparty exposure is never of such a size that the failure of that counterparty would threaten the exposed bank.
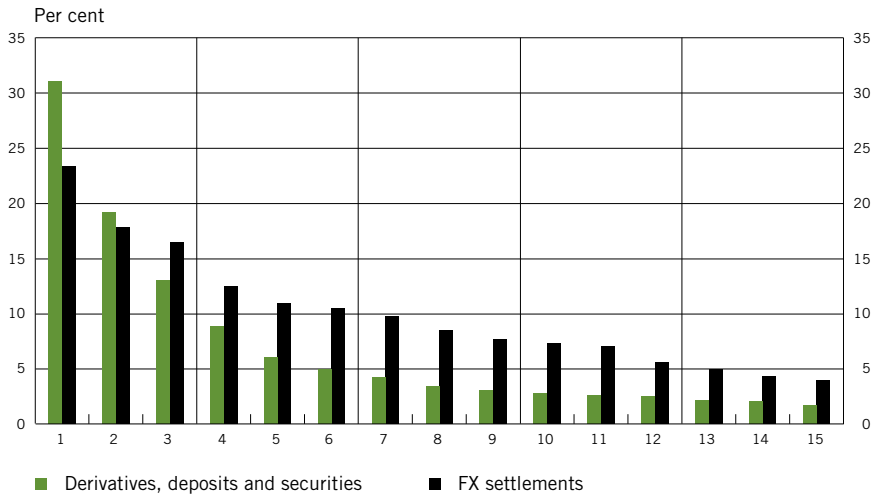
The reporting requirements cover the fifteen largest individual exposures.

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[5] "Globally" here refers to all business lines and all geographical locations in which a bank is active. Banks generally do not have information systems that collect financial exposures on a real time basis. The exposures are controlled by the setting of credit limits globally on particular counterparties, limits that then are distributed to different business units which may deal with that particular counterparty.

Figure 1. Swedish banks' concentration to the fifteen largest counterparties; average exposures in relation to total Tier 1 capital

Per cent

■ Derivatives, deposits and securities   ■ FX settlements

Source: The Riksbank.

Exposures containing full principal credit risk should be covered in the reporting requirements.

One issue that was important when setting up the reporting requirements was what kind of exposures should be covered. As the purpose was to analyse what the effects on solvency would be if one of the largest counterparties failed from one day to another, the focus was decided to be on exposures containing full principal credit risk. This means that the ranking was based upon uncollateralised exposures. To exclude collateralised exposures is reasonable since one of the most commonly used instruments on the Swedish inter-bank market is repurchase agreements with government bonds as the underlying assets. In most cases, there would be no losses on these repurchase agreements if a counterparty fails. If these exposures were not excluded, they would risk dominating the data. However, collateralised exposures are reported as memo items to the fifteen largest counterparties, although they do not comprise the basis for the ranking.[6]

Outstanding foreign exchange settlement exposures are included in the reporting.

The uncollateralised credit exposures that give rise to the size ranking are uncollateralised lending, holdings of securities issued by counterparties and the credit element of de-

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[6] See Annex 1, reporting tables for further information.

rivative exposures.[7] However, full principal credit risk can also arise because of settlement exposures, if the payments and settlement systems are not constructed to provide for payment versus payment (PvP) or DvP mechanisms. Swedish payment and settlement systems provide for such mechanisms, except for foreign exchange (FX) settlement. FX settlement gives rise to a full principal credit exposure lasting on average two days. Outstanding FX settlement exposures are therefore included in the reporting. As these exposures are sometimes substantial compared to other exposures, they are not included in the size ranking of the counterparties, in order not to dominate the ranking. The fifteen largest FX settlement exposures are instead ranked separately. By putting the two ranking lists together, the largest counterparties both including and excluding FX settlement exposures can then be established.

In addition to the ranking of the largest individual exposures, the banks' total exposures within each respective area have been listed, in order to give a picture of the total size of inter-bank exposures and how concentrated these markets are.

The reporting also includes the names of each of the counterparties. This is useful for two reasons in particular. By having the names of the counterparties, the Riksbank can see if a failure of one bank will affect several of the Swedish banks. The names also make it possible to analyse second round effects of contagion, that is, to construct scenarios with possible chain effects from defaults. The reporting also covers counterparties that are not financial institutions, even though it was expected that it would be mainly financial institutions to which the banks had very large exposures. This expectation has been confirmed; financial institutions dominate the ranking list, although from time to time non-financial companies are included on the lists, as well as financial companies.

The banks generally do not have information systems that collect financial exposures on a real time basis or near real time basis. The exposures are controlled by the setting of credit limits globally on particular counterparties, limits that are then distributed to different business units which may deal with that particular counterparty. To collect the actual exposures and rank them is quite burdensome and time consuming for the banks.

As the kinds of exposures that are covered in this reporting are highly variable, it would in principle be interesting to get more frequent reporting. In order

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[7] This means the positive market value of derivatives positions that a bank has against a particular counterparty. The relevant contracts are OTC-derivatives rather than exchange traded derivatives, as these exposures are normally secured. Banks often have contracts of both positive and negative value with a particular counterparty. These contracts can be netted against each other if the parties adopt netting agreements. Therefore, both gross and netted exposures are reported.

not to impose an undue burden on the banks, the Riksbank has limited the requirement to quarterly reporting. The reports are taken in for the end of the quarter, so that they coincide with the dates for financial statements, where actual exposures have to be collected globally within each institution anyway. The low frequency of reporting and the particular dates are of course a limitation for the analysis. Exposures can be expected to vary greatly from one day to another, and they are probably lower at the end of quarters, since the banks in general do not like to show larger balance sheets than necessary. The Riksbank thus sees the reported exposures as indications of what size the exposures might be, rather than exact figures that are valid over time.

Reported counterparty and foreign exchange exposures

OVERALL SIZE OF EXPOSURES

The overall size of the reported exposures is approximately SEK 1,600 billion during 2001 for the four major Swedish banks.[8] This is a slight increase on the previous year.

Figure 2. Reported counterparty exposures by the four major Swedish banks
SEK billion

Legend: FX settlement ■ Deposit ■ Securities ■ Derivatives

Source: The Riksbank.

[8] Reported exposures of SEK 1,600 billion can be compared to the Swedish GDP of approximately SEK 2,000 billion.

The largest exposures are in the foreign exchange settlement segment, with these exposures normally making up between SEK 490 to 730 billion of the total exposures. Deposits have varied between SEK 273–378 billion and securities between SEK 228–414 billion. Derivative exposure is the smallest class of exposures and has over the years increased from around SEK 60 billion to a high of SEK 110 billion and is now at SEK 87 billion. At the turn of the millennium the exposure levels were much lower, which is the result of very low levels of exposure to FX settlement and lower than normal exposure to deposits.

Counterparty rating

Possibly the banks' foremost means of controlling counterparty risks is to mainly expose themselves to counterparties with high credit standing and to set limitations for exposures. One method of assessing credit standing is to study Standard & Poor's and Moody's credit ratings for the respective counterparties, as the Riksbank has no internal function for making credit assessments of banks.

The Swedish banks' counterparties have high credit ratings, according to the counterparty statistics. The average credit rating is A+/A1, which corresponds well to the ratings of the Swedish banks. The average credit rating has been at this level since the reports started in 1999.[9] The banks are largely exposed to counterparties with credit rating A or higher (see figure 3). There are counterparties with Baa ratings or with no rating from either S&P or Moody's. Counterparties lacking a public rating do not necessarily comprise greater credit risks than those with a rating, since the lack of credit rating could simply mean that they do not borrow directly in the market. Counterparties with no public rating from the rating agencies are normally well known by the banks that are exposed to them. The counterparties' relatively good credit standing indicates a low probability of a sudden default among the counterparties.

Generally, the counterparties used by the Swedish banks are internationally

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[9] The data was first reported for June 1999, in this article data from September 1999 and forward is included, as the data from June does not fully correspond to the data reported later.

Figure 3. Number of counterparties by rating category

Legend: NR, Baa, A, Aa, Aaa
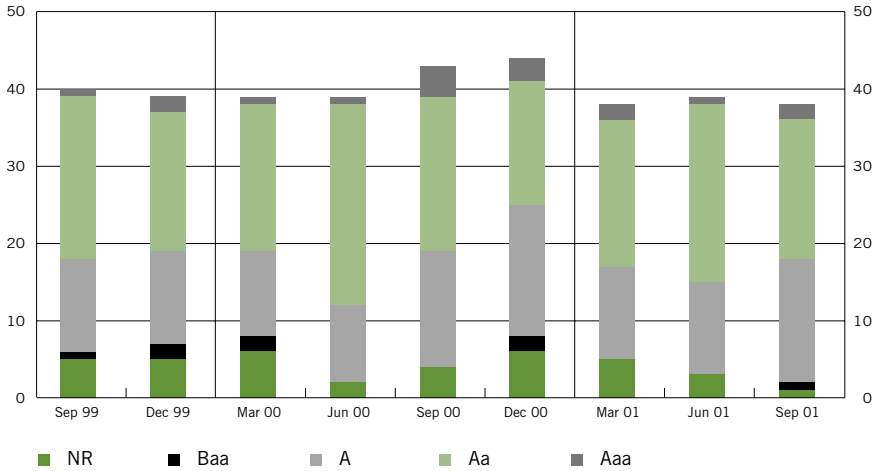
active foreign financial companies, Swedish and Nordic banking groups and some Swedish large and mid-sized non-financial companies.[10]

This confirms what we have seen in our work on credit risk management in the Swedish banks, that is that the Swedish banks actively manage which counterparties they do business with. Normally, limits on exposures are set through the use of ratings on the potential counterparties, either from rating agencies or internal ratings.

The four reporting banks rank their exposures from the largest to number fifteen, as they report the fifteen largest exposures as described above. The maximum possible number of counterparties on each reporting occasion for the four major banks is, thus, 60. Since September 1999 the number of counterparties used by the banks has varied between 38 and 44 (see figure 3). The banks have little (or no) knowledge of which counterparties the other banks use regularly, and have no knowledge of which banks their competitors are exposed to at present. The number of counterparties reported by the banks indicates that the name concentration is not as big a problem as could have been assumed. The fact that the reported counterparties do not add up to 60 implies that there are counterparties to which more than one Swedish bank is exposed.

The fact that more than one major Swedish bank might be exposed to the

[10] Counterparties reported by a major Swedish bank can, of course, include one or more of the other major Swedish banks.

Figure 4. Number of Swedish banks exposed to the same counterparty

■ Four banks   ■ Three banks   ■ Two banks
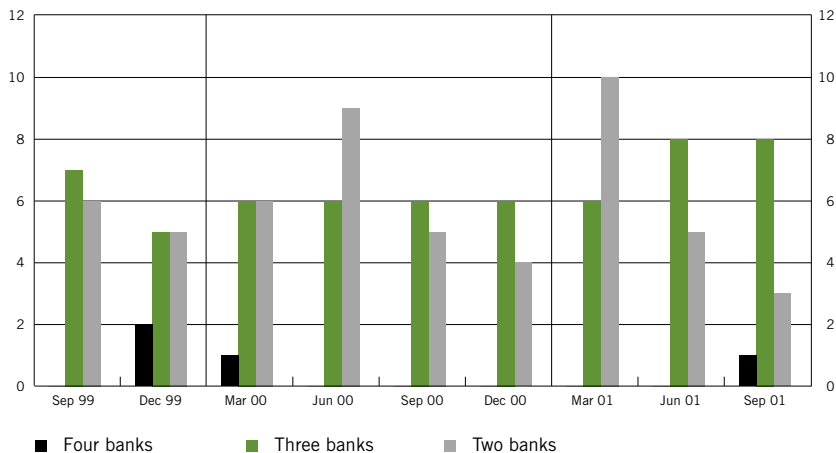
Note: As an example, in December 1999 there were two counterparties to which all four major Swedish banks were exposed. In March 2000 there was only one counterparty to which all four banks were exposed.

Source: The Riksbank.

same counterparty is a possible source of risk concentration in the banking system. There are few counterparties to which all four of the banks are exposed at any time, but there

> **There are a number of counterparties to which two or three of the Swedish banks are exposed at any given time.**

are a number of counterparties to which two or three of the Swedish banks are exposed at any given time (see figure 4). The few counterparties shared by all four of the banks are not a major source of concern as they are normally highly rated counterparties to which the banks have lower levels of exposure. The counterparties shared by three of the banks deserve more attention, as this group normally includes several of the Swedish banks, and possibly could include some financial companies with lower credit ratings.

DIRECT CONTAGION EFFECTS WITHIN THE SWEDISH BANKING SYSTEM

In the event of a default in one of the Swedish banks, there is a slight risk of a subsequent failure of another Swedish bank. A subsequent default could occur if one or several of the Swedish banks suffered such large

> **A loss big enough to lead to the Tier 1 capital of the bank falling below the required level of 4 per cent is assumed to constitute a default.**

losses that their capital was reduced below the statutory levels or to such a level of

capital that the bank could not refinance itself in the market. In this paper, a loss big enough to lead to the Tier 1 capital of the bank falling below the required level of 4 per cent is assumed to constitute a default. This is probably a quite conservative threshold.

The Tier 1 capital ratios were high during the first half of the studied time period.

Since September 1999 there have been a number of cases where a Swedish bank has had such substantial exposures towards another Swedish bank that there has been direct risk of contagion, if one of these counterparties had defaulted. In such cases it is only if almost the whole of the exposed amount were to be lost that the exposed banks' capital would actually decline sufficiently for a direct contagion to occur. The Tier 1 capital ratios of the Swedish banks have declined over the studied time period. The Tier 1 capital ratios were high during the first half of the studied time period as some Swedish banks were in the process of merging or taking over other banks. Higher initial capital ratios give the banks stronger resilience to losses from counterparty exposures. The shift in Tier 1 capital ratios can clearly be seen in figure 5. The shift occurs between September and December 2000.

With the reported counterparty exposures and the Tier 1 capital ratios of the

Figure 5. Tier 1 capital in the Swedish banks after a major Swedish bank has defaulted, assuming no recoveries

Per cent

◇ Bank A in default   ● Bank B in default   ● Bank C in default   ◇ Bank D in default
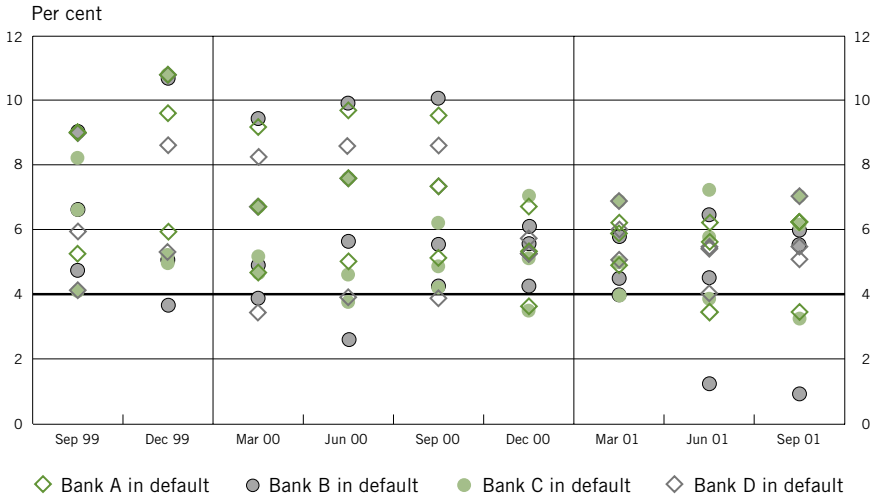
Note: Figures 5 and 6 illustrate the Tier 1 capital ratios in the three surviving Swedish banks after one of the other Swedish banks has defaulted, e.g. the lowest capital ratio would have been the effect of bank C being in default.

Source: The Riksbank.

Swedish banks there have been 16 cases where the exposed bank's Tier 1 capital ratio would have fallen below the statutory 4 per cent level if one of the other Swedish banks defaulted (see figure 5). The total number of reported counterparty exposures is to date 108 cases. These 16 cases occur assuming no recovery at all, or a full loss of the total exposed amount. Assuming no recovery at all is, of course, a very conservative assumption by all standards. If we assume that the losses at default are only 75 per cent of the exposed amounts, or a 25 per cent recovery, the number of cases where the Tier 1 capital ratio falls below 4 per cent would be only 4 (see figure 6).

Figure 6. Tier 1 capital in the Swedish banks after a major Swedish bank has defaulted, assuming 25 per cent recoveries
Per cent

◇ Bank A in default ● Bank B in default ● Bank C in default ◇ Bank D in default
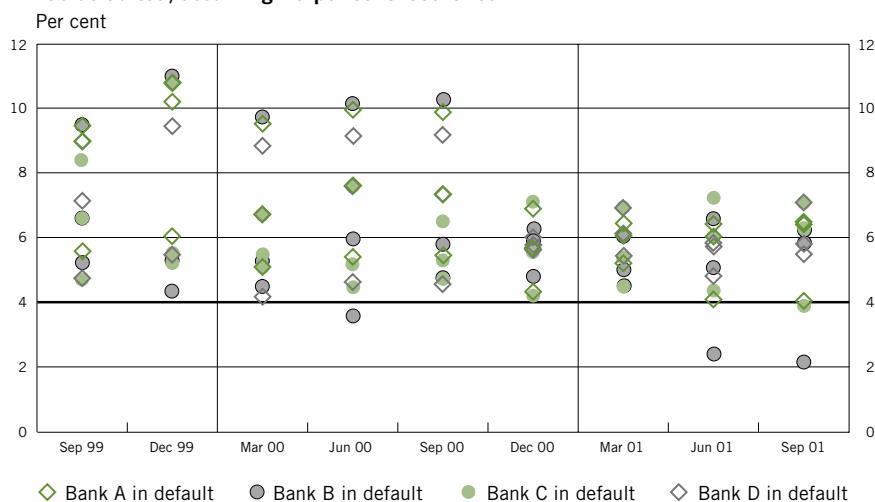
Source: The Riksbank.

The severity of the losses also seems to increase during the latter part of the time period for which data is available. This is the effect of decreases in the Tier 1 capital ratios of

Depending on which of the Swedish banks defaults the risk of direct contagion varies.

all of the Swedish banks, but also of higher levels of exposure between some of the Swedish banks. The main observation from the effects on direct contagion in the Swedish inter-bank markets is that there is a potential for large losses by some Swedish banks if other Swedish banks default. The likelihood of a direct contagion in the Swedish banking system is dependent on which of the banks defaults, as there are links between the Swedish banks. Depending on which of the Swedish banks defaults the risk of direct contagion varies, as the exposures major

banks allow themselves to other banks differ quite substantially. In the event of a counterparty default occurring, it is only major losses with low degrees of recovery that would lead to contagion from one Swedish bank to another, almost regardless of which bank defaults. The risk of contagion effects between the banks is thus relatively slight, even though a few would definitely constitute very severe losses to some of the banks, even forcing the exposed bank into default.

Direct contagion from abroad

We conclude that the risk of contagion within the Swedish banking system is relatively slight. There could of course be other channels from which direct contagion effects might hit the Swedish banking system. One such channel is the foreign counterparties to which the major Swedish banks are exposed.

Figure 7. Tier 1 capital in the Swedish banks after losing their largest foreign counterparty, assuming no recoveries
Per cent
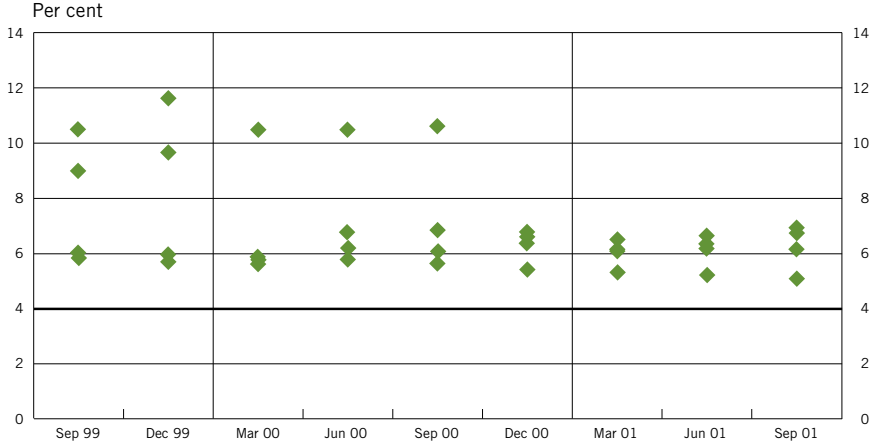
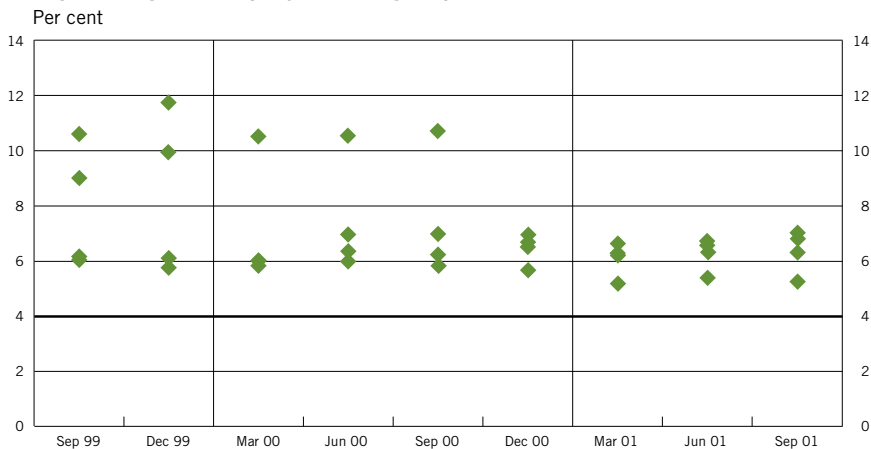
Source: The Riksbank.

The effects on the system from foreign counterparties seem to be smaller than from the domestic counterparties.

The effects on the Swedish banks if their largest foreign counterparty defaulted could possibly become a threat to financial stability. We have observed the Tier 1 capital ratios for the Swedish banks after their largest foreign counterparty has defaulted. In figure 7 the capital ratios are calculated for the Swedish banks assuming a full loss of the exposed amounts and in figure 8 we allow for a 25 per cent recovery. There are no instances when the capital ratio falls below the statutory 4 per cent level. The effects on the system from foreign

counterparties thus seem to be smaller than the effects from the domestic counterparties. The foreign counterparties in these calculations are based on the same form of ranking as in the section on domestic exposures above.

Figure 8. Tier 1 capital in the Swedish banks after losing their largest foreign counterparty, assuming 25 per cent recoveries
Per cent

Source: The Riksbank.

The severity of the losses on the capital ratios of the Swedish banks are also less for the foreign counterparties than for the Swedish counterparties. There is a less severe effect with regard to both the number of cases

The possibility of direct contagion effects from foreign counterparties is very slight for the Swedish banking system.

where capital ratios fall below 4 per cent and to the actual capital ratios. We can only conclude that the possibility of direct contagion effects from foreign counterparties is very slight for the Swedish banking system.

Direct contagion from foreign exchange settlement

FX settlement exposure accounts for almost half of the total exposures reported by the banks, which makes these exposures a likely channel for direct contagion. The effects on the Swedish banks of losing the largest FX

FX settlement exposure accounts for almost half of the total exposures, which makes them a likely channel for direct contagion.

settlement exposures are calculated below. The counterparties in this case are Swedish and Nordic banks, large Swedish non-financial companies and some foreign financial companies.

The findings from the calculated Tier 1 capital ratios in the Swedish banks after losing their largest FX exposures are that no fewer than 12 cases where the capital ratios fall below the 4 per cent threshold can be observed, assuming no recoveries. Assuming 25 per cent recovery on the FX exposures limits the number of cases where the capital ratio falls below the statutory level to 6. The number of cases where the capital ratios fall below the statutory level when assuming 25 per cent recovery decreases less than in the calculations above. This is the effect of the fact that the losses incurred by the FX settlement exposures are larger than the losses above.

Figure 9. Tier 1 capital ratios in the Swedish banks after losing their largest FX counterparty, assuming no recoveries
Per cent
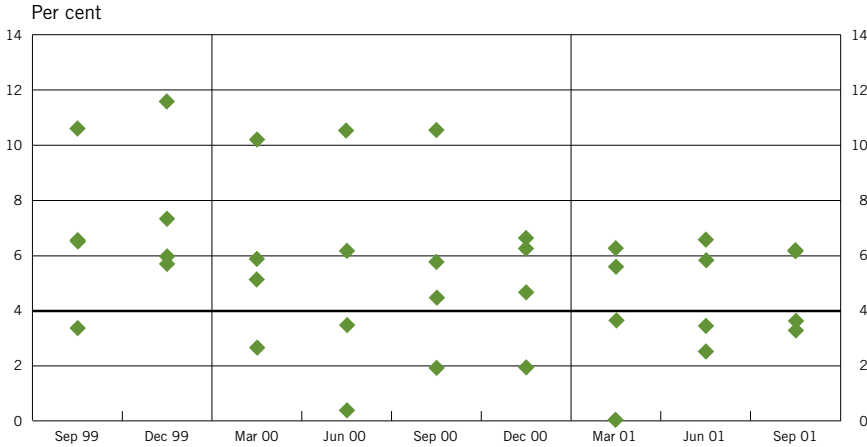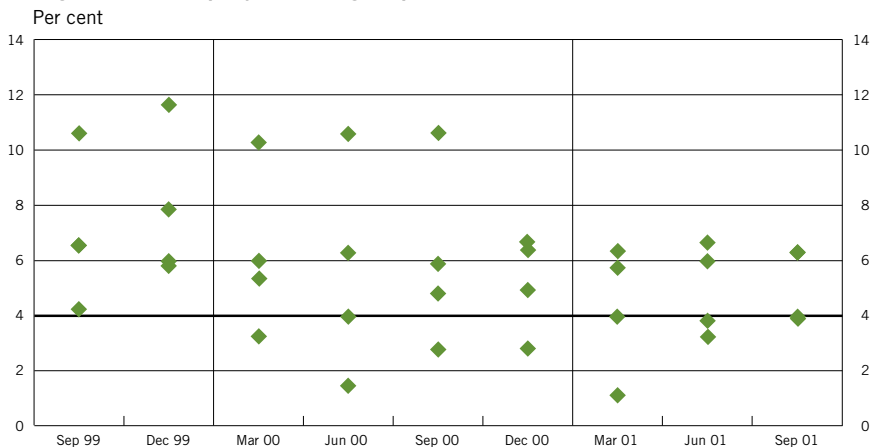

Source: The Riksbank.

The size of the foreign exchange settlement exposures differs between the four major Swedish banks.

The size of the foreign exchange settlement exposures differs markedly between the four major Swedish banks, as was the case with the size of the exposures in the Swedish inter-bank market. The banks most at risk from the FX settlement exposures are not the same banks as the ones most at risk from exposures to other Swedish banks. The fact that different banks have large exposures in the Swedish inter-bank market and the FX settlement market reduces the risk for direct contagion from one specific counterparty to several Swedish banks at the same time as the Swedish banks are vulnerable to defaults from different counterparties.

Figure 10. Tier 1 capital ratios in the Swedish banks after losing their largest FX counterparty, assuming 25 per cent recoveries
Per cent

Source: The Riksbank.

The risk of sequential direct contagion is a consequence of the possibility of one bank losing substantial amounts from the default of a foreign counterparty, the effect being that the bank defaults. The default of the first Swedish bank could then trigger another round of defaults among the Swedish banks. This is the worst scenario from a direct contagion perspective for the stability of the Swedish financial system.

Figure 11. Currency pairs September 2001
Percentages
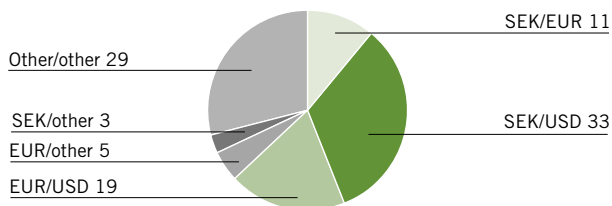
Source: The Riksbank.

The effects of exposures in FX settlement are possibly the most severe ones when looking at direct contagion for the Swedish banks. The size of the effects of defaults will diminish when foreign exchange settlement starts us-

The effects of exposures in FX settlement are possibly the most severe ones when looking at direct contagion for the Swedish banks.

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ing payment versus payment mechanisms within the CLS Bank. The Swedish krona will not be one of the original currencies in CLS, but there are beneficial effects of trading USD/EUR on a payment versus payment basis (see figure 11). The EUR/USD exposures reported by the Swedish banks account for 19 per cent of the total exposures or SEK 125 billion in exposures. The effects of the krona being traded in the same way can also be assessed from figure 11; the exposures including the krona and one of the original currencies are at least 63 per cent of the total exposures and could possibly be an even larger part of the total.[11] The effects of PvP in foreign exchange settlements would also diminish the exposure levels in the domestic inter-bank market and to the foreign counterparties, as these markets also include FX settlement exposures to some extent.

Liquidity impact

The potential liquidity impact on banks from counterparty exposures is difficult to estimate, as the report does not cover the duration of the exposures.

This far, the focus of the analysis of direct contagion has been on the solvency effect (that is the size of the loan loss) on the Swedish banks, should one of their major counterparties default. A sudden default of a major counterparty would also comprise a liquidity effect, since the repayments of the relevant claims on that counterparty would not occur. The potential liquidity impact on banks from counterparty exposures is difficult to estimate, as the Riksbank's report does not cover the duration of the exposures. One can assume that the majority of the exposures have very short duration, but those of securities and derivatives could potentially be quite long. We therefore make the assumption that we can approximate the effects on the exposed banks' liquidity of a counterparty default by looking at the FX settlement and deposit classes of exposures. FX settlement exposures typically endure for a maximum of two days. According to a survey of the Swedish banks in 1998, the major part of the inter-bank deposits in the Swedish banks are overnight and very few mature in more than one month. When assessing the liquidity effect of banks, it thus does not seem overwhelmingly conservative to assume that the total exposure in FX settlement and deposits to a single counterparty will be due for payment at very short notice.

Assessing the liquidity impact has so far not been part of the on going work at the Riksbank, but will be included in the future. Here, only a very simple calculation of the liquidity impact will be made. The methods for doing this could

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[11] Adding the exposures that are known to include SEK, USD, EUR (11 % + 33 % + 19 %=63 %).

probably be enhanced significantly. The effects on the liquidity of the Swedish banks have been calculated by comparing the exposure in deposits and FX settlement with data on unutilised collateral in the payment system, the RIX system. These calculations have been made for the other major Swedish banks and for the largest FX settlement counterparty as reported by the banks. The full loss from a counterparty is related to the unused collateral in the payment system. If the loss is larger than the posted unused collateral it is indicated in table 1 below as a liquidity effect. The severity of the liquidity shortage varied considerably between the six cases.

Table 1. Liquidity effects on the Swedish banks on 30 September 2001

| Affected bank | Failing bank | | | | |
	Bank A	Bank B	Bank C	Bank D	Largest FX counterparty
Bank A	–				
Bank B		–			
Bank C		Liquidity effect	–		Liquidity effect
Bank D	Liquidity effect	Liquidity effect	Liquidity effect	–	Liquidity effect

Source: The Riksbank.

The results in table 1 are only indicative of the possible liquidity effects, as the calculations are for one specific date. The calculations also do not take into account the fact that collateral in the Swedish payment system can be posted within minutes. Selling of other liquid assets by the bank could also mitigate the liquidity effects. Another opportunity is to borrow funds from other institutions, but in a situation where another Swedish bank has failed, this may be difficult since lenders may be reluctant to provide liquidity to a bank within the same system.

This very limited approach makes it hard to draw conclusions. However, to only take into account the collateral that is posted in the RIX system, which is readily available

> It is a good sign that liquidity effects are not observed for all banks with this conservative approach.

for immediate borrowing, is a very conservative approach. A very limited conclusion may be that it is a good sign that liquidity effects are not observed for all banks with this conservative approach.

Counterparty credit risk mitigation

There are ways of diminishing counterparty credit exposures.

Inter-bank credit exposures are often thought of as being a necessary result of banking business, that is that there is not much that can be done about these exposures by the banks. Especially in a concentrated banking system like the Swedish system, this is a common perception. In this section, the available methods for counterparty credit risk mitigation are briefly discussed, showing that there are ways of diminishing counterparty credit exposures.

The most obvious credit risk mitigation technique is the setting of *credit limits*.

The most obvious credit risk mitigation technique is of course the setting of *credit limits*. There are substantial differences between the Swedish banks as to how large exposures they are willing to accept to their counterparties. This indicates that it is possible to set conservative credit limits, especially since these patterns are consistent over time in our data. In order to have conservative credit limits, it may be necessary to have an extensive network of counterparties, in order to *diversify* the counterparty credit risk by using different counterparties, that is name diversification.

All four large Swedish banks have introduced *FX settlement limits*.

Swedish banks do not in general see FX settlement exposures as ordinary credit exposures. Before 1998, the banks did not in general have any systems for limiting these exposures. Since then, all the four large Swedish banks have introduced *FX settlement limits*. These are limit systems that are separate from the ordinary credit limit systems. It could be discussed whether these normal credit limits and FX settlement limits should be integrated, in order to have better control over total credit exposures within the bank.

The most important way of limiting FX settlement exposures is the introduction of a *PvP mechanism* for FX settlement.

The most important way of limiting FX settlement exposures is of course the introduction of a *PvP mechanism* for FX settlement. The creation of CLS Bank is naturally a major step, which will decrease settlement exposures substantially. For the Swedish banks, however, the effect will not be that big initially, since the Swedish krona is not one of the original member currencies and a major part of Swedish banks' FX positions involve the krona (see figure 11).

As banks take on positions against each other on either side of the balance sheet, the scope for *netting* of these exposures is important. Both positive and negative positions against the same counterparty could be netted, particularly in de-

rivative positions. Master agreements[12] that
allow for netting of derivative positions are
commonly used by the Swedish banks and
their most important counterparties in these
markets. With respect to the positions report-

ed to the Riksbank, netting reduces the credit positions with on average 55 to 60
per cent for the fifteen largest counterparties. It is more uncertain whether other
kinds of exposures could be netted against each other in case of a failure.

Another obvious credit risk mitigation
technique is the use of *collateral*. The most ap-
parent area for this is financing, where banks
can choose to lend to one another with un-

**Another obvious credit risk
mitigation technique is the use of
collateral.**

collateralised deposits or with collateralised transactions, in Sweden that is mainly
done through repurchase agreements. Collateral is of course costly, and banks are
not likely to always hold a sufficient amount of securities that can be used as col-
lateral for all transactions. Another area where the use of collateral is growing is
in derivative trading. This applies especially to dealing in derivatives with long
maturities, where posting collateral can be a very attractive way of hedging coun-
terparty risk.

Policy conclusions

Sweden has a concentrated banking system,
with four large banks covering at least 80 per
cent of the system, like in many other small
countries. This is one reason to expect large
inter-bank exposures within these systems, as

**A reduction of inter-bank exposures
between the large Swedish banks is
desirable in order to limit the risk of
direct contagion.**

banks may have few other alternatives than to deal with each other in the inter-
bank markets. Data on inter-bank exposures shows that internal direct contagion
effects are less than might have been expected in the Swedish banking system. In
most cases where one of the four banks fails, the other banks will not suffer direct
losses that would reduce their Tier 1 capital ratio below the regulatory level. How-
ever, this could occur on some occasions, according to the data set. Moreover, the
exposures are measured at the end of quarters, so they are probably underestimat-
ed compared to exposures at peak levels, particularly in intra-day exposures. There-

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[12] Master agreements in this context are derivatives contracts that are developed by industry organisations such as
International Swaps and Derivatives Association (ISDA), which allow for a standardised treatment of several deri-
vatives deals between two counterparties, for instance regulating netting opportunities.

fore, a reduction of inter-bank exposures between the large Swedish banks is desirable in order to limit the risk of direct contagion within the Swedish system.

The introduction of PvP mechanisms in foreign exchange settlement is a major advancement in risk reduction.

The risk for direct contagion from abroad mainly arises from exposures on foreign exchange settlement exposures. There are a number of cases where a failure by a foreign counterparty has the effect that one of the Swedish banks is hit by a loss that makes their Tier 1 capital ratio decrease below the regulatory level. If FX settlement exposures are excluded, there are no cases where a Swedish bank will suffer a loss from abroad that leads to a Tier 1 capital ratio that is too low. The introduction of PvP mechanisms in foreign exchange settlement through CLS Bank is a major advancement in risk reduction for banks active in the foreign exchange market.

The Swedish banks show substantial differences with respect to how large individual exposures they are prepared to have to their counterparties. This indicates that it should be possible to reduce inter-bank exposures even in a concentrated banking system. It also leads to the conclusion that banks with large exposures in the inter-bank market are the ones we need to observe more closely.

Mechanisms for decreasing the size of exposures between banks are to diversify exposures, to use collateral, to adopt netting and to use clearing and settlement systems that provide for DvP or PvP.

The main mechanisms for decreasing the size of exposures between banks is to diversify exposures to more counterparties, to use collateralised instruments when possible, to adopt netting and to use clearing and settlement systems that provide for DvP or PvP when available. Many of the markets where large exposures arise for the Swedish banks are international markets, where the concentrated national banking system does not pose an obstacle to the diversification to a larger number of counterparties.

The Swedish banks are universal banks that do not differ particularly from other large international banks. There is no reason to believe that banks in other countries differ substantially from the Swedish banks with respect to exposure to direct contagion. The large differences with respect to the size of the largest exposures between the Swedish banks suggest, however, that there may be significant differences in individual banks' exposure to direct contagion effects. One element that may lead to a larger exposure within the Swedish system compared to other countries is the substantial holdings of mortgage backed bonds in the Swedish banks. Most of the mortgage institutions are subsidiaries to the Swedish banks and are thus seen as part of the banks in the context of contagion.

The large Swedish banks have relatively high ratings and must in general be seen as rather risk conscious. The observation that banks take on so large exposures that they may not fulfil capital adequacy rules if there is a large loss on one of these exposures suggests that the banks see a sudden failure of an important counterparty as an extremely unlikely event. The reason behind this is probably not merely the actual probability of the event occurring, but also expectations that the authorities would not allow a sudden failure of an important bank. The fact that this kind of expectations exist is confirmed by the discussions that the Riksbank has had with the banks.

Moral hazard thus seems to be present with respect to the exposure towards direct contagion. As the fear of contagion is one of the most obvious reasons for public authorities to intervene, it is hard to see that there are incentives for banks to decrease these exposures. To some extent they are actually protected by the existence of risks of direct contagion, as these make government intervention more likely. Consequently, this can be seen as a market failure, which makes it reasonable to question whether there is scope for regulation in this area.

Moral hazard seems to be present with respect to exposure towards direct contagion.

In Sweden, the Riksbank has had discussions with the supervisory authority (FSA) on whether the rules on large exposures should be sharpened, in order to also take into account short-term inter-bank exposures. The conclusion has been not to do so at this stage. The reason is that the regulatory system is developed internationally, particularly within the EU. The level playing field argument makes it difficult to suggest stricter rules for national banks than what is required by the EU system. It therefore seems more natural to bring up the issue in international discussions. However, the large focus on Basle II, where these issues are not discussed, has made this quite difficult. Another reason not to introduce new rules at this stage is the creation of CLS Bank. As quite a large portion of the contagion effects arises from FX settlement exposures, the total exposure to direct contagion might diminish substantially with the introduction of CLS. Instead of introducing stricter regulations, the Riksbank and the FSA jointly will increase the monitoring of banks' counterparty and settlement risk management, in particular the setting of credit limits. Monitoring credit limits can be an alternative to measuring the actual exposures the way the Riksbank does it, especially since this may be less burdensome for the banks involved and since the limits reveal the maximum exposure that the banks are willing to accept.

Monitoring credit limits can be an alternative to measuring the actual exposures.

Another alternative to posing stricter rules on large exposures is to consider whether it is possible to increase transparency in this area. If banks had to show their exposure to single counterparties in some form (of course without giving out the names of the counterparties), this ought to benefit the banks' investors, as it indicates the banks' capability of managing their risks. This information could be used to raise the required return on their investment or to drive down the size of the exposures depending on the risk appetite of the investors.

In this article the focus has been on the work carried out by the Riksbank. The methodology used by the Riksbank to monitor interbank counterparty exposures is one possible approach to monitoring the exposures in the banking system, the most notable deficiency of this approach being the infrequent reporting. The workload, as discussed above, placed on the banks by the reporting requirements does not make it possible for the Riksbank to require more frequent reports. An alternative approach, which might make it possible to receive more frequent reports, might be to have the banks report their credit limits on major counterparties as these possibly vary less over time. When the limits are known to the Riksbank the banks would merely need to report how much of these limits were used at any given time. This approach might be more in line with the internal reports of the banks and thereby prove less burdensome for the banks. On the other hand, individual limits reveal even more of the banks' business strategy than actual exposures, and banks may be even more reluctant to reveal this information.

Appendix

Counterparty	Derivatives	Securities	Deposits		Total	FX settlement	Stock loans	Repurchase agreements	Other collateralised loans	Exposures to companies within the same group
			Gross	Net						
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Total										

Counterparty	SEK/EUR	SEK/USD	EUR/USD	EUR/Other	SEK/Other	Other/Other	Total
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
Total 15							
Total							

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Rixmod – The Riksbank's macroeconomic model for monetary policy analysis

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Rixmod is a large macroeconomic model that is in regular use at the Riksbank for policy analyses and forecasting. The aim is to obtain guidelines as to how a monetary policy that includes an inflation target should be conducted. The reason for introducing Rixmod was to offer within one and the same model a consistent analytical framework for forecasting and a tool for studying specific policy issues. The structure of the model makes it possible to throw light on what significance various economic mechanisms have for inflation.

This article describes the basic structure of Rixmod. The characteristics of the model are illustrated with some examples of policy simulations.

Rixmod – two models

Rixmod consists of a steady state model and a dynamic model. The steady state model describes the state the economy will reach when the effects of disturbances have faded away.

Rixmod consists of a steady state model and a dynamic model.[1] The steady state model describes the underlying state of long-term equilibrium, or the steady state, in the economy. By steady state is meant the conceptual state of balance reached by the economy when the effects of all disturbances have faded away. In this steady state, all relative prices and quantities are consistent with

[1] Rixmod is based on the "Quarterly Projection Model (QPM)" designed by the Bank of Canada. However, it has been regularly adapted to Swedish conditions. For descriptions of the model see Black, Laxton, Rose & Tetlow (1994), Coletti, Hunt, Rose & Tetlow (1996) and Karlsson (1998). For analyses of different monetary policy issues carried out using Rixmod see Dillén, Karlsson & Nilsson (1998) and Dillén & Nilsson (1999). In a forthcoming paper Jonsson, Nilsson, Nilsson & Shahnazarian (2002) provide a more detailed technical description of Rixmod.

each other, economic agents' expectations regarding these variables are satisfied, and all agents achieve their targets. This steady state is determined by factors which, according to well-established macroeconomic theory, influence domestic consumers and enterprises and their transactions with the foreign sector. Even though such a steady state can seldom be observed in practice, it is important as a point of reference for assessing the character and consequences of the various disturbances that have occurred. The steady state is not constant but will change if structural changes, or permanent disturbances, occur.[2]

The dynamic model describes the mechanism by which the economy adjusts towards a steady state after it has been exposed to various types of disturbance. These disturbances could be either temporary or permanent. In event of a temporary disturbance the long-term steady state will remain unchanged.[3] In this case, the dynamic model will describe the adjustment back to the steady state. In the event of a permanent disturbance, the dynamic model describes the process of adjustment to the new steady state. The idea is that the dynamic model should capture aspects of economic behaviour that are not explained in the steady state model but exist in the data, such as rigidities of one kind or another in wage and price formation as well as imperfect information.

The dynamic model describes the mechanism for adjustments towards the steady state after disturbances of various types.

The steady state model in Rixmod shares certain basic features with the dynamic general equilibrium model (DGEM) described in Jonsson (2002). Models of this type are based on the principle that macroeconomic models should be constructed using as the point of departure a microeconomic description of the decision-making processes of households and firms. This means that the individual agents' goal functions and budget restrictions are specified and that assumptions are made regarding market structures and about what information the agents have access to when they make their decisions.[4]

The steady state model in Rixmod shares fundamental similarities with dynamic general equilibrium models (DGEM).

[2] By permanent disturbance is meant, by definition, a change in the long-term steady state. A permanent change in the tax structure, such as a reduction in direct taxes and a corresponding increase in indirect taxes, would cause a change in the steady state in Rixmod.

[3] A temporary disturbance does not affect the long-term steady state, but its effects can be longer or shorter in duration. Temporary disturbances could consist of a brief rise in commodity prices or a temporary rise in the rate of nominal wage increases (for reasons that are not explained in the model).

[4] DGEM has its origins in the "real business cycle" models of the eighties, which focused on productivity disturbances as the underlying explanatory factor behind economic cycles. DGEM uses the underlying methodology of "real business cycle" models but extends the analysis in various directions.

Rixmod contains mechanisms that are similar to those in DGEM, but there are key differences.

Even though Rixmod contains mechanisms that are similar to those in DGEM there are key differences. A DGEM can be used to explain long-term determining factors and short-term dynamic adjustments in the event of disturbances in one and the same model. In Rixmod the long-term steady state is described with the aid of the steady state model, while the short-term adjustments towards the long-term equilibrium are explained by the dynamic model. This dual way of looking at things is justified by the Riksbank's wish to be able to use Rixmod as a tool in its forecasting activities, coupled with the view that currently available DGEM are neither adequately developed nor detailed enough to be suitable for use in forecasting.

Like many other macroeconomic models, Rixmod is basically a single-product model.

For the same reasons the steady state model in Rixmod has been extended to include mechanisms for which no microeconomic foundations have been provided. In common with the DGEM discussed by Jonsson (2002) and many other macroeconomic models, Rixmod is basically a one good model, in which a particular product is produced according to an aggregated production function with the input of labour and physical capital. This good can be used for private consumption, capital formation, public consumption or exports. Nor is any formal distinction regarding its usability made between a product of domestic manufacture and an imported one. In the strict sense, in a one good model of this type there are no relative prices; regardless of where the product is produced or what it is used for the "price" is the same.[5] The one good model is thus not directly applicable for analysing a real economy that displays significant variations over time in relative prices, terms-of-trade and real exchange rates. Even if a formal multi-good model might be more satisfactory theoretically, the construction and use of such a solution would require a great deal of effort. In the solution preferred for Rixmod a relative price structure has been designed on top of the one good model. In this case the desired specification of the dynamic model has guided the design of the steady state model.

Calibration

Rixmod is a calibrated model.

Rixmod is a calibrated model. The calibration process involves selecting parameters to

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[5] In such a model the real exchange rate is constant and no distinction is made between the real exchange rate and the terms-of-trade.

create system features that are believed to reflect the key mechanisms in the economy. The setting of parameter values is guided by several criteria: restrictions from economic theory, stylised facts in the form, for example, of the relative volatility of different time series, and dynamic adjustment rates (impulse-response functions).[6]

One drawback with calibration is that there is no statistical measure of how well the model matches the data. The traditional method of determining model parameters is to use econometric estimating. However, it is difficult to use econometric estimating as the main method for parameter determination in the class of model to which Rixmod belongs. System estimates are needed to take into account the interdependence of the equations in the model; in the case of large models this is not possible as there are too few observations in relation to the number of parameters that need to be determined. In practice, therefore, econometric estimating of large models means that individual equations or possibly groups of equations have to be estimated independently of each other. However, satisfactory statistical measures of the explanatory capacity of individual equations do not necessarily mean that the model as a whole will have good characteristics. Furthermore, structural shifts can mean that estimates based on historical data do not reflect the current correlations.

> **Satisfactory statistical measures of the explanatory power of individual equations do not necessarily mean that the model as a whole will have good characteristics.**

The steady state model

The steady state stock-flow equilibrium involves three types of assets: government bonds, the stock of real capital and net foreign assets. Whereas the level of the central government debt as a proportion of GDP is assumed to be an exogenously given policy decision, the capital stock and net foreign assets or liabilities are determined on the basis of rules of behaviour that have their foundations in economic theory.

> **The steady state stock-flow equilibrium involves three types of assets: government bonds, the stock of real capital and net foreign assets.**

When households/consumers decide on their consumption they balance the benefit of consuming today against the benefit of saving and thus being able to

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[6] Karlsson (1998) discusses the calibration of Rixmod's steady state model. See also Dawkins, Srinivasan & Whalley (2001) for a review of calibration as a method for determination of parameters in economic models.

consume more in the future. The model is based on a common assumption in economic theory, namely that households/consumers plan their consumption over an infinite time horizon subject to a budget restriction. It is assumed that the household/consumer sector consists of identical individuals in overlapping generations and that population growth is determined by an exogenously given birth rate and an exogenously given mortality. The likelihood of dying reduces the value a consumer places on consumption planned for the future.[7]

In a steady state households consume a constant proportion of their total wealth.

In a steady state households consume a constant proportion of their total wealth. The total wealth of households consists of financial assets and human capital, which equals the present value of future earned incomes. What proportion is consumed in each period depends on the real interest rate, how willing consumers are to exchange consumption today for consumption tomorrow (the intertemporal elasticity of substitution), the subjective discounting by consumers of their future utility, and the likelihood of the consumer dying during the period.[8]

Firms choose the optimal level for their capital stock and the investments that will enable them to maintain this level.

Domestic firms produce using labour input and physical capital according to what is known as the Cobb-Douglas production function with constant returns to scale.[9] Firms choose the optimal level for their capital stock and the investments required to maintain this level. The capital stock required depends on such factors as the cost of capital, which, in turn, depends on such factors as depreciation, real required returns and taxation.

The supply of labour and the equilibrium unemployment rate are determined outside the model.

The supply of labour and the unemployment rate in steady state are determined outside the model. The quantity of labour that individuals provide, in combination with the

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[7] These assumptions are made so that an analytical derivation will be manageable. The assumption that the likelihood of dying is the same for all individuals ("consumers") facilitates the aggregation of the decisions of the individual consumers. Blanchard-Fisher (1989) calls this assumption "a model of perpetual youth", that is to say the individuals in the model have eternal youth.

[8] See Jonsson (2002) for a more detailed description of the problems facing consumers when making decisions. One difference is that in Jonsson (2002) the consumer's choice between consumption and leisure is also modelled, whereas in Rixmod the supply of labour is exogenous (see below). Another difference is that Rixmod assumes overlapping generations with limited life expectations, while Jonsson (2002) assumes that the typical consumer has an infinite time horizon (can be explained on the basis of altruistic links between different generations). The demographic assumption of overlapping generations is the reason why the budget deficit has real effects in Rixmod (see section "Fiscal policy", p. 56).

[9] Constant returns to scale means that if the capital stock and labour input increase by the same factor, production will increase pro rata.

assumed equilibrium level of unemployment, determines how much labour firms employ in steady state. Real wages are determined by the normal marginal product conditions, which include total factor productivity and capital intensity.

As Rixmod is essentially a one good model there is no microeconomic derivation for the relative price structure in the model.

Relative prices depend on domestic cost factors and import prices.

As the various demand components in the balance of supply will be satisfied by both domestically manufactured products and imports, relative prices will depend on both domestic cost factors and import prices. Differences in indirect taxation can also influence relative prices.

A typical assumption for a small open economy is that the economy in question takes its export and import prices as given. On this assumption, the decisions of domestic agents will determine what export and import volumes are possible. In the steady

The real exchange rate is determined from a relation that includes the ratio of exports and the size of the domestic economy in relation to foreign economies.

state model Rixmod departs from this description by allowing the size of the domestic economy in relation to foreign economies to influence the real exchange rate and export prices. In Rixmod, the domestic economy can be said to be "an almost small open economy". The real exchange rate is determined from a relationship that includes the export ratio and the size of the domestic economy in relation to other economies. Higher exports in relation to GDP would require a depreciation of the real exchange rate. If the domestic economy grows faster than other economies the exchange rate will appreciate.[10]

It is assumed that in the long term prices on the domestic credit market are determined internationally, which means, for example, that net foreign assets are determined as a residual factor.

Prices on the domestic credit market can be assumed to be determined internationally in the long run.

The government sector determines the level of the domestic national debt and optimisation decisions by firms determine the level of the capital stock. Consumers' decisions about their desired wealth simultaneously determine the net foreign assets, given the other two types of asset. In the steady state, the short (three months) yield is determined so as to be equal to the short foreign real yield plus an exogenously determined risk premium. The long (ten

[10] One possible explanation as to why the real equilibrium exchange rate varies with time is the differences in productivity trends in sectors that are either exposed to or shielded from competition. Alexius (1999) and Alexius & Nilsson (1997) discuss this Harrod-Balassa-Samuelson hypothesis and provide empirical support for the view that the real exchange rate will appreciate when the size of the domestic economy grows relative to other economies.

year) yield is given by the short yield plus an exogenously determined term premium. Risk premiums for various types of agents mean that the interest consumers and business enterprises have to pay on their loans is higher than the interest on the government debt.

The payments of interest on foreign debt must be financed out of a trade surplus. Other things being equal, a long-term increase in the net foreign debt will require a larger trade surplus. To achieve this increase in net exports it will be necessary for the real exchange rate to depreciate.

The public sector's targets for expenditure, transfer payments and net debt, as well as for most tax rates, are determined outside the model. The tax rate on labour income is adjusted so that the public sector's budget restrictions are satisfied.

It is assumed that the consolidated public sector purchases some of the private sector production and finances its purchases by levying taxes on or borrowing from consumers.[11] The public sector also makes transfer payments to households. The public sector's targets for its expenditure and transfer payments as a proportion of GDP, the target for the level of net debt in relation to GDP and most tax rates (capital tax and indirect taxes) are determined outside the model. The rate of tax on income from employment, on the other hand, is endogenous and adjusted so that the public sector's budget restriction is satisfied.

In the steady state model monetary policy is limited to an exogenously determined inflation target.

The steady state model does not take into account any real long-term effects of how monetary policy is conducted. In the steady state model, monetary policy is limited to an exogenously determined inflation target that will only influence the level and rate of change in nominal variables.

The dynamic model

EXPECTATIONS FORMATION AND ADJUSTMENT COSTS

The dynamics of Rixmod depend on the assumptions made regarding the occurrence of various types of adjustment cost and on how the expectations of agents in the economy are formed.[12]

Adjustment costs could, for example, consist of fixed costs in connection with

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[11] Public consumption is assumed not to influence consumer benefit and therefore in the model it has no direct effect on households' consumption decisions.

[12] A third factor that affects the dynamics consists of monetary policy and fiscal policy response functions.

capital formation or of contract costs required for changing wages and prices. The existence of such costs means that consumers and business enterprises also adjust gradually after a disturbance in the hypothetical case with perfect foresight and when the effects of the disturbance are well known.

When analysing the effects of economic policy measures it is important to take into account how consumers' and business enterprises' expectations influence their decisions.

In Rixmod expectations are modelled as a combination of forward-looking and backward-looking components.

These expectations could relate to income from employment, inflation, interest rates and exchange rates in the future. The main issue challenging macroeconomic research over the past few decades has been the importance of assuming that households and firms have model-consistent (rational) expectations or not.[13] Assuming that consumers and firms form their expectations rationally is appropriate in an analytical framework in which the agents in the economy are assumed to be rational and optimising. However, in order to describe their decision-making situation in a relevant way, such an approach should take account of the learning process and the cost of collecting information. Models that assume that expectations are strictly model consistent also have difficulties in explaining the dynamism contained in the data.[14] In Rixmod, therefore, expectations are modelled as a combination of forward-looking and backward-looking components, consisting of earlier values for the variable in question. The backward-looking components are relatively heavily weighted, in the interval of 0.65–0.8 depending on the variable. What the forward-looking component includes, apart from the model-consistent expectations, depends on whether the variable is real or nominal. Forward-looking expectations relating to real variables take account of the steady state value. As nominal price levels are not determined in the steady state model but by the mechanisms in the dynamic model and by the specific disturbances that are assumed to have occurred – there is no such anchor in the steady state for nominal variables.[15]

[13] If the expected value of the variable is model-consistent then it coincides with the solution provided by the model. A typical assumption that involves expectations that are not model-consistent (except in special cases) is that the agents in the economy have adaptive expectations.

[14] See, e.g. Lindé (2001).

[15] This is related to how the central bank's role as the "nominal anchor" is specified. In Rixmod it is assumed that the central bank has an inflation target, which means that some price drift will occur (see below, section "Monetary policy", pp. 57–58). It is possible in Rixmod to give some weighting to the inflation target in the price expectations that are formed. This gives an exogenous credibility to the inflation target. The Riksbank does not need to act equally forcefully in the event of disturbances in order to maintain confidence in the inflation target.

Potential production

In the dynamic model potential production is defined as the production that can be achieved with full employment using the capital stock in existence.[16] Potential production will thus deviate from the production that is possible in the long term as long as the actual capital stock is not the same as the optimal long-term capital stock.[17] Equilibrium paths for such factors as real wages, consumption, exports and imports are also associated with the potential level of production. In the dynamic model, it is possible for actual consumption, for example, to deviate from the equilibrium path for consumption (on account of the rigidities noted above), but actual consumption will gradually approach the equilibrium path.[18]

Determination of demand variables

The equations in the dynamic model that determine consumption, capital formation, exports, imports, employment, etc. share a common structure. For each demand variable there is a backward-looking component, which consists of earlier realisations for the variable, and a forward-looking component. This basic structure has then been augmented to include specific determining factors for each of the variables.

When determining household consumption the forward-looking component consists of expectations regarding future disposable incomes, which means that the household's "permanent income" will play a part in its consumption decisions. Household consumption is also affected by current interest rates. If consumers' financial assets deviate from the desired long-term level, they will adjust their consumption with the object of closing the gap. A disequilibrium in consumers' financial assets is matched by a disequilibrium in the net assets/liabilities in relation to foreign countries. In Rixmod, therefore, consumption is influenced by whether or not the net position in relation to foreign countries deviates from its equilibrium value.

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[16] Potential production is also determined by total factor productivity (TFP). The role of TFP is discussed below in an example.

[17] The fact that the actual capital stock is not the same as optimal long-term stock is due to the existence of adjustment costs and rigidities in the price and expectation formation process.

[18] These equilibrium paths are not equivalent to the dynamic adjustments that take place in the DGEM. When Rixmod is used for forecasting, the steady state model is used to generate a further type of time-varying steady-state path. This means that a distinction is made between long-term steady state and time-varying equilibrium paths that are derived from the steady-state model.

Disturbances that affect firms' capital costs will result in firms wishing to adjust their level of capital stock. However, firms will not change their investment plans so that they achieve the optimal, long-term capital stock immediately. Instead, they gradually adjust the actual capital stock towards the optimal long-term level. Investments will be determined by the planned adjustments in capital stock, taking into account the fact that it takes time for firms to put their investment plans into effect.

The forward-looking component in export and import demand consists of the trends along each equilibrium path. Over and above this, exports are positively affected and imports negatively affected by a temporary depreciation of the real exchange rate (with a time lag of up to one year). Export volumes are also positively affected by the foreign excess demand. Correspondingly, imports are affected positively by domestic demand and export volumes being higher than the level of aggregate demand that is compatible with equilibrium.

The forward-looking component in the determination of employment depends on expected production and productivity.[19]

Price and wage formation and inflation

In the steady state model it is assumed that prices are determined on perfectly competitive markets, which means among other things that a firm's marginal revenue is equal to its marginal costs. In the dynamic model, however, it is assumed that firms can influence prices. This means that in the short term they can set prices that exceed their marginal costs. This mark-up is assumed to depend on the demand situation. The cost of adjusting prices means that price setters will weigh the cost of deviating from the optimal price against the cost of changing the price. In this trade-off, the price setters' expectations of future prices and wages will play an important role. A similar structure for wage formation can be justified using a model for the labour market in which wages are determined after negotiations between employers and union organisations. The connection between prices and wages therefore depends on both lagged and expected prices and wages as well as measures of the excess demand.

> **The determination of prices and wages depends not only on lagged but also expected prices and wages, as well as on the excess demand situation.**

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[19] When firms make decisions on the level of employment they take account of future labour requirements. Expected future labour requirements are determined by expectations regarding demand, productivity and future use of capital.

Exchange rates and interest rates

The nominal exchange rate satisfies the conditions for open interest rate parity.[20] In Rixmod, changes in the real exchange rate are a fundamental force driving the nominal exchange rate. The expected nominal exchange rate is determined by the expected real exchange rate and expected trends in domestic prices in relation to expected changes in prices abroad.

Long nominal yields are determined partly by expectations regarding future short-term yields, according to the expectation hypothesis. Expectations regarding future short-term yields are model consistent. However, in Sweden's interest rates statistics, the long and short yields co-vary to a greater extent than can be explained by the expectation hypothesis. Over and above the expected changes in the short yield the long yield in Rixmod is therefore affected directly by changes in the short yield (parallel shift in the yield curve). Long international yields also have a direct effect on long domestic yields.

Fiscal policy

Tax on income from employment is adjusted to achieve the debt target; transfer payments function as "automatic stabilisers".

The public sector has long-term targets for the central government debt, public consumption and transfer payments. In the dynamic model the rate of tax on income from employment is adjusted in order to achieve the debt target. If, for example, the debt ratio is higher than the targeted ratio, the rate of tax on income from employment will be raised, which will increase tax revenue. The higher revenue is then used to reduce the debt ratio to its long-term steady state. Public expenditure (to a small extent) and transfer payments (to a greater extent) are counter-cyclical and will depart from their targeted levels as a result of developments in the state of the economy. Public transfer payments in particular therefore serve as automatic stabilisers. The fiscal policy response functions in the dynamic model are not forward-looking, as the government responds to deviations during the current period.

As consumers do not expect to live forever their consumption decisions are influenced by how the public sector finances its expenditure. Forward-looking consumers take account of expected tax rates in the future and of their effects on their incomes over their life cycle. A tax reduction or an unfinanced increase in expenditure today will mean higher taxes in the future, provided the public sec-

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[20] Open interest rate parity means that the expected depreciation rate is equal to the yield differential in relation to other economies (taking account of an exogenous risk premium).

tor's long-term target for the net government debt remains unchanged. However, as individuals, consumers know that there is a certain probability that they themselves will not be affected by these compensatory tax increases as they are mortal (without actually knowing when their lives will end). Instead the tax increases will be paid by tomorrow's taxpayers. "Ricardian equivalence"[21] thus does not apply in Rixmod.

Monetary policy

The role of monetary policy is to maintain or bring about a state of stability in the general level of prices. Monetary policy is forward-looking and focused on keeping inflation at 2 per cent. Inflation is kept on target by changing the short (three-month) nominal interest rate in relation to deviations in inflation from the target rate over six or seven quarterly periods.[22] The monetary policy rule also takes account of the latest interest rate in order to prevent interest rates from fluctuating excessively violently.

> The role of monetary policy is to maintain or bring about a state of stability in the general level of prices.

Monetary policy focuses on the trend in underlying inflation. Statistics Sweden's calculation of the UND1X is based on the CPI but excludes mortgage costs on private houses and changes in the net effect of indirect taxes and subsidies. In the approach selected for Rixmod UND1X inflation is a function of domestic unit labour costs and imported inflation.[23]

> Monetary policy focuses on the trend in underlying inflation.

Monetary policy is transmitted through several different channels. As it is assumed that the Riksbank is able to control the short nominal interest rate, the bank can influence the costs incurred by business and consumers on investing and consuming today in relation to the future. As prices change only slowly in the short term, changes in nominal yields will lead to

> Monetary policy makes its effect through several different channels.

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[21] According to "Ricardian equivalence" it does not matter if an increase in public expenditure is financed by increased taxes or by lending (that is to say, a budget deficit).

[22] There is no repo rate in Rixmod; the assumption is that the Riksbank has full control over the three-month interest rate. The monetary policy rule in Rixmod does not correspond fully to the simple rule described by Heikensten (1999). According to the Riksbank's simple rule of thumb, monetary policy is adjusted with the object of restoring inflation to the target level over a one- to two-year horizon. Rixmod's monetary policy rule permits inflation to deviate from 2 per cent at the end of the horizon, but this deviation is determined by how much weight is given to achieving the target. However it is not possible with reasonable assumptions in the model to achieve exact target satisfaction within the target horizon.

[23] Unit labour costs are calculated from the nominal wage and a measure of steady state labour productivity. Import prices are determined largely by a weighted average of foreign prices of manufactured goods and commodity prices, and the nominal exchange rate.

changes in real interest rates. Investment demand is affected by changes in real interest rates. When the Riksbank raises the short-term rate by more than the long one, a yield gap will open which will have a restraining effect on private consumption. When the Riksbank changes the short nominal yield, the nominal exchange rate will also be affected. As prices only change slowly, changes in the nominal exchange rate will also have an effect on the real exchange rate. The real exchange rate affects, in turn, export and import volumes. Through these channels, the Riksbank is able to influence the pressure of demand in the economy and, thereby, inflation. The trend in the nominal exchange rate also has a direct affect on inflation through import prices.

Two examples of Rixmod simulations

To give a feeling for the characteristics of the model and for how it can be used in monetary policy analysis, this section presents two examples of Rixmod simulations. A common way of illustrating the properties of a macro model is to expose the model to simple and relatively well-defined disturbances, such as a permanent change in the government's net debt or a temporary rise in commodity prices. In the examples below, the disturbances are more complex, since the purpose is to show how Rixmod can be used to analyse a current policy issue.

Developments in the Swedish economy in 2001 can illustrate the difficulties monetary policy decision-makers can face.

A serious difficulty facing practical monetary policy is to measure changes in potential production and the accompanying production gap. Developments in the Swedish economy in 2001 can serve to illustrate the difficulties that monetary policy decision-makers can face. In 2001, GDP growth in Sweden was significantly lower than was generally expected at the end of 2000. Domestic private demand and exports were seriously weakened, and trends in labour productivity were also far weaker than expected. Instead, unit labour costs and inflation rose faster, and the exchange rate turned out to be weaker, than expected. A possible explanation for this could be that temporary effects had pushed up inflation by more than people had foreseen, and that this outweighed the deflationary effects of the lower demand, itself caused by slower international growth.

An alternative, or perhaps complementary explanation for this situation could, however, be that more fundamental supply side disturbances had occurred in the economy[24], disturbances that give rise to variations in potential GDP

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[24] See, for example, the discussion in the box headed "The relationship between growth and inflation" in the 2001:4 Inflation Report.

growth. From this perspective, the "new economy's" combination of rapid growth and low inflation in the USA in the 1990s has been put down to the way positive supply side disturbances raised the potential GDP growth rate. Similarly, proponents of "real business cycle" models interpreted the slow-down in real growth that occurred in the USA in 2000 as the result of disturbances that had a negative effect on potential GDP growth.[25] In a situation where growth in actual GDP falls because a negative supply-side shock has reduced growth in potential GDP, there will be no unused resources. It would therefore not be possible for monetary policy to stimulate production by adopting an expansive stance. An expansionary monetary policy would only lead to higher inflation instead.

To throw light on these considerations, we will first look at the effects of an international recession on the Swedish economy, according to the Rixmod simulation. This

A common assumption in the examples is that the economy is initially in a steady state.

will then be illustrated by a situation in which a disturbance has a negative effect on the supply side of the economy.

An assumption that is common to the examples is that the economy is initially in a steady state.[26] Even if the actual production in the Swedish economy, according to many analysts, was close to potential production in 2000 (i.e. the production gap had closed), this does not mean that the economy was also in a long-term steady state. An example of this is the rapid growth in exports and imports (relative to GDP) in the 1990s, which suggests that the economy was adapting to structural changes that involve an increase in the foreign trade ratio.[27] In the examples, the steady state corresponds to the assumption that the Swedish economy in 2000 was not too far from an equilibrium in terms of capacity utilisation, price trends and expectations.

The growth path that the economy was to follow in the original long-term steady state is referred to below as the "control solution". The figures reflect changes in the variables in two ways:

1) As a *percentage* deviation from the control solution. GDP, private consumption, exports, nominal hourly wages, nominal and real exchange rates, relative com-

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[25] See, for example, the discussion in "Theory ahead of rhetoric: Economic policy for a 'new economy'" in the 1999 Annual Report and "Theory ahead of rhetoric: Measurement and the 'new economy'" in the 2000 Annual report, Federal Reserve Bank of Cleveland.

[26] As the economy is initially assumed to be in a steady state, the effects of the assumed disturbances are isolated. If the initial situation is not that of a steady state, it will be difficult to isolate the effects of the disturbances from the adjustment of the economy as a result of the initial disequilibrium.

[27] When Rixmod is used for the purposes of forecasting, filtering techniques are needed to take into account the impact of structural changes.

modity prices, total factor productivity (TFP) and potential production are presented in this way.

2) As a *percentage point* deviation from the control solution. Short-term interest rates, the rate of inflation (annual, measured in terms of UND1X or deflators), unit labour costs, the production gap and net exports (as a proportion of GDP) are presented in this way.

AN INTERNATIONAL RECESSION

In this example, the international recession opens up a negative production gap and lowers the inflation rate (see figure 1).[28] The relative prices of commodities fall, which is to say that commodity prices are more sensitive to the fall in demand than prices of manufactured goods. It is assumed that central banks abroad take steps to overcome the recession by pursuing expansive monetary policies, with lower interest rates as a consequence. The economic cycle continues for a little more than five years. After the opening downturn, foreign demand recovers and a positive production gap opens after about two years. Capacity utilisation, the inflation rate, interest rates and relative commodity prices eventually return to their long-term steady-state levels. This upturn phase also has implications for developments in the domestic economy.

In this example, the international recession opens up a negative production gap and lowers the inflation rate.

The domestic economy is affected by the rest of the world via a number of channels. Weaker demand abroad leads to lower exports. Changes in the terms-of-trade have an effect on incomes and wealth, which in turn affect domestic demand. Price trends abroad have a direct effect on domestic prices and an indirect one since foreign interest rates influence domestic interest rates and the exchange rate.

Figure 2 shows the effects of the international recession on the Swedish economy. One direct effect of the lower inflation rate abroad and falling commodity prices is that imported inflationary pressures weaken. The impact via the foreign trade means that falling demand and production abroad lower the demand for Swedish exports. This, in turn, leads to a lower level of activity in the Swedish economy, and subsequently to a lower rate of wage increases. Wage formation is influenced by several factors, including the expectations of lower inflation that is beginning to emerge. UND1X is affected initially mainly by the decline in

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[28] The example is only intended to illustrate how Rixmod works and does not represent an assessment of what the international business cycle relevant to the Swedish economy looks like.

imported inflation, and eventually the lower rate of wage increases and the lower unit labour costs also help to contain inflation.[29]

In the example, the Riksbank immediately recognises the consequences of the global recession for the Swedish economy, particularly for inflation, and responds by cutting the short-term interest rate. However, domestic rates are reduced less than foreign rates, which initially strengthens the nominal exchange rate; a negative change in the krona index corresponds to an appreciation of the exchange rate. However, the rate of domestic inflation rises faster than inflation rates abroad, which gradually pushes price levels in relation to other countries above the level in the control solution. The nominal exchange rate will therefore have weakened by 1 per cent by the end of the economic cycle in relation to the control solution, while the real exchange rate will have remained unchanged.

Monetary policy stimulation boosts private consumption in the first two years, while there is only an insignificant impact on business investment plans. The increase in domestic demand will offset the shortfall in foreign demand, but will do so at the cost of a decline in household wealth, which is matched by a deterioration in the net position in relation to foreign economies. This decline in consumer wealth is not desirable in the long term and must eventually be reversed.[30]

The positive production gap abroad that is required to curb the fall in prices and to restore inflation to its target level means that demand for Swedish exports will once again increase two years after the initial disturbance to demand. To reverse the declining trend in their wealth, Swedish consumers will cut down on their consumption.[31]

A TEMPORARY DECLINE IN PRODUCTIVITY

While lower demand leads to lower production and lower inflation, a negative disturbance on the production side can result in lower production but higher inflation. In this example, the lower growth is caused by a temporary decline in total factor pro-

> In this example, the lower growth rate is caused by a temporary decline in total factor productivity.

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[29] Figure 2 shows the nominal wage in relation to the control. When the process of adjustment to the disturbance ends, nominal wages have fallen by 1 per cent in relation to the control solution.

[30] During the first year, net exports as a proportion of GDP will decrease by 0.4 percentage points compared to control. The adverse volume effect on the current account is offset, however, by improved terms-of-trade brought about by the way import prices are affected by the lower relative price of commodities more quickly and to a greater extent than export prices. The current account still, however, is weaker than in the control solution, which undermines the net position in relation to other countries.

[31] Rising exports and falling imports will result in an increase in the trade surplus. A deterioration in the terms-of-trade, however, means that the current account will remain weak for another year or so.

Figure 1a. Downturn in international economic activity; production gap and relative prices of raw materials

Percentage points and per cent, respectively

— Production gap (left scale)   — Relative prices of raw materials (right scale)
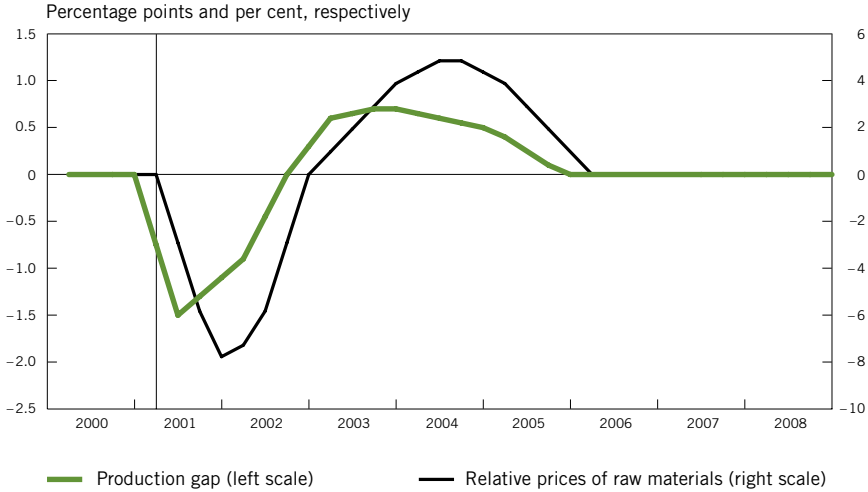
Figure 1b. Downturn in international economic activity; nominal short-term interest rate and inflation rate

Percentage points

— Nominal short-term interest rate   — Inflation rate
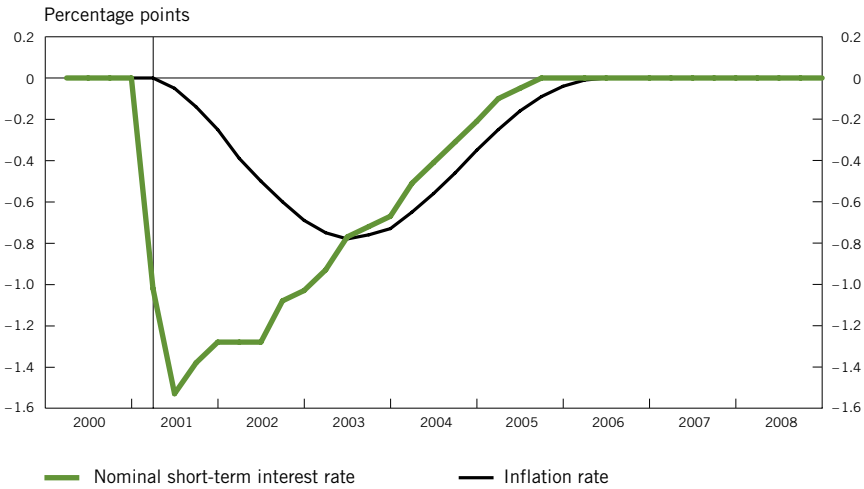
ductivity (TFP).[32] Figure 3 shows the assumed disturbance, a temporary decline in TFP lasting about two years.

[32] In the empirical analysis of productivity trends, TFP is a residual item that is usually taken to reflect technological and organisational effects. See, for example, the box headed "Problems with the measurement of information technology's effects on growth in the United States, Sweden and Europe" in the Inflation Report 2000:4.

Figure 2a. Effect of downturn in international economic activity on UND1X, nominal short-term interest rate and GDP

Percentage points and per cent, respectively

| UND1X | Nominal short-term interest rate | GDP |
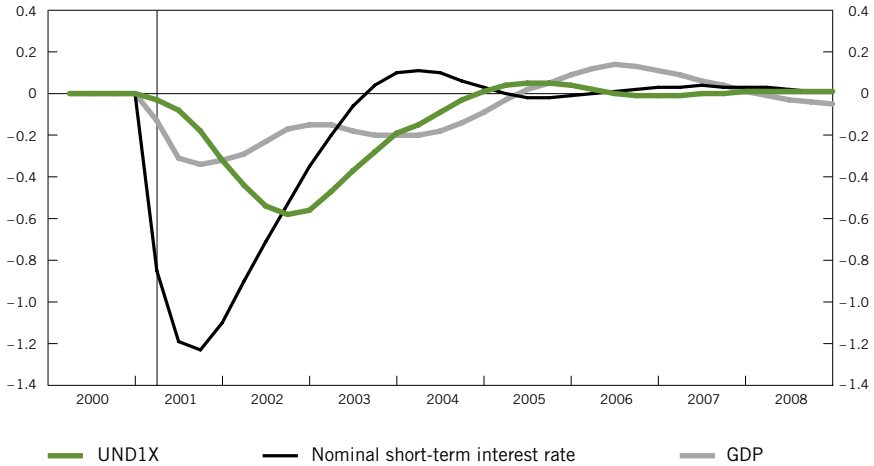
Figure 2b. Effect of downturn in international economic activity on import deflator, unit labour cost and nominal hourly rate

Percentage points and per cent, respectively

| Import deflator | Unit labour cost | Nominal hourly rate |
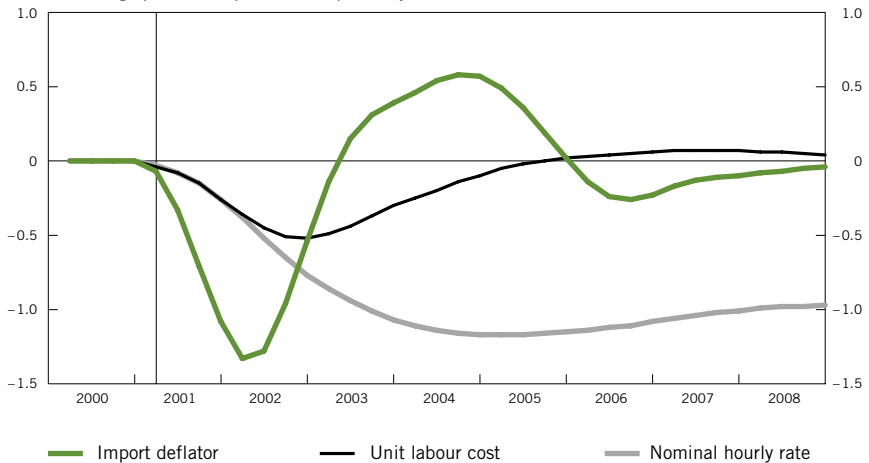
In the example, it is assumed that TFP gradually returns to the path it was following prior to the negative disturbance.[33] This means that after the effects of this disturbance have faded away, the economy will be back in its original steady

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[33] A possible interpretation of the negative disturbance to TFP assumed in the example is that it turns out that certain investments made in previous years were based on incorrect assumptions.

**Figure 2c. Effect of downturn in international economic activity
on private consumption, exports and imports**

Per cent

	Private consumption		Exports		Imports
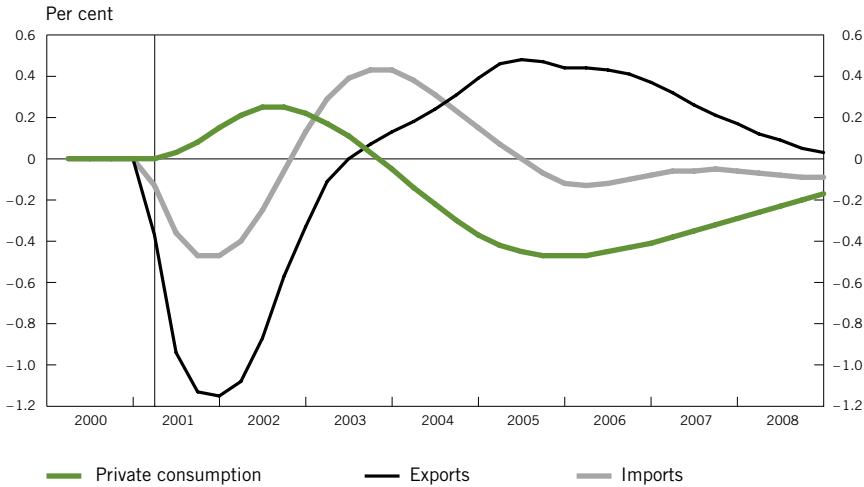
**Figure 2d. Effect of downturn in international economic activity
on nominal and real exchange rate**

Per cent

	Nominal exchange rate		Real exchange rate
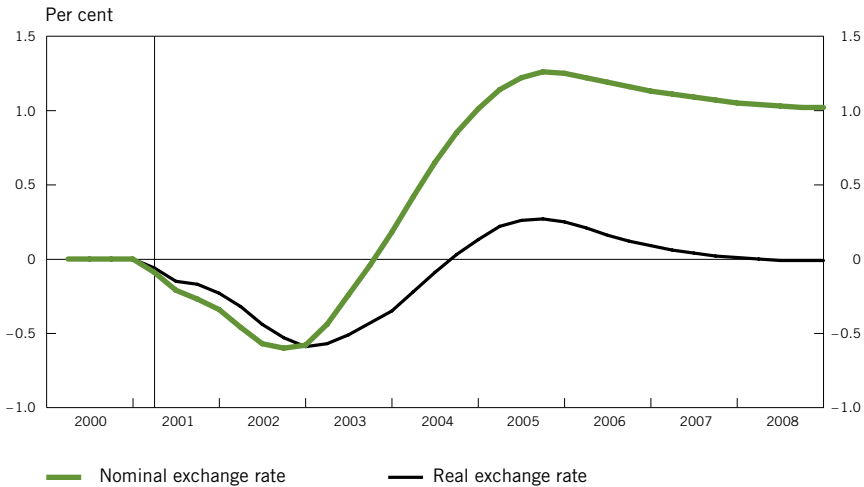
state.[34] Growth rates, relative quantities and prices (e.g. the real exchange rate) will, then, remain unchanged in relation to the control solution.

Households and firms in the economy did not foresee the initial reduction in TFP. Even if households and firms are forward-looking in their approach, and

[34] It is worth pointing out that the productivity shock only affects the domestic economy, not that of other countries.

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Figure 3. A temporary decline in total factor productivity

Per cent

TFP ——— Potential GDP
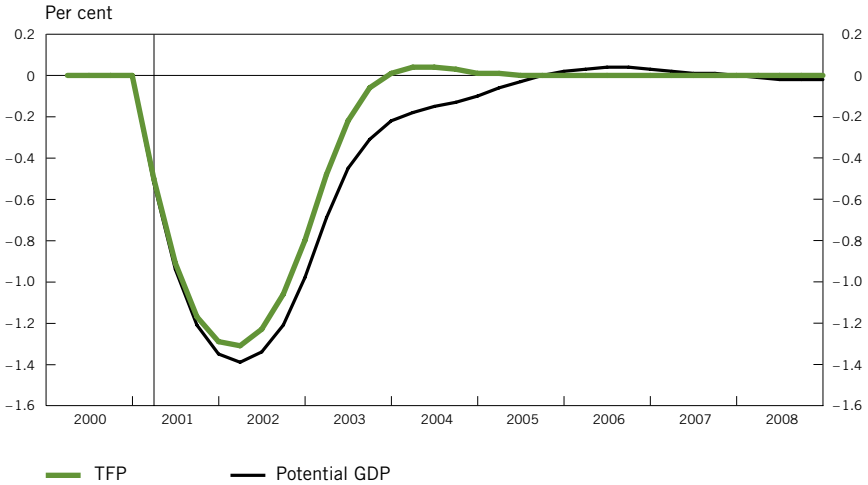
even if they gradually realise that TFP will return to its original productivity path, they are by no means certain what effects the productivity changes will have on, say, wage trends and production costs.[35]

Whereas changes in TFP are exogenously determined in the example, potential production (see figure 3) is affected by the endogenous developments to the actual capital stock. Production capacity, as it is reflected in potential production, declines during the first year by almost 1.5 per cent in relation to the control solution.

Households see the shift in the economy's potential growth rate to a lower level and respond by reducing consumption growth relative to the control solution (see figure 4). Since the households initially regard the decline in productivity as lasting, the response in consumption is relatively vigorous, even though the households do not reduce their consumption by as much as their expected "permanent incomes" have fallen. They also offset the impact of the decline in production on consumption by reducing their net foreign assets.

Whilst consumers adjust the growth in their consumption more or less immediately to the lower potential growth, the business sector reduces its investments more gradually. With wages and salaries being slow to adjust and with falling labour productivity, unit labour costs in business start to climb, which causes prices to rise. In response to rising costs and lower than expected GDP growth,

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[35] The example uses the steady-state model to work out the equilibrium paths consistent with the assumed trend in TFP. For example, the way consumers' permanent incomes behave in the underlying steady state affects consumer expectations regarding their total wealth and thus their spending power.

Figure 4a. Effects of a temporary decline in total factor productivity on UND1X, nominal short-term interest rate and GDP

Percentage points and per cent, respectively

| | UND1X | | Nominal short-term interest rate | | GDP |
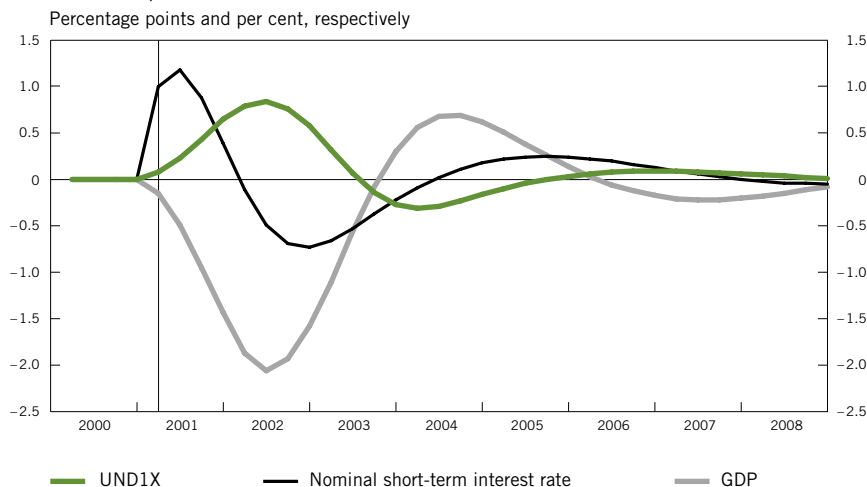
Figure 4b. Effects of a temporary decline in total factor productivity on import deflator, unit labour cost and nominal hourly rate

Percentage points and per cent, respectively

| | Import deflator | | Unit labour cost | | Nominal hourly rate |
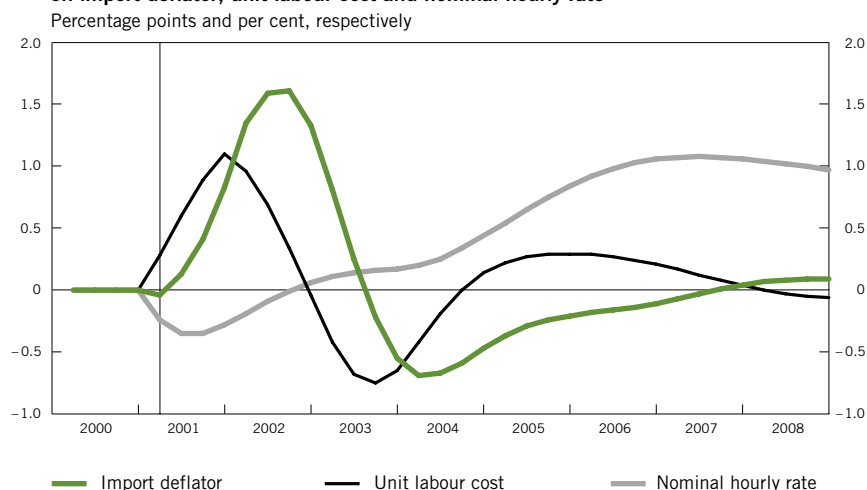
firms cut down on their capital expenditure. The fact that productivity first falls and then returns to its previous path generates a relatively powerful investment cycle. The production gap will initially be positive since lower productivity affects potential production faster than it affects actual production.

Monetary policy is initially focused on combating the inflationary pressures brought about by higher costs. This is essential as a means of preventing higher inflation influencing inflation expectations. Gradually, however, a negative pro-

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duction gap will emerge as demand is moderated as a result of the lower potential growth. The weaker demand thus aids the Riksbank, in this case, in stabilising expectations at around the inflation target, which initially reduces the need for drastic increases in the short-term interest rate. After four quarters, the actual slow-down in production predominates over the decline in potential growth to such an extent that the interest rate will be lower than the long-term neutral rate.

The exchange rate is influenced by two opposing mechanisms. Because of the weaker productivity there is a tendency for the exchange rate to depreciate. The real exchange rate depreciates, but only temporarily as productivity is expected to return to its reference path. The nominal exchange rate will also depreciate. For the first year, the depreciating exchange rate will have a tendency to push up the inflation rate since imported inflation will increase. This tendency of the exchange rate to depreciate is offset by a tighter monetary policy, but since the inflationary pressures are higher than in other countries, the depreciation of the nominal exchange rate becomes permanent.

A COMPARISON OF THE SIMULATIONS

The results for a number of key variables in the two examples are compared in Table 1. One clear difference is that a global recession will reduce the inflation rate. This is an anticipated result of a negative demand-side disturbance. In the case of the global recession, an increase in domestic demand offsets the fall in exports. In the case with a temporary fall in TFP, both domestic demand and export volumes decline.[36]

In the case of an international recession, the short-term interest rate should be lowered in the first year by 1 percentage point; in the case of a lower productivity, the short-term interest rate should instead be raised by 1 percentage point.

The actual result will depend on what interest rate policy the Riksbank is pursuing, in accordance with Rixmod's monetary policy rule, in each case. In the case of the global recession, the short-term interest rate is reduced in the first year by 1 percentage point. If the underlying cause of the decline in production and demand is lower productivity, the short-term interest rate should instead be raised by 1 percentage point during the first year.

[36] However, in that imports decline more than exports, the trade surplus increases.

Figure 4c. Effects of a temporary decline in total factor productivity on private consumption, investment and net exports

Per cent and percentage points, respectively
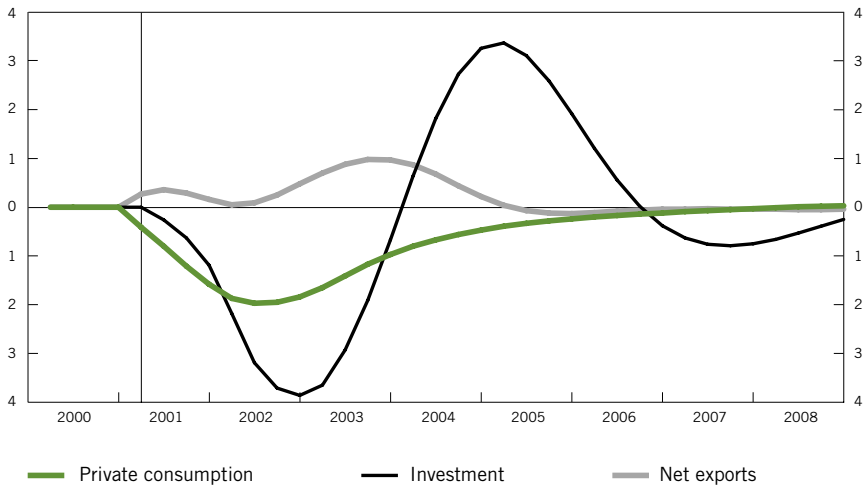
—— Private consumption   —— Investment   —— Net exports

Figure 4d. Effects of a temporary decline in total factor productivity on nominal and real exchange rate
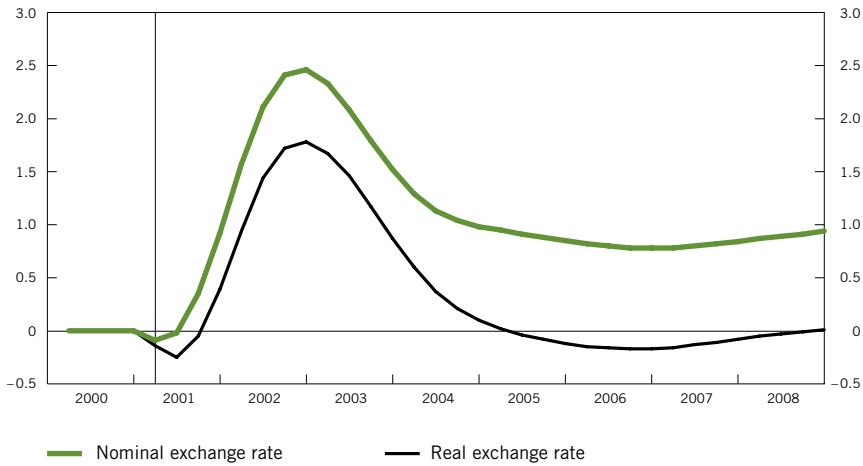
Per cent

—— Nominal exchange rate   —— Real exchange rate

Table 1. Effects on the Swedish economy during the first year of an international economic downturn and a temporary decline in total factor productivity respectively
Deviation in per cent from the control solution

	Foreign demand	TFP
Households' consumption	0.1	−1.0
Public consumption	0.1	−1.5
Fixed gross investment	0.0	−0.5
Exports	−0.9	−1.2
Imports	−0.4	−1.6
GDP	−0.3	−0.8
Hours worked	−0.1	0.1
Labour productivity (GDP/hours worked)	−0.2	−0.9
UND1X (Dec/Dec)	−0.3	0.6
TCW nominal (level)	−0.2	0.3
Short-term interest rate	−1.1	0.9

Note: Deviations for UND1X and short-term interest rate are percentage points.

Concluding comments

Apart from the fact that the results in the examples naturally depend on the strength of the mechanisms built in to the Rixmod simulation model, the results are also sensitive to specific assumptions about the disturbances that are assumed to have affected the economy. In the examples it is also assumed that the Riksbank immediately understands the nature of the disturbances (and how they will evolve with time) and that it can assess the consequences for the Swedish economy, particularly for inflation. It is obvious that the assumptions in the model require a great deal of information and knowledge about the functioning of the economy, requirements that central banks in the real world would find very hard to satisfy. By varying the assumptions concerning, say, access to information, the formation of expectations, and the monetary policy response, the model can nonetheless help us to illustrate the consequences of decisions taken at times of uncertainty with regard to what has actually occurred and how the economy responds to disturbances.

Another area of application for Rixmod is in connection with the Riksbank's forecasting activities. Given a main scenario, Rixmod can be used to generate a variety of alternative scenarios. Examples of this are that the global economy is weaker than the forecast in the main scenario or that domestic utilisation of resources is initially higher than assumed in the main scenario.

When Rixmod is used in forecasting exercises, account needs to be taken of the fact that the actual data concerning economic developments reflect the effects of permanent disturbances, or structural changes, that have occurred. This is done by using a set of constructed – filtered – variables as the model's equilibrium paths. Over history these represent shifts in the long-term steady state in response

to various disturbances. During the forecasting period, they can be explained as a gradual adjustment towards the long-term steady state. The role these variables play in the dynamic model is that they are used to measure gaps in relation to observed variable values over history, or to the forecast values that make up the solution in the dynamic model. By applying this procedure, the assumptions concerning the long-term steady state are only gradually given any weight in the short-term forecast. The latter can be appropriate as it is preferable that the short-term forecast is not affected too much by what, when all is said and done, are fairly uncertain assumptions regarding the underlying, long-term development of the economy.

When making forecasts, it is also possible to "force upon" the model judgements that are based on other information than that taken into account in Rixmod. This type of procedure permits the use of a model while taking into account the fact that a model is by definition a simplified (and strictly speaking always incorrect) picture of reality.

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Should tax expenditures be integrated into the budget process?

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Tax expenditure calculations have been presented in the annual spring budget proposals since the spring of 1996. The reason for this is to throw light on departures from the taxation system's "principle of uniformity" and from the 1990/91 tax reform, as well as to highlight tax expenditures that are comparable to transfer payments on the expenditure side of the budget. Eventually, the tax expenditure calculations could also be given a more formal role in helping to enforce budget discipline. Expenditure reforms that involve a risk of pushing expenditure above the expenditure ceiling can often be replaced by analogous tax reductions. If such devices come into widespread use, there is a risk that the purpose of the expenditure ceiling would be undermined. A complete integration of tax expenditures into the budget process would remove the incentive to circumvent the expenditure ceiling by reducing taxes instead.

Introduction

Transfer payments can be replaced by tax reductions.

The expenditure side of the government budget includes, besides public consumption, welfare spending in the form of grants and transfer payments to households and companies. This type of expenditure is also presented under different expenditure areas. Child allowances, for example, are stated under expenditure area 12 (Financial welfare for families and children). However, households and companies can also be given support via the tax sys-

tem. Child allowances could be abolished and replaced by a tax reduction having the same effect on the family's disposable income as the existing child allowances. Such a tax benefit could also be stated under expenditure area 12. Tax benefits are already being provided today when certain categories of taxpayers or certain economic activities are taxed at a rate that differs from the general rate. The tax on private pension saving, for example, is levied at half the general rate charged on income from investments. People who invest in a private pension insurance plan thus enjoy a tax benefit. These kinds of tax benefit are regarded as deviations from the general tax rate and are known as "tax expenditures".

The government has been publishing its tax expenditure calculations in an appendix to the annual spring budget proposals since the spring of 1996.[1] The spending departments also indicate in the autumn budget

The government publishes its tax expenditure calculations in its annual spring budget proposals.

bill, based on the calculations in the spring budget bill, the tax expenditures that are linked to the expenditure area in question and if new tax expenditures will arise on account of the proposals presented in the budget. One purpose of the government's tax expenditure report is to clarify departures, if any, from the principle of uniformity applied to the tax system; another is to highlight any tax benefits that are directly comparable to transfer payments on the expenditure side of the budget. The principle of uniformity, which was one of the keystones of the 1990/91 tax reform, is based on the idea that economic activities of a similar nature should be subject to similar tax rules. In other words, the guiding ethic of the tax system is that it should not put particular economic activities or tax-payers at an advantage or a disadvantage. Since the 1990/91 tax reform was based on the principle of uniformity, the tax expenditure report can also be seen as one way of maintaining the integrity of the tax reform.

Tax expenditure reporting is also central to a discussion on tax policy priorities, since it shows the extent of tax revenues that do not reach the government because of tax expenditures. If these tax expenditures were abolished, it would strengthen the public sector budget, which could be applied to other ends.

Even if the tax expenditure reporting should have some effect on budget discipline, currently it has no formal importance in the budget process. In 1997, an expenditure ceil-

The tax expenditure report currently has no formal importance in the budget process.

[1] These calculations are primarily based on the proposals made in the report "Förmåner och sanktioner" (Benefits and sanctions), (SOU 1995:36).

ing was introduced for the (central) government's nominal expenditure. This includes individual expenditure ceilings for each expenditure area. The purpose of the expenditure ceilings is to improve budget discipline. However, there are many ways of getting round the ceiling if it looks as if it might be exceeded. The committee of enquiry set up to evaluate and make proposals for the further strengthening of the budget process[2] identified ten or so different types of measure that could be taken to get around the expenditure ceiling. The committee's report explained, among other things, how the ceiling could be evaded by replacing expenditure reforms that might cause spending overruns beyond the ceiling with analogous tax reductions. In contrast to spending proposals, tax reduction proposals are neither subject to a limit nor to the same type of careful scrutiny within the budget process as spending proposals. A concrete example of this is the recently announced temporary employment support of 3 billion kronor, which, under certain conditions, will be allotted to the local government sector this year in the form of a municipal tax account credit. It requires no feat of imagination to see that such support could have been provided far more simply if the government had given the municipalities extra grants-in-aid of 3 billion kronor instead. However, given the current state of public finances, there was a risk that such an increase in the grant-in-aid could have caused a spending overrun beyond the expenditure ceiling.

The purpose of the expenditure ceiling could be undermined if spending reforms were replaced by tax reductions having the same effect.

There is a risk that the purpose of the expenditure ceiling would be undermined if spending reforms that threaten to exceed the ceiling were replaced by analogous tax reductions. The point at issue is whether it is possible to make the budget process more stringent as a means of avoiding this problem. One proposal that has been discussed is to integrate the tax expenditures in the budget process. That is, tax reductions that can be regarded as benefits, i.e. support that could equally well have taken the form of a transfer payment, should always trigger a reduction in the expenditure ceiling. Such a budget rule would entirely remove any incentive to circumvent the expenditure ceiling by proposing tax reductions instead of transfers.

The purpose of this article is to provide a brief account of how the Swedish tax expenditure calculations are made[3] and to discuss some problems of applica-

[2] SOU (2000:61).
[3] See also Appendix 2 to the 2002 spring budget bill.

tion that arise. The matter of how the principle of uniformity is to be interpreted and applied is also discussed. These issues are pivotal to an assessment not only of what are to be considered as benefits in the tax system, but also of whether it is possible to fully integrate tax expenditures into the budget process.[4]

A brief presentation of the tax expenditure calculations

A tax benefit or tax expenditure is the result of levying tax at a reduced rate in relation to a particular tax norm.[5] In order to identify a

A tax expenditure (deviation) can be either a tax benefit or a tax sanction.

tax expenditure, therefore, the actual tax rate charged (the existing tax system) must be compared with the chosen norm.[6] The norm that is used for the government's tax expenditure calculations is based, as noted in the introduction, primarily on the principle of uniform taxation of economic activities of similar types.[7] This norm means, for example, that all types of income shall be taxed according to uniform principles, and that all consumption of goods and services shall be subject to the same level of VAT.[8] A departure from a uniform tax charge is perceived to be a tax benefit if a particular category of tax-payers enjoys some form of tax relief in relation to the norm. A couple of examples can serve to illustrate this point:

i) The standard rate of VAT is assumed to be 25 per cent. The reduction in VAT on food from 25 per cent to 12 per cent is therefore treated as a tax benefit.[9]

ii) According to the norm, all income from capital shall be taxed at the same general rate of 30 per cent. However, income from private pension schemes is

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[4] The object is not to assess whether full integration of tax expenditures into the budget process is politically desirable. The argument is sometimes put forward in the political debate that expenditure ceilings per se involve excessive policy constraints. A complete integration of tax expenditures into the budget process would make these constraints even more stringent.

[5] One usually uses the term "tax expenditures" when referring to tax deviations in the tax system. A more general term would be just "tax deviations", since a deviation from a benchmark can be either a tax benefit or a tax sanction. A tax sanction is the result of levying tax at a higher rate than the norm. However, following the specialist literature, the term "tax expenditures" is used in the remainder of this paper.

[6] See also OECD (1996).

[7] However, there are some exceptions from this norm, mainly in the field of energy taxation, where excise duties have for the most part been introduced for environmental management purposes, and in view of this purpose it would appear eccentric to apply the principle of uniformity. However, some excise duties on energy, such as energy tax, have been introduced for strictly fiscal reasons. In the case of these taxes, the norm is that the tax should be proportional to the energy content.

[8] For a detailed discussion of the principle of uniformity, see, e.g. Grosskopf, Rabe & Johansson (1995), pp. 47–52.

[9] The reduction of the tax rate has been performed in different steps. The latest reduction in 1996, from 21 to 12 per cent, was implemented to "compensate" consumers for a contemporary reduction in the unemployment benefit, and was a result of an agreement between the government and the Centre Party.

taxed at the lower rate of 15 per cent. Individuals who save through such private pension schemes thus enjoy a tax benefit.[10]

These tax expenditures are reported by tax area and, in those cases where the tax expenditure is obviously linked to an expenditure area, to that expenditure area. For example, carbon dioxide tax is not levied on domestic flights. The civil aviation sector thus enjoys a tax benefit, which is stated under the tax area "Excise duties" and under expenditure area 22 (Transport and communications).[11]

Not all tax changes can be linked to economic activities that are covered by the principle of uniformity.

However, not all tax changes can be linked to economic activities that are covered by the principle of uniformity, particularly in the case of straightforward tax reductions that are not connected to any specific tax. However, in many cases even these tax reductions can still be deemed to be a benefit that could equally well have been provided in the form of a grant, in which case they would have been subject to the expenditure ceiling. A case in point is the tax reduction consumers can get if they connect their home to the broadband network. Such tax expenditures are designated *general tax reductions* in the tax expenditure report and are reported under a special heading. However, the fact that tax reductions cannot always be related to a norm or a particular tax area does not necessarily mean that they lack any tie with an expenditure area. The tax reduction for joining the broadband network cannot be related to a particular tax but is reported under expenditure area 19 (Regional equalisation and development), since the main purpose of the reduction is to promote the installation of broadband facilities outside of the metropolitan regions.

Tax expenditures can be converted into public sector transfer payments.

As noted by way of introduction, a benefit of the same size as that obtained by means of a tax cut could instead be provided in the form of a public transfer payment. Tax expenditures can thus be converted into transfer payments. In the tax expenditure report, the government has opted to base its figures on the norm whereby all transfer payments shall be liable to taxation. To be able to compare a proposal to cut certain taxes with a spending proposal having the same effect, it is therefore necessary to present the tax reduction proposal

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[10] The purpose of the deviation is to create an incentive for individuals to save for their pension.

[11] In view of the fact that the uniformity norm is based on the belief that economic activities having a similar character should be subject to similar tax rules, one alternative would be to report the tax expenditures by type of economic activity rather than by tax area. For example, a reduction in tax on private pension schemes could be reported under the tax heading "saving", which would provide a clearer picture of what types of saving benefit from various types of tax relief.

on a *gross* basis. However, tax expenditures are reported both gross and net. A *net* tax expenditure shows the amount of the *tax-free* transfer payment that would provide full compensation for the category of tax-payers that enjoys the tax benefit if the benefit were to be removed. A net tax expenditure can (in certain circumstances) also be calculated as the loss of tax revenue caused by the tax reduction. A *gross* tax expenditure shows the level of the corresponding *taxable* transfer payment that would compensate the tax-payers covered by the tax benefit, if it were abolished. The following example is a simple illustration of the difference between net and gross reporting of tax expenditures.

The reduction of the tax on income from capital invested in private pension schemes is estimated to cause a loss of 11.5 billion kronor in tax revenue this year.[12] This

A presentation of new tax expenditures could be used to lower the expenditure ceiling.

is the *net* tax expenditure and also the tax-free transfer payment that would be needed to fully compensate the category of tax-payers covered by this tax benefit if it were abolished. The taxable transfer (the *gross* tax expenditure) that also would compensate the tax payers covered by the tax benefit, if it were abolished, is calculated as follows: Suppose that the tax-payers were to pay tax on this compensatory transfer payment under income from capital, for which the normal tax rate is 30 per cent. The gross tax expenditure can therefore be estimated at $11.5/(1–0.3) = 16.4$. To express it another way: if the reduction in tax on income from capital invested in private pension schemes were removed, and the category of tax-payers who currently enjoy this tax benefit were paid a grant of 16.4 billion kronor, which then became liable for taxation as income from capital, these tax-payers would in practice have enjoyed a benefit of 11.5 billion kronor [16.4 x $(1–0.3) = 11.5$]. Unlike the tax expenditure, a transfer having the same effect would have been stated on the expenditure side of the budget and would also have been covered by the expenditure ceiling. The inclusion of new tax expenditures in the budget process could therefore be used to lower the expenditure ceiling in so far as integrating tax expenditure reporting completely into the budget process is considered to be politically desirable.

[12] See 2002 Spring budget proposals, appendix 2.

Problems of application

PRINCIPLE OF UNIFORMITY

The underlying reason for the principle of uniformity is the view that the tax system should neither encourage tax avoidance nor distort the allocation of production resources.

The underlying reason for the principle of uniformity is the view that the tax system should neither encourage tax avoidance nor distort the allocation of production resources. It would probably not be difficult to create a consensus in favour of such a principle for structuring the tax system. On the other hand, it is not immediately obvious how the principle of uniformity should be defined and how strictly it should be applied in practice. The need for strict application of the principle of uniformity has to be weighed against the interest in having simple tax rules that can be understood and applied in practice. If the tax expenditure reporting is to be used to identify tax benefits and, in the long run, to be fully integrated into the budget process, it is important to be sure of the existence of a broad political consensus in the Riksdag with regard to how the principle of uniformity should be defined and applied. This section explains how the *government* has decided to interpret and apply the principle of uniformity within the framework of the tax expenditure reporting. It also looks at some of the problems associated with this view.

For reasons of practicality, the principle of uniformity should be interpreted to mean that the tax rules should be neutral but not necessarily identical.

Does the principle of uniformity mean that tax rules should be identical or that they should be neutral? Tax neutrality can be said to exist when the economic effect of any preferred alternative is not affected, either positively or negatively, by the structure of the tax system. If, say, the taxation of residential property were neutral the tax system would neither favour nor penalise any particular type of dwelling in relation to another. Tax neutrality can be arrived at without the need for identical tax rules. The company taxation systems provide examples of this. Business can be carried on within many different types of legal structure. It would seem reasonable to suppose that the principle of uniformity means that limited liability companies and sole traders are taxed in a similar way. A limited liability company pays company tax on its income while a sole trader pays tax on income from employment. The tax system, however, provides certain "compensation" in the form of interest distribution and expansion funds to give the sole trader a similar opportunity to

pay tax as if on income from capital. As the various types of legal structure differ from one another it is not always possible, in practice, to have identical rules. For reasons of practicality, therefore, the principle of uniformity should be interpreted to mean that the tax rules should be broadly neutral rather than identical.

The tax expenditure calculations are worked out on the basis of the Haig-Simons income principle, according to which the income that is subject to taxation consists of the sum of expenditure on consumption and the change in the value of net assets during the taxation period.[13] This principle means that any capital gains arising during the taxation period shall be liable for taxation, regardless of whether they are realised or not. In practice, capital gains are not taxed until they are realised, which means that if the owners of the assets retain them for a long time, they have obtained a tax credit, according to this way of thinking.[14] Such tax credits are included in the government's tax expenditure report as tax benefits, albeit only in the case of increases in the value of listed shares, private houses, and co-operative flats. The report is therefore not complete.

In practice, regular taxation of unrealised capital gains would involve serious problems. Firstly, the tax authorities would need to have information on the changes in value of all types of asset. As things are, they don't have this information. Consistent application of the Haig-Simons principle, which is that increases in value should be taxed when they arise and not when they are realised, would, in the case of the taxation of the imputed income from owner occupied housing, involve serious practical problems.[15] It is also hard to imagine the government, in accordance with the Haig-Simons principle, hitting upon the idea of introducing a tax system in which increases in the value of shares are taxed when they arise rather than when they are realised. In the light of these problems, it is pertinent to ask whether the tax norms in the tax expenditure reporting really should be based on the Haig-Simons definition of income. Another point of interest in this context is whether norms that are considered to be theoretically "correct", but which are not capable of ready application on account of a variety of reasons, should be used in tax expenditure calculations. One conclusion to be drawn from this is that

> **In practice, regular taxation of unrealised capital gains involves serious problems.**

[13] See Simons (1938).

[14] To put it another way, when assets are owned for long periods of time, the effective rate of capital gains tax will be considerably lower than the nominal rate (see King (1977)).

[15] See Boije & Shahnazarian (2000) and Boije & Lind (2002). Failure to tax imputed income from owner occupation is only treated as a tax expenditure in a minority of countries, according to a survey provided by the OECD (1996). The reason for this is a combination of theoretical and practical difficulties, according to the survey.

either the practical shortcomings of the theoretical norms should be accepted, as maintaining them offers many advantages, or else the tax expenditure reporting should be based on a more pragmatic and intuitively comprehensible application of the principle of uniformity.

The government does not apply the principle of uniformity consistently to different types of income.

The government does not apply the principle of uniformity consistently to different types of income. The Haig-Simons principle makes no distinction between income from employment (wages and salaries) and income from capital. In practice, income in the form of interest is taxed at 30 per cent, while the average marginal tax rate on income from employment is far higher than that. However, this difference is not taken up as a tax expenditure in the present tax expenditure reporting. The reason is (probably) the dual income tax model that was introduced in connection with the 1990/91 tax reform, in which income from capital is taxed separately from income from employment. Even though it might be justified, from other perspectives, to tax income from employment at a higher rate than income from capital[16], it is inconsistent not to apply the Haig-Simons principle to a comparison of the rates at which income from employment and income from capital are taxed. The wide gap between the two rates of taxation is critical, for example, when it comes to the formulation and application of the 3:12 rules that apply to the taxation of income from close companies.[17] Applying the Haig-Simons principle so strictly within a given income class, as the government does (considering that capital gains should be taxed when they arise and not when they are realised), but not between one class of income and another, is inconsistent. If, on the other hand, the sole purpose of the tax expenditure reporting were to report deviations from the 1990/91 tax reform, this inconsistency in the reporting could possibly be justified.

Not all departures from the principle of uniformity are included in the tax expenditure report.

Not all departures from the principle of uniformity are included in the tax expenditure report. A case in point is the zero rate of VAT on financial services, another is exemptions from wealth tax. According to the current definition, unlisted shares and holdings of shares classified as "working capital" are not liable to wealth tax.

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[16] It is frequently claimed that, as the tax base for income from capital is more exposed to the internationalisation process than that for income from employment, this is an argument in favour of lower taxation of income from capital.

[17] The object of these rules is to prevent the owners of close companies from withdrawing income from employment in the form of income from capital, and thus paying a lower tax.

Owners of such shares thus enjoy a tax benefit in relation to owners of assets that are liable to wealth tax (shares on Stockholmsbörsen's "A" list, on which shares are chargeable on 80 per cent of their value, or private homes charged on 75 per cent of their estimated market value).[18] Further examples are provided by the taxation of capital goods. According to prevailing norms, the property tax on private houses is classified as a taxation of (imputed) income from capital. If all capital goods were to be taxed in the income from capital class, untaxed assets, such as boats, cars, works of art and jewellery, would also have to be reported as tax benefits.[19]

CALCULATION PROBLEMS

Various technical problems are associated with the calculation of the tax expenditures. This might not be a serious problem as long as the tax expenditure reporting is only used to provide rough estimates of the value of the various tax benefits, and as long as the tax expenditure reporting has no formal importance in the budget process. However, if the tax expenditure reporting were to be fully integrated into the budget process in connection with the allocation of budget funds to the various expenditure areas, these problems would be critical. In this final section, we will look at some of these problems.[20]

The tax expenditures are calculated on the assumption that tax bases are static. This means that the tax expenditure calculations take no account of the possibility that the tax

Net tax benefits are not necessarily accurate measures of the losses of tax revenue.

bases could change if the tax expenditures were to be abolished. For example, a higher rate of property tax on private houses would probably cause a fall in market values and consequently also of tax assessment values.[21] Calculating the tax expenditure without taking this point into consideration would result in the tax expenditure being over-estimated. In the case of most tax benefits, the tax base

[18] This "shortcoming" in the tax expenditure reporting could perhaps be justified with the argument that the Haig-Simons principle does not directly state that wealth per se should be liable to taxation. It is changes in value that are to be taxed according to this principle. This could, on the one hand, be used as a pretext for regarding wealth tax as a tax sanction. On the other hand, provided that wealth tax is levied on fiscal grounds or as a distribution policy instrument, consistent application of the principle of uniformity would – as was pointed out by Boije (2000) – mean that asymmetries in wealth taxation should also be included among the tax expenditures.

[19] The reporting of what are known as "tax expenditures not affecting the budget balance" is not complete either. These tax expenditures consist largely of public sector transfer payments of various types that are entitled to full or partial tax relief. One of the advantages of not taxing such transfer payments is that it helps to keep down the overall tax ratio. Another advantage is that the "policy of giving with one hand and taking with the other" in the tax and transfer payment systems can be reduced.

[20] The government has also highlighted some of these points in the introduction to the tax expenditure report in the 2002 Spring budget proposals.

[21] See Boije (1999, 2000).

would probably contract if the benefit were removed. The reverse applies to tax sanctions. This also means that statically calculated net tax expenditures are not necessarily accurate measures of the potential tax revenue the government has lost.

Transparency regarding the object of the different tax expenditures would promote a discussion of tax policy priorities.

It is not always obvious to which expenditure area any given tax expenditure relates. The object of the existing reporting system is that it is the purpose of the tax expenditure that determines which expenditure area the tax expenditure should be linked to. However, the purpose of the various tax expenditures is, unfortunately, not disclosed in the tax expenditure report. Naturally, there can be many good reasons for a tax expenditure, which makes it even more useful to highlight the purpose of it. Transparent reporting of the purpose of the tax expenditures would promote a more informed discussion of fiscal policy priorities.

It is not obvious what tax rate should be used when calculating the gross tax expenditure.

It is not immediately obvious what tax rate should be used when calculating the gross tax expenditures. Should we assume that the compensatory transfer payment will be paid to the tax subject who is legally obliged to pay the tax, or can it be assumed to go to whoever it is in practice that enjoys the tax benefit? An example can illustrate this problem: The most recent reduction in VAT on food was made on grounds of distribution policy. The intention was that consumers primarily should benefit from this reduction. In the existing tax expenditure reporting the effective corporate tax rate is used for calculating the gross tax expenditure, with regard to VAT tax expenditures. At present it is assumed, when calculating the gross tax expenditure, that a corresponding benefit could have been brought about by paying to "the producer" (who is legally obliged to pay in VAT to the state) a grant or subsidy that would be liable to corporate taxation. As it is the purpose of the tax expenditure that should determine which expenditure area the tax expenditure is linked to, it may appear inconsistent if it is the obligation to pay in the tax that determines what tax rate is used when calculating the gross tax expenditure. If the purpose of the tax expenditure is that it should provide a benefit for food consumers, it would appear more natural to assume that the "compensatory contribution" goes to food consumers rather than to producers, in the event of the tax expenditure being abolished. In such a case, it is the weighted average marginal tax rate on income from employment that should be used to calculate the gross tax expenditure, not the effective corporate tax rate. However, this would result in

a far higher gross tax expenditure, since the average marginal tax on income from employment is considerably higher than the effective corporate tax rate.

As the case above shows, some gross tax expenditures are based on the calculation of the effective corporate tax rate. However, calculating this tax rate is complicated. The nominal rate of corporate tax is 28 per cent. The effective tax rate is a great deal lower on account of the use of net allocations to untaxed reserves[22] and of tax adjustments[23]. In the most recent tax expenditure report, the effective corporate tax rate was estimated at 26.6 per cent.[24] However, this calculation only takes into account the rules for transfers to periodisation reserve, and not all net allocations to untaxed reserves and tax adjustments. The figures presented in the budget proposals for 2000 show that the average effective corporate tax rate can be as low as 18 per cent, if all net allocations to untaxed reserves and tax adjustments are taken into account.

Calculating the effective corporate tax rate is complicated.

The existence of differentiated tax rates means that a "standard tax rate" needs to be defined. In the case of VAT, for instance, the highest applied tax rate of 25 per cent is considered to be the "standard rate". Such an assumption is reasonable as long as the predominating part of total consumption is subject to VAT at 25 per cent. If the reductions became extensive enough, one alternative would be to define the "standard tax rate" as the then most widely used tax rate.

Owing to the absence of relevant data, it is in certain cases not possible to quantify all tax expenditures. This situation would naturally become a serious problem in the event of a complete integration of tax expenditures into the budget process.

It is not possible to quantify all tax expenditures, which would be a serious problem in the event of full integration of tax expenditures into the budget process.

If the tax expenditures are to be fully integrated into the budget process, the question also arises as to whether nominal changes in already existing tax expenditures, caused by nominal changes in the tax bases, shall make it necessary to correct allocations of budget funds and expenditure ceilings or whether only new and removed tax expenditures should make an adjustment necessary. The former alternative is likely to be very impractical.

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[22] E.g. accelerated depreciation for tax purposes of machinery and equipment.

[23] E.g. deduction of accumulated loss allowances.

[24] See also "Beräkningskonventioner för 2002" (Calculation conventions for 2002) published by the Ministry of Finance.

Summary and conclusions

The object of this article has been to explain the functioning and purpose of the government's tax expenditure reporting and to discuss various application problems that are pivotal if it should be thought desirable in the long term to integrate the tax expenditures fully in the budget process. The inventory of problems indicates that the uniformity principle, on which the tax expenditures are currently based, has some serious application problems. It is important that there exists a broad political consensus in the Riksdag on the interpretation of the uniformity principle, at least if the tax expenditures are to be fully integrated into the budget process.

It is *at present* not possible to fully integrate tax expenditures into the budget process.

The inventory of problems also indicates that the present tax expenditure calculations are flawed by some technical problems, and that they in many aspects are not complete. From this it may be concluded that it is not *at present* possible to fully integrate the tax expenditures into the budget process. Despite these shortcomings, the current tax expenditure report is important in that it provides rough estimates of the tax benefits in the tax system, and in that it, to some extent, identifies tax reduction proposals that are made with the object of by-passing the expenditure ceiling.

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Notices

Allocation of the Riksbank's net profits

The Riksbank's profits for the financial year 2001 amounted before appropriations to SEK 19.3 billion. According to the current guidelines, 80 per cent of the average income before appropriations over the past five years shall be transferred to the Treasury. The income used as a base for calculating the size of the transfer (dividend) is adjusted for exchange rate effects and changes in the market value of gold. The dividend for 2001 should therefore be SEK 7.3 billion.

The General Council of the Riksbank has decided, in the light of a report from the Executive Board, that there is scope for an additional transfer of SEK 20 billion. The proposal from the General Council is therefore that a total of SEK 27.3 billion be transferred to the Treasury. This assumes that the current principles for allocation of net income will continue to be applied.

The Riksbank plans to sell Pengar i Sverige AB

The Executive Board of the Riksbank has taken a decision regarding the orientation for a sale of its wholly-owned subsidiary Pengar i Sverige AB, which is responsible for the practical distribution of banknotes and coins. The purpose of the sale is to further improve efficiency in cash management and to open the door to private operators.

The intention is to divide Pengar i Sverige AB into two different operations. The plan is to transfer the commercially-oriented part of the operations, which is responsible for transporting and counting daily takings from the retail trade, to a private owner. The other part, which comprises, for instance, storage, delivery and receipt of banknotes and delivery of coins, is closely connected with the banking system and the Riksbank will examine the possibility of transferring this operation to the commercial banks.

If the changes are implemented, the Riksbank's responsibility for cash management will be limited to supplying banknotes and coins, maintaining strategic stocks of cash for extraordinary requirements and destroying worn banknotes.

Mats Galvenius Head of Market Operations Department

The Executive Board of the Riksbank has decided to appoint Mats Galvenius the Head of the Market Operations Department. He succeeds Christina Lindenius, who is leaving the bank to become Director General and Head of the Financial Markets and Institutions Department at the Ministry of Finance

Mats Galvenius has been deputy head of the Market Operations Department since 2001. Prior to that he worked as adviser to ECB Executive Board member Sirkka Hämäläinen. Mr Galvenius is an economist with an MBA from Stockholm School of Economics and will take up his new post on 5 August.

Governor Urban Bäckström will leave his post at the end of the year

The Governor of the Riksbank, Mr Urban Bäckström, informed the Chairman of the Riksbank's General Council, Mr Sven Hulterström, during the Whitsun holiday that he intends to resign at the end of this year. This means that he will leave his post two years before the end of his present term.

"I have now been Governor of the Riksbank for almost a decade and I think that's about enough. So, I've decided not to be available for re-election to a further term. By resigning already at the end of this year – instead of at the end of 2004 – I hope to give my successor plenty of time to manage the issues that may become topical in the coming years. What I have in mind is, for instance, the European Economic and Monetary Union and the consequences of the outcome of a referendum, if any, and the Riksdag's subsequent decision. That leads in my opinion to the best possible continuity," said Mr Bäckström.

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.

2002-03-18   The *repo rate* is increased by the Riksbank from 3.75 per cent to 4.0 per cent as of 20 March 2002. The *deposit rate* is accordingly adjusted to 3.25 per cent and the *lending rate* to 4.75 per cent.

2002-04-25   The *repo rate* is increased by the Riksbank from 4.0 per cent to 4.25 per cent as of 2 May 2002. The *deposit rate* is accordingly adjusted to 3.5 per cent and the *lending rate* to 5.0 per cent.

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	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	17 436	–	69 135	147 698	1 263	235 532
2002	Jan	17 436	–	59 249	153 172	3 008	232 865
	Feb	17 436	–	56 564	154 218	3 266	231 484
	March	17 436	–	55 400	157 307	1 749	231 892
	April	17 436	–	53 522	151 943	3 902	226 803

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	107 111	70 890	48	9 024	48 459	235 532
2002	Jan	98 571	70 890	402	10 203	52 799	232 865
	Feb	97 395	70 890	89	11 090	52 020	231 484
	March	98 790	70 890	59	10 991	51 162	231 892
	April	97 023	70 890	525	7 823	50 542	226 803

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
	Dec	97 012	1 004 878	Dec	8.8	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			
2002	03-20	4.00	3.25	4.75			
	05-02	4.25	3.50	5.00			

* 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

		Bonds issued by:				Housing	(Caisse)
		Central government				2 years	5 years
		3 years	5 years	7 years	9–10 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	5.01	5.65
	Aug	4.49	4.77	5.01	5.16	4.71	5.29
	Sept	4.23	4.74	5.04	5.26	4.45	5.26
	Oct	3.98	4.60	4.92	5.17	4.16	5.10
	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
	Feb	4.76	5.18	5.28	5.36	4.94	5.57
	March	5.05	5.46	5.55	5.63	5.22	5.83
	April	5.10	5.46	5.56	5.69	5.28	5.83

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
	Feb	3.75	3.85	3.87	3.99		4.01	4.14
	March	3.84	3.94	4.09	4.29	4.64	4.27	4.43
	April	4.00	4.10	4.25	4.41		4.52	4.69

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
	Feb	1.81	3.30	3.94	3.87	1.94	3.33	4.08	3.99
	March	1.91	3.34	4.03	4.09	2.15	3.45	4.23	4.29
	April	1.87	3.39	4.06	4.25	2.11	3.47	4.26	4.41

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
	Feb	135.65	10.56	9.1869	7.91	1.1494	133.60
	March	133.81	10.34	9.0600	7.89	1.1419	131.02
	April	134.83	10.31	9.1331	7.88	1.1290	130.75

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

8

Nominal effective TCW exchange rate
Index: 18 November 1992=100
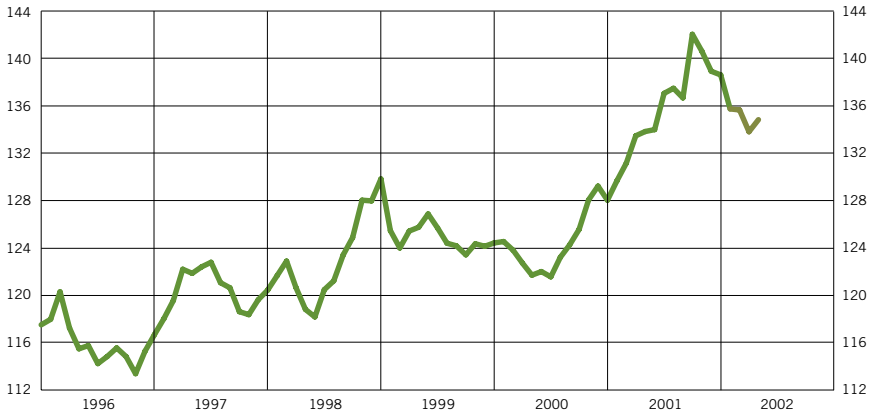
9

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 58
	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
	Nov	–404 895	–16 742	196 365	0	–225 272
	Dec	–390 156	–16 763	198 322	0	–208 597
2002	Jan	–380 368	–29 553	229 071	–5 753	–186 603

Signed articles in earlier issues

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